IMPACT REVIEW

Significant Stories of Impact

A summary of significant stories of innovation impact at individual meat companies that are the result of MLA/AMPC R&D outcomes

AMPC

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MEAT & LIVESTOCK AUSTRALIA

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"Tails of success"

(2004-2006)

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The father of many modern business methods, Peter Drucker, once said that *"business has only two functions: innovation and marketing"*.

Simplistic or not, the fact remains that your business is nothing if it doesn't find a market, and have the capability to grow and change as the market grows and changes.

David Liddy, the Managing Director of the Bank of Queensland, tells business to *"Innovate or Die"*. While this feels like Darwin's *"survival of the fittest"*, in the business jungle only industries that successfully innovate will survive.

Who is the competition? Brazil, Argentina and others. Even for domestic plants, the world market will eliminate you unless you are competitive, and that means innovation.

As the processing industry hits domestic maturity it is clear that only those with a strong efficiency and innovation culture will survive. On current trends more than 20% of Australian processors will be gone within 10 years. Who will be they be?

One of MLA/AMPC's most important roles is to foster and support innovation.

Australian culture is innovative and inventive, but turning the good idea into operational success requires persistence, vision and considerable risk taking.

Adapting overseas innovation is often difficult because Australian production is different. There are stories here that have required imagination, alteration, and often new technology to make them work. There is often so much learned that the technology is essentially redeveloped, and the process fosters more imagination and further improvement.

Then there are the classical Australian inventions that solve a problem and sometimes open up new areas of commercial activity. Again, this breeds a questioning culture, a systems approach and a belief that "it can be done". It is this vision that makes Australians the great innovators that they are.

We are proud to recognise these leading edge companies that have the guts to solve the problems, the persistence to see them through to economically sustainable results and the spirit to share their learning with industry.

A Message from Joanne Sillince, CEO AMPC

Evidence of R&D impact at the "enterprise" level

A core reason for being for MLA/AMPC is to facilitate the adoption of new R&D outputs by the red meat processing industry. Key factors that are borne in mind when delivering these services are;

- That industry adopters make **D**ecisions about a commitment to adopt only after **R**esearch outputs have been converted into **I**nformation which will form the basis of the following **K**nowledge (within a local context), where -
  - There is a match between their local requirements and the available technology
  - There is confidence that a technology and/or product design is capable of meeting local performance requirements
  - A technology and/or product is determined to be operable within local cost, schedule and quality targets.

The following project case studies are taken from the last two years of the MLA/AMPC Innovation Awards program. The appearance of a project below means that the activity has qualified against at least two of the following three criteria for judging the attribution of industry impact of the R&D investment:

- The information and knowledge was generated as a consequence of MLA/AMPC investment in R&D, and
- There is evidence of adoption in meat processing plants, and/or
- There is evidence of actual financial benefit being derived from adoption of this information and application of this knowledge.

Slaughter floor and grading semi-automation

Australian Country Choice, Cannon Hill, Queensland

The problem

The Meat Standards Australia (MSA) program was implemented with the core goal to measure and control (systems and standards) against known Critical Control Points within an enterprise's Total Quality Management system. This program is based on consumer quality research.

Traditionally the assessment of carcases for quality attributes has been confined to collection of attributes post chilling, some 12 hours post slaughter. Inherent issues related to traditional practices include:

- Lag time to make decisions based on quality
- Activities based on 'Night Shift' work times
- Speed of collection required.

The solution

In line with the meat industry's desire to reduce costs allocated to this assessment activity, MSA investigated the possibility of varying collection points for determination of carcase attributes in order to create a streamlined effect.

MSA Express 'Hot Grading' was developed for industry to ensure the grading process would be more suitable to high throughput processing facilities.

'Hot Grading' does not eliminate chiller assessment. Chiller assessment is still required for the collection of meat colour, ultimate pH and loin temperature for an eating quality score to be applied to a carcase.

Australian Country Choice has overcome many of the common problems of post chilling carcase assessment by implementing "Hot Grading" technology into their production data capture system.

Pre-assessment: 13 carcase attributes were collected throughout the production process. Three of these attributes were also collected in the chiller.

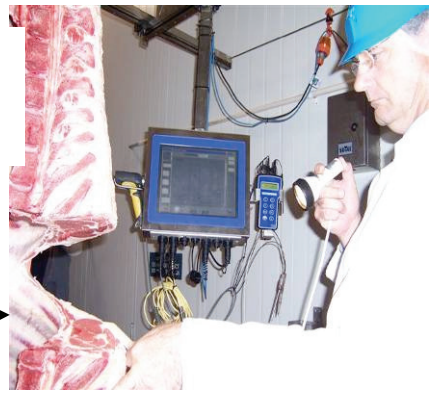
Post-assessment: One system has been established for managing data flow. This:

- negates the need to collect data twice
- gives backup where an attribute is not allocated
- gives instant validation of the process and graders
- allows pre-grades to be allocated by market destination
- makes pre-chiller marshalling possible.

This system reduces the chiller labour required to re-draft carcases into boning room groups prior to boning. Over time it is also envisaged that this pre-grade information will also assist in production and boning room management.

The ACC slaughter-floor grading system

The ACC grading system in use



The benefits

The key benefits arising from the technology are a reduction in labour and increased efficiencies from redesign of the grading process. Because the grading system is now integrated with the existing slaughtering software system it has also offered efficiencies in factory software management from a support and maintenance perspective.

Further synergies were achieved by the implementation and integration of lairage / livestock IT system upgrades concurrently with the combined grading / slaughtering system. The fully integrated system now provides for a more flexible and dynamic data reporting capability at both financial and operational levels.

Key Benefit Area	**Outcomes**
Cost Savings	• 11% cost reduction in year 1. • 15% saving in the second year and ongoing.
Allocation of pre-grade	• Reduction in carcase drafting prior to boning.
Labour skills	• Operatives on the slaughter floor are not required to be Aus-Meat chiller assessors. • Increased ability to multi-skill and train operatives. • Reduction in labour for grading and weighing.
Labour working hrs	• Chiller assessment can be commenced 2 hours later.
OHS issues reduced	• Introduction of a grading station. • No staff in the chillers (less possible contamination). • Ergonomic work stations and equipment. • Limited manual carcase movement.
Key Benefit Area	**Outcomes**
Multi Tasking	• Combining labour units for data collection.
Data collection	• Collection of full data set. • Increased feedback for genetic improvement. • Real time data collection. • Accuracy of data. • Ease and flexibility of collection. • Back up collection possible.
Food Safety and Shelf Life	• Permits longer chilling cycles and later grading start time.

The cost/payback
Based on current data-entry cost, this technology will reduce costs to the enterprise to allocate a quality grade over 10 years by $509,019 ($0.98 to grade each carcase). The total cost to grade is 0.6% of the total cost to slaughter and bone an average carcase on site. As a comparison, chiller assessment costs represent 0.5% of slaughter and bone costs, with limited additional benefits.

Costs	Chiller Assessment		Cold Grade		Hot Grade	
Year	1	2	1	2	1	2
per kg (HSCW)	$0.0045	$0.0040	$0.0067	$0.0066	$0.0059	$0.0048
Per head	$0.92	$0.82	$1.35	$1.19	$1.20	$0.98

Economic: The technology has realised a cost savings of 11% in year 1 and 15% in year 2.

Anecdotally data accuracy was noted as an issue to the extent that pre pilot 2 - 3% error was not uncommon. Currently the post-pilot systems are recording less than 1% error, avoiding the need for re-working product.

A comprehensive environmental management program

Australian Country Choice – Cannon Hill, QLD

Background
Australian Country Choice Pty Ltd (ACC) has embarked on an ambitious corporate strategy that will constitute world best practice for environmental management in the Australian livestock production and meat processing industries. This will demonstrate to the Australian agribusiness community the commercial benefits to be gained by implementing and maintaining the highest international standards in environmental management performance.

ACC is an integrated agri-chain enterprise including cattle production properties, cattle feedlots and a 'single roof solution' central beef processing facility. The company is a Coles Myer – Food & Liquor Division dedicated supplier and processor providing a cohesive supply chain incorporating livestock supply, slaughtering, boning, value adding and retail ready meat products for Australia-wide distribution.

ACC has successfully established a comprehensive environmental management program (EMP) for its food-processing facility and is rolling this out to their farm and feedlot operations.

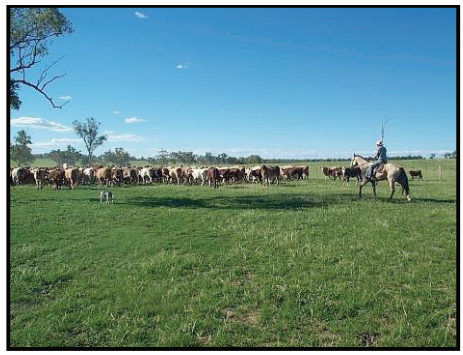
The ACC EMP has not been undertaken alone. It has involved the formation of partnerships with the Queensland Environmental Protection Agency (QEPA) and Meat and Livestock Australia (MLA), with the support of the United Nations Environment Program (UNEP) Working Group for Cleaner Production and expert input from a variety of environmental professionals.

Initiative & Innovation
ACC's charter and vision is to conduct operations in accordance with defined world's best industry practices underpinned by certified international standards for environmental management (ISO 14001).

To achieve eco-efficiency and sustainability ACC have deployed a number of business tools including environmental management systems, life cycle assessment techniques, cleaner production methods and environmental labelling mechanisms.

Environmental Management System (EMS) – Factory / Feedlot / Farm modules
ACC achieved ISO 14001 certification for their central processing facility (factory) at Cannon Hill, Brisbane, Queensland, in August 2001. In June of 2003 stage 2 of the plan was completed with the 'World First' tri-certification of the Brisbane Valley Feedlot for ISO 9001 Quality, ISO 14001 Environment and HACCP 9000 Food Safety. The final stage of the working model for through chain implementation includes the tri-certification of Babbiloora station in March 2004, completing the development of modular generic EMS templates for farm, feedlot and factory business units in the ACC group.

ACC's Brisbane Valley feedlot



ACC's Babbiloora Station

Cleaner Production

A Cleaner Production Implementation Plan (CPI plan) was developed following a cleaner production assessment completed at the Cannon Hill central processing facility which identified a number of eco-efficiency opportunities in water, energy, wastewater and waste solids management. The CPI plan requires a range of simple, through to complex, processing modifications to deliver potential economic and efficiency benefits over a ten-year term. These benefits will equate to target resource and waste reductions of:

- total water use by 37% (10 year target)
- total greenhouse gas emissions by 8,027 tonnes (CO_2) from reduced energy use
- total coal use by 36%
- biosolids by 84%
- waste water by 36%

The staged approach of the plan will commence with simple initiatives in energy, water and waste management that require minimal capital expense. Examples include fitting efficient spray nozzles to hoses, minimising water flow rates, reusing treated wastewater in non-critical applications, and introducing practices that reduce heat ingress into refrigerated spaces.

This will be followed by steps to implement plant alterations that require an intermediate level of capital expenditure without major process redesign. This includes initiatives such as replacement of sensor and timer controls on hand wash stations and insulated knife sterilisers, replacing refrigeration condensers, converting red offal wash to sensor-operation and recovering heat from boiler blowdown for preheating the boiler feed water.

Stages 3 & 4 require process redesign to allow for alternative sources of energy and water including:

- Rainwater harvesting as mains water replacement in non food contact areas (cleaning, ablutions, irrigation)
- Heat recovery from refrigeration compressors
- Anaerobic digestion of waste water and manure to produce biogas (methane) and the reduction of biosolids production from the wastewater treatment system
- Utilisation of biogas to supplement coal in the existing boiler.

Life Cycle Assessment
As a vertically integrated "plate-to-paddock" demand chain organisation (demand driven as opposed to supply driven), ACC is in a unique position to complete a Product Life Cycle Assessment to identify and quantify environmental impacts throughout the entire product life cycle. An inventory of product life cycle data was completed for the Cannon Hill central processing facility in July 2001, with an entire agri-chain life cycle assessment being considered from farm through to factory.

Extension, Promotion & Presentation

The core philosophy of the ACC EMP is to attain a 'beyond compliance' position, be proactive to community environmental values and derive a commercial benefit in the process. To meet the challenge ACC must remain tuned to the issues of the day and the future.

Industry extension and dissemination initiatives are a critical component of ACC partnership arrangements with the program stakeholders and therefore strategies for wider communication and application of ACC's activities is assured.

"Doing our bit for the Bremer" – The Dinmore food processing facility tertiary wastewater treatment program

Australia Meat Holdings – Dinmore, QLD

The problem
Australia Meat Holdings Pty Limited (AMH) and the Queensland EPA entered into negotiations on a revised environmental licence in 2001 for the Dinmore Food Processing Facility. Available scientific information demonstrated that the Bremer River, to which Dinmore's treated effluent and numerous other point and non-point sources are released, has been under stress for many years and was in a pretty poor state.

As a result, AMH made the commitment to try and improve the health of the River. The Company negotiated an outcome with the EPA that would impose very stringent standards on effluent loads to be released from the plant, yet still be achievable with the right technological solutions and a significant amount of effort. At the time this commitment was made, it was not certain that the limits that were imposed could be achieved consistently and at a throughput of 6ML per day.

The solution
AMH established a major R & D Program to help identify the best form of treatment that would achieve the results required under the revised Environmental Licence. Assistance was sought from MLA/AMPC to undertake some trials on nutrient reduction both at the point of generation and within the treatment system itself.

Further to this, a major review was required to determine the most feasible treatment technology that would achieve standards of water quality that meet a Class 'A' non-potable standard or, in simpler terms, a quality of water that is safe to swim in. Various technologies such as Ozonation and UV disinfection that have been implemented throughout the sewage treatment industry were considered. However, these technologies are largely untested on meat processing effluent.

After considerable input from people inside and outside the company, a treatment solution was selected that included:

- Optimising recycling on site in accordance with AMH's Water Efficiency Campaign.
- Chemical precipitation of phosphorous through the addition of Alum and Lime for pH correction within the Sequencing Batch Reactors (SBRs);
- Design and construction of a Tertiary stage Dissolved Air Flotation (DAF) Unit, including polymer addition, for Total Suspended Solids and some BOD reduction;

- A suitably designed chlorine-based disinfection system to ensure compliance with bacterial standards. UV and ozonation proved to have technical deficiencies with transmissibility through the water column and were not cost-effective.

The system has been constructed and successfully commissioned. The system is now producing the following water quality attributes:

Water Quality Parameter	Range
Biochemical Oxygen Demand	5 – 15 mg/L
Total Suspended Solids	5 – 15 mg/L
Dissolved Oxygen	>6 mg/L
Total Nitrogen	10-25 mg/L
Total Phosphorous	2-8 mg/L
Total Faecal Coliforms:	<10 cfu/100mL
Enterococci:	<10 cfu/100mL

The benefits

- Dinmore is arguably the first integrated beef plant in Australia and possibly the world that treats its own effluent to a non-potable 'Class-A' standard.
- The system helps to ensure Dinmore remains in compliance against what are arguably some of the most stringent, yet achievable, licence conditions for release to surface waters in the industry.
- Dinmore now has around 1GL per annum of excellent quality water available to divert into future treated effluent reuse schemes, as opposed to releasing it to the Bremer River. This will provide cost-effective water to other parts of the agri-business and general industry sectors in southeast Queensland
- The actions taken by AMH on this project reflect positively on the willingness of the Company to show its commitment to contributing to a better environment and 'walking the talk'.
- The EPA has a 'world's best practice' operation right on their doorstep with which they can demonstrate AMH's and the EPA's commitment to working together for the benefit of both industry and the environment.
- This type of technology can be applied throughout the industry, particularly at those facilities, which release to surface waters.
- By treating the effluent to this standard it is transformed from a cost burden into something that is of value for re-use in industry or agri-business sectors. Preliminary discussions have been held with Ipswich Water and others and this quality of effluent could return around $100,000 p.a., as opposed to additional cost for further treatment.

The cost
The capital and operating costs to deliver this highly successful achievement includes:

Capital: $2.2 million (approx.)
Operating: $200,000 p.a. (approx.)

Dinmore's new Tertiary DAF and Disinfection System

"Every drop counts" – The Australia Meat Holdings Pty Ltd water efficiency campaign

Australia Meat Holdings – Dinmore, QLD

The problem
Prior to the commencement of a water efficiency program, water consumption on plant at Dinmore was at an all-time high – up to 5.5 ML per day. The existing wastewater treatment plant was designed to accommodate 6 ML per day, and the design capacity was beginning to be stretched to its limit. Wastewater treatment performance was suffering as a result, which put at risk compliance with the company's regulatory requirements with the EPA.

In addition to this, it was costing AMH many thousands of dollars per week in purchase of water and the additional cost of treatment. They were also looking at a major investment to expand the wastewater treatment system to accommodate these flows. The Company decided that this was not a viable alternative and, at the end of the day, building additional capacity was not addressing the source of the problem, merely the symptoms.

The solution
It was agreed that rather than build additional capacity, they would recover the capacity in the existing wastewater treatment system by reducing their water consumption. From that point in time, AMH commenced the Water Efficiency Campaign and introduced a target consumption figure of 4.5 ML/day. At the beginning of the Campaign, it was not certain that the goal could be achieved, but the results have proven that it could be, and is being, achieved consistently.

To achieve this goal, firstly a water reduction committee was established, which included representatives from Senior Management, Engineering, Environmental and Production. A logic-based mapping exercise then followed, using a portable flow meter that was installed across various water supply lines to determine flows over time. Once a snapshot of relative flows across the plant were determined on a line by line basis, with the assistance of MLA, over 12 permanent flow meters were installed and linked to the existing SCADA network to enable each flow to be measured continuously and to establish baseline data.

Engineering, Environmental and Production employees were involved in the mapping of the water consumption across the plant and a comprehensive training and awareness program was developed and presented to over 200 staff on the importance of environmental issues and, in particular, how to use less water. Senior Management has been and continues to be highly supportive of the Program throughout its duration, with reporting on progress being tabled at each Corporate Environment Committee meeting.

A wide variety of innovative and eco-efficient measures were undertaken to help reduce consumption. Training and awareness to help modify employee behaviour was a critical component. The installation of AAA rated water nozzles for wash basins; installing effective and efficient spray nozzles; placing solenoids on various areas of the plant to control the application of water depending on production; controlling pressures to various supply points; and optimising recycling, have all contributed to achieve this outstanding result.

The installation of the flow meters allows AMH to measure water use. With innovative use of a series of novel changes to programming, the data is able to be collected through the SCADA network and tracked through linking software programs. This allows data to be presented against a 30-day rolling datasheet on a daily basis. This innovation allows the company to identify when there is an obvious increase in otherwise 'expected' flows, thereby providing a tracking mechanism to flag possible leaks or excursions from standard practice.

The benefits

As a result of AMH's Campaign, the following environmental and financial benefits have been realised:

- Town water consumption has reduced to 4.5 ML per day. This is a reduction in water consumption by a very significant 184 ML p.a. This has significantly reduced AMH Dinmore's demand on this precious natural resource. The 184 ML is now available for use by other members of the local community;
- Overall performance of the wastewater treatment system has increased due to the increase in the hydraulic retention time. This gives the treatment system more time to do its work;
- Delayed indefinitely further capital expenditure of around $2 million to increase treatment capacity by installing an additional Sequencing Batch Reactor (SBR).
- Saved around $300,000 p.a. straight off the bottom line on water purchasing and treatment costs alone.
- The plant has now reached new reduced levels of water consumption which staff at Dinmore believe are 'cutting edge' and extend beyond world's best practice on kL/tHSCW and a litres/head basis for an integrated beef plant.
- Through the training programs that have been undertaken, staff and employees are fully aware of the importance of saving water and actively pursue water reduction opportunities where possible throughout the plant.

Because of its success and its cost-effectiveness to implement, this Campaign is now being implemented throughout all of AMH's Processing Facilities as it can be readily applied to any plant with minimal capital outlay.

The cost
The capital and operating costs to deliver this highly successful achievement for Dinmore includes:

Capital: $65,000 (approx.) Operating: $10,000 p.a. (approx.)

One of Dinmore's Environmental Officers monitoring water flows through the plant on a 'real-time' basis on the SCADA Network

Flooded woodland effluent management system

Cowra Abattoir – Cowra, NSW

The problem

The problem at Cowra Abattoir was to control the usage of effluent waters and to meet a requirement of the EPA for zero run-off from the Effluent Reuse Area (ERA) including measures to: protect surface and ground water quality; prevent land degradation and maximise the reuse of effluent

The ultimate objective of the plan was to ensure that the operations of the Cowra Abattoir are carried out in an environmentally sustainable manner that is in accordance with community expectations and regulatory requirements. To achieve these outcomes any initiative must: ensure maximum effective use of the available effluent reuse area; use a vegetation system capable of utilising water on a year round basis and minimise odours and odour complaints from the public.

The solution

The problem has been solved through the planting of an 8 hectare eucalypt woodlot at the western end of the ERA. This area has been bunded to capture all run-off from the pasture area and to receive irrigation run-off in the winter. Irrigation is supplied from a 58 megalitre holding dam. The woodlot has been established on flat ground and receives run-off during wet weather. It is likely to be flooded for some periods each year. While this would make it difficult for pasture to thrive, some tree species are adapted to winter flooding. Additionally these trees have a high crop evapo-transpiration factor.

The area was deep ripped to one metre deep, three months prior to planting. Gypsum was spread to the rip lines at the rate of three tonnes per hectare. Weed spraying was carried out and the planting of River Red Gum seedlings followed three weeks later in three metre rows, two metres apart. This relatively high density required the planting of 7,000 trees and is designed to establish a canopy cover as quickly as possible.

The benefits

The woodlot system will enable storage of water during winter for the trees to utilise in summer. A eucalypt has the capacity to displace 40 litres of water per tree per day. The depth of the free water can gradually be increased from a few centimetres in the first winter to a metre once the trees are 10 metres high. It is proposed that the maximum depth will be 0.5 metres. The site will be allowed to dry out completely each summer, apart from accepting rainfall run-off from the irrigation area. The varieties of eucalypts favour this winter flood/summer dry cycle.

An aerial view showing the holding dam above and woodlot in flood below

The developing woodlot area taken from the bunding wall below

Eucalypts exhibit higher winter transpiration than crops such as lucerne. Therefore the use of trees will assist water uptake during the wet winter seasons. Nitrogen and phosphorus uptakes by eucalypts are estimated to be 80 kg/ha/year and 5 kg/ha/year respectively averaged over 10 years.

The phosphorus absorption capacity of the soil profile is sufficient to absorb the excess phosphorus for at least 300 years and the scheme will as a result comply with EPA requirements for the full discount of Load Based License fees, when the LBL scheme is introduced. The bunding of the woodlot offers a minimum of a further 40 megalitres contingency storage during winter.

The woodlot will be managed for timber production. This will involve the selective thinning of the stand between years five and ten to promote the most vigorous trees. Harvesting of trees for timber will be undertaken on a rotational basis to maintain a mixture of trees of different ages.

The trees have become well established and are currently over 2 metres tall.

Arthur Cooper amongst the developing woodlot trees

Benefits to the project so far are:

- Bird life migration to the woodland area for protection and breeding.
- Odour reductions
- Acceptance by the EPA officials
- Favourable comments from local community residents
- Carbon credits when & if these are introduced.

The cost
The cost to prepare the area for the flooded woodlot was $15-16,000 based on a bulldozer hire rate of $125 per hour. This cost would be variable from site to site and would be dependent on the site level and the cost to build bund walls. The cost to purchase the seedlings is 34 cents per tree or 60-70 cents per tree if larger tubestock is used.

Payback has not yet been determined but is expected in the areas of:

- Sale of the trees for wood for furniture. Prices are strong and are expected to increase over future years.
- Reduction in stockfeed costs due to the cropping of 60-80 hectares of lucerne from the run-off area immediately above the woodlot.

The future of the environment in the meat industry

EG Green & Sons – Harvey, WA

The problem

The E.G.Green and Sons Pty Ltd owned Harvey Beef processing plant has grown from a "handful" of cattle each week in 1919 to an annual kill and process of in excess of 160,000 head of cattle per year on a multi shift 7 days per week basis. During this time the township has grown significantly to its current population of 3000, and its production industries have diversified. Traditional dairy farming has been slowly replaced with viticulture and tourist based industries such as B&B's. It's proximity to Perth makes it an idyllic weekend retreat. This influx of tourists and wine connoisseurs has led to complaints in regard to odour and noise emanating from the site, especially considering the 7 day operation.

The solutions – 1. Odour from rendering

The approach

In 2002 Harvey Beef installed an enclosed biofilter system. The project was undertaken to eliminate odours from condensable and non condensable gases released as part of the rendering process as well as general odours released during blood drying and all other activities undertaken through a fully integrated rendering process.

The benefit

Immediate benefit came through compliance to DEP license conditions, immediate reduction in neighbourhood complaints and immediate reduction in raw emissions to the environment.

Cost and payback

The cost to install the biofilter has been determined as $432,000. The immediate payback has been through the ability to continue rendering activities on a 24 hour basis. The value of this has not been calculated but the investment in the biofilter is considerably less than the cost of additional rendering plant to reduce production to 10-12 hours.

There has also been a reduction of local odour complaints from 32 per month to 1 per month.

The Biofilter Fan Shed

The Biofilter from Rendering to Scrubbers.

The solutions – 2. Odour from waste treatment

The approach

In 2002/2003 Harvey Beef installed what is affectionately called the "RENOIR", in short reduced nitrogen through aeration for irrigation. It is designed to achieve robust nitrogen reduction from medium strength effluents using biological nitrogen removal. The key features include:

- provision of an anoxic zone incorporating carbon-rich raw feed to fuel denitrification of nitrate;
- provision of directional aerators to provide required recycle of water from aerated to anoxic zones; mixing of pond contents and aeration;
- provision of a sludge settling zone demarked from the aerated zone by a turnover baffle arrangement which permits low vertical velocities in the settle zone to permit sludge settling; sludge capture and management and/or sludge recycle back to the aerated zone.

The previous anaerobic pond system was continually at maximum capacity as far as nitrogen and phosphorous reduction, and treated water was another source of odour as it was dispersed around the surrounding farmland as irrigation water.

The benefit

An immediate reduction in nitrogen and phosphorous levels allowed more water to be dispersed within a smaller irrigation area. This not only significantly reduced the area needed to irrigate but limited the number of neighbours exposed to irrigation water. Secondary to this, the "RENOIR" has allowed the water released to irrigation to be supplied for re-use as trade water by other irrigators if required. The commercial value of this resource has not yet been determined.

"Renoir" Tuarts in background.

NATA Signatory Sherri Christie.

Cost and payback

The cost to install *"Renoir"* has been determined as $750.000. The payback is in the ability to achieve compliance to DEP license requirements and the ability to continue processing.

The solutions – 3. The management team, EMS and quality systems

The Approach

To facilitate the process of assessments and ongoing quality management culture a multi-level environment committee has been formed. The committee meets on a fortnightly basis and discusses and actions major environmental challenges and initiatives including:

- Community Liaison Strategy – Complaints and feedback and strategy progress.
- Correspondence from DEP, both incoming and outgoing, and actions to be undertaken
- Project overviews, including analysis of consultant data.
- Discussion of waste minimisation strategies.

The EMS is incorporated into the MSQA (Meat Safety Quality Assurance) manual ensuring:
Management Review, Internal Audit, External Audit and Document control and process conformance monitoring.

The benefits

- A controlled management system in alignment with ISO14001 with the ability to become ISO accredited if marketing opportunity exists.
- Career path progression for quality assurance personnel into environment streams.
- Utilisation of on-site resources for sampling and testing of water, air and environment.
- Excellent rapport with DEP personnel, including knowledge of on-site resources and contact personnel within the company.

Dewatering bags to reduce the water content of abattoir sludges, to allow incorporation of these sludges in composting

Fletcher International WA – Albany, WA

The problem

One of the main problems facing the meat processing industry is how to economically treat bio-solids in an environmentally friendly manner. Common practices have been to directly incorporate bio-solids into compost, directly spread onto paddocks, de-water with belt presses, de-water using RFDF equipment and by direct disposal to sewerage.

Problems encountered by Fletcher International WA have resulted from spreading the bio-solids into compost making the composting facility unusable due to the large quantities of bio-solids produced daily and the high moisture content of this material. The nature of this material prevents it from composting properly (due to an ineffective carbon to nitrogen ratio). This results in the formation of odour and compost in an inorganic form.

Spreading over the irrigation paddocks was another option for Fletcher's in WA. However this too has resulted in problems. The nitrogen and ammonia levels in the groundwater have shown evidence of gradually increasing; this combined with the loss of available grazing land gives this option a limited life.

The solution

Fletcher's WA has shown that this problem can be solved with the incorporation of de-watering bags as a means of separating fine solids from wastewater. This operation is a relatively cost effective means to treat bio-solids, with the benefit of producing a solid material with a significantly reduced water content suitable for composting, or other similar disposal method, plus water suitable for re-use on-site, or for irrigation or sewerage disposal.

Depending on the volume of the bio-solids produced and the water: solids composition, the de-watering bags can be used as a means to treat bio-solids/sludge produced by the Dissolved Air Flotation (DAF), or as a means to treat bio-solids when de-sludging ponds or wetlands.

A trial bag has been used, which was approximately 4 m x 4 m, with one fill port. This bag held approximately 72,000 litres of sludge (of approx 5 to 10% solids) pumped in over a four week period. The bag was installed in the composting facility to utilise the bunded area.

The benefits

The use of dewatering bags gives:

1. A cost effective means of treating sludge/ paunch,
2. The ability to re-use water from bags back into the system,
3. Material suitable for composting or combining for soil conditioning
4. Options are open for use in a variety of other functions such as ongoing DAF sludge treatment, paunch treatment, pond de-sludging, or for water treatment,
5. Nil odour release.

The cost

Costs of de-watering bags depends on the size required. Three different sizes have been investigated, 20 m, 50 m and 80 m bags. Typical bag costs are shown in the following table.

20 m bags	50 m bags	80 m bags
2 to 4: $2,750 each	2 or more: $6,250 each	up to 2: $10,000 each
5 to 11: $2,500 each	more than 5: $5,875 each	more than 3: $9,400 each
more than 12: $2,350 each		

All tubes listed above are approximately 13.7 m in circumference, with fabric strength of approximately 70 x 10^5 kN/m. Their capacity is about 10 to 11 m_ per metre of length.

A drain board has proven of benefit to use as a means to increase the surface area. This costs in the range of $7.95/m_. (rolls are 20 m x 2 m)

The trial bag in use at Fletcher International WA

Larger bags currently used at the Water Corporation in Albany, WA

Protecon Advanced Meat Recovery System

Cargill Beef - Kooragang Island, NSW

The problem
Extracting beef close to the bone is almost impossible in today's high speed boning operations. As a result this meat is not recovered for edible purposes and is lost to the inedible rendering operations. This edible meat loss results in lost boning room yields, increased labour cost per kilo of edible meat recovered and ultimately lost revenue to the company.

The solution
The solution for Cargill Beef Australia has been to identify a suitable mechanical system for recovering this meat from the bones in such a way that it retains its hygienic edible status and remains in a recognisable and acceptable form for the company's customers. Cargill management identified that the most effective and cost efficient solution would be the development and installation of a Protecon advanced meat recovery system suitable for Australian conditions.

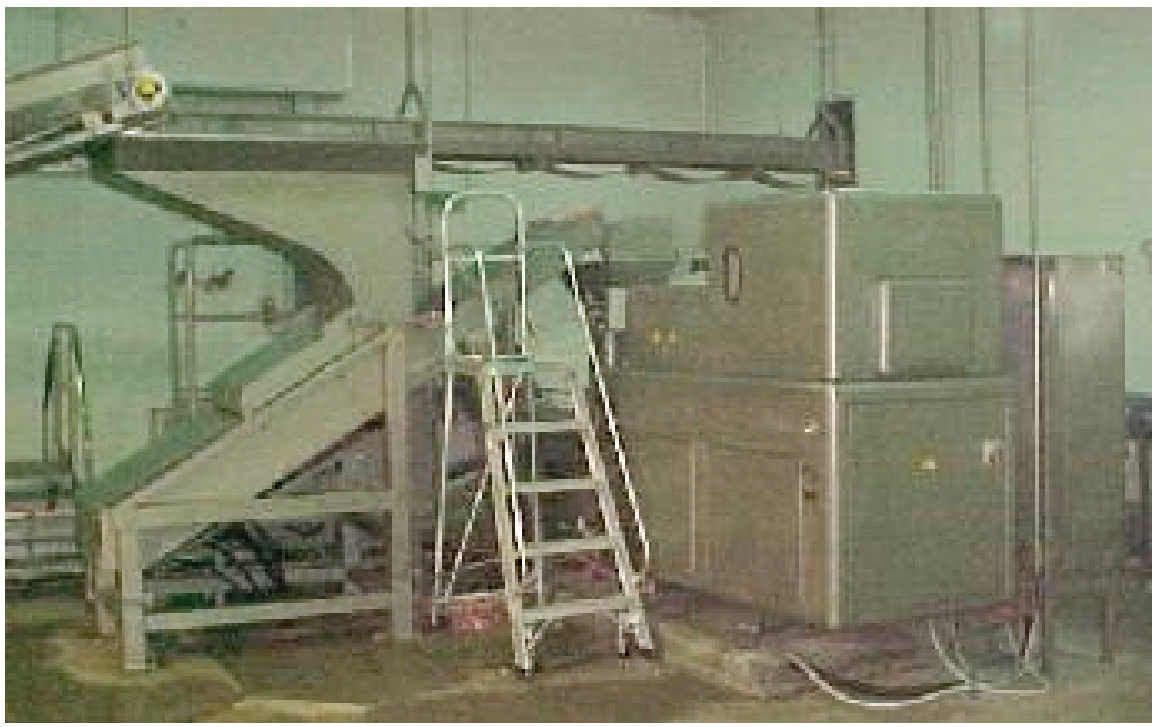


Photo 1 showing the Protecon meat recovery equipment.

The development process involved, firstly, redefining the definition of "meat" in Australia where Cargill worked with the Australian Quarantine Inspection System (AQIS) and Safemeat, which had expanded the definition of meat to include products derived from advanced lean recovery systems. In the new regulations, products, to be considered meat, must be derived from a processing system that does not crush, grind or pulverize bones and the end product must contain less than 150 mg calcium/100 g of product.

Cargill Beef Australia then worked with customers on the use of the recovered meat and the advantages of using the product from this innovative technology.

Photo 2 showing the recovered meat from the Protecon system

The benefits

The product is classified as meat and has an appearance the same as lean ground beef. The recovered meat is used by customers as a replacement for beef trimmings in hamburger patties, pies, etc. It is now accepted by customers as 'second to none'.

Yield from the Protecon advanced meat recovery system has averaged 3 kg per head of cattle returning approximately $6 per head. Estimated payback for the system from this yield of recovered meat is 1 year.

The cost
The capital cost to purchase, install and commission the Protecon advanced meat recovery system under Australian conditions has been approximately $1 million.

Minimal staff are required to operate the system including handling raw material and packing and handling finished product. Product is packed in standard corrugated fibreboard cartons with poly liners and is despatched frozen. Options exist for handling as chilled product to nearby customers.

With an estimated working life in excess of 10 years and a payback of only 1 year the development and installation of this equipment has proven a valuable investment for Cargill Beef Australia.

Robotic Sheep Kidney Fat Removal System

CRF (Colac Otway) Pty Ltd – Colac, VIC

The problem

CRF (Colac Otway) is a Coles Supermarkets' dedicated food-processing facility, specialising in lamb, mutton and veal. CRF have belief in their role as an industry leader, and pride themselves on the continual development of efficient and innovative processes.

CRF recognises the fact that they need to constantly strive for success if they wish to remain at the forefront of the red meat processing industry. However the company has been plagued by the very serious issue of employee recruitment and retention.

Despite the fact that CRF is the main employer for the Colac and district community, they still struggle to recruit employees, with retention levels extremely low. This problem affects throughput, reduces profit and puts pressure on the remaining workforce.

The solution

Management at CRF felt that automation was the solution, and with the advances recently being made in regards to visual imaging, they believed that this uncertain step could open many doors, not only for CRF, but also for the red meat processing industry in general. An approach was made to Meat and Livestock Australia Ltd (MLA) for advice on this new venture.

MLA, in conjunction with Food Science Australia completed an audit of the plant, wanting to pinpoint an area of the production line in which to begin implementation of some form of automation. The kidney fat removal station was chosen because it appeared to be one of the easier positions to tackle as the first attempt at automation.

In August of 2003, MLA assigned Food Science Australia the task of developing a system that would be capable of completing the kidney fat removal operation efficiently and more effectively than the current manual process. The project moved through from concept to commission within 6 months, with MLA, FSA, local contractors and the CRF project team working closely together to ensure all necessary steps and precautions were undertaken to ensure a smooth and effective operation.

The automated kidney fat removal system (which has been affectionately named 'Arnie' by the employees and management at CRF) consists of an ABB robot, specially designed end effector, polycarbonate safety enclosure, sensing equipment and light curtains.

Arnie on line at CRF.

The system was programmed and trialed extensively at the FSA in Cannon Hill, before being commissioned at CRF, where further production trials took place.

The benefits

The automated kidney fat removal system has the ability to increase quality of product, reduce training, OH&S and work cover costs, and replace up to 2 labour units. For CRF, this equates to an annual saving of approximately $70,000. The project has marked a huge milestone for CRF as well as the meat industry, being the first robot in Australia to be fully commissioned on a red meat processing floor.

'Arnie' is currently being used in the production line at CRF. However the system is yet to reach the desired performance levels and further testing and trials are still being conducted by the CRF project team to improve performance.

Arnie in the operation of fat removal

Once the technology is perfected, MLA will encourage other processing companies to consider the system, which is intended to become commercially available in the future.

The cost

The total cost of the project has been approximately $265,000 and has been jointly funded my CRF, MLA and AMPC. CRF's contribution has been approximately $100,000 with a pay back period of just over one year.

The future

This is not the end of the innovation program for CRF. CRF is extremely dedicated to innovation, with the Arnie project being just the tip of the iceberg. They believe that for Australia's red meat processing industry to reach the competitive levels of other industries, such as the chicken processing industry, they need to become more innovative, and encourage change. For CRF this involves further automation in the processing and further-processing lines, as well as a strong focus on value added product. CRF, with the support and guidance of MLA, are determined to rise to this challenge, encouraging the rest of the Australian red meat industry to follow in their footsteps.

Arnie with the CRF innovation development team

Electronic QA Data Collection using Theta Information Leader

Oakey Abattoir – Oakey, QLD

The problem
Oakey Abattoir, located at Oakey on the Darling Downs operates a vertically integrated beef processing facility. Nippon's Oakey operation provides value-added beef products to sensitive world markets. The 5-day a week operation employs in excess of 450 full time staff. To enable Oakey Abattoir to consistently supply the US & Japanese markets with high-grade grain fed beef, the company has developed and implemented multiple management programs including:

- HACCP Quality Program
- EU Approved Meat Safety Program
- USDA Approved Meat Safety Program
- NATA Approved Laboratory Program
- AUSMEAT Quality Program

Day to day operation of the company's management programs involve company management and QA Staff monitoring livestock, processes, product and equipment in accordance with documented program requirements.

The information collected through the monitoring process was previously recorded using traditional paper-based methods, with an equivalent of up to 80 sheets of A4 paper per shift per day. After company management signed off documents, the majority of information collected was archived in storage facilities for up to 7 years.

Due to the dependence on countless sheets of paper, reviewing and retrieving information was time consuming and costly, generally resulting in a time delay between a problem occurring and staff being notified so that they could respond accordingly. This also made it much more difficult to effectively utilise operational information to improve the companies programs, products or processes.

The solution
In July 2001, Oakey Abattoir seized the opportunity to replicate all the companies' management programs electronically through the use of Theta's Information Leader application. Version 1.0 of Information Leader was installed in September of 2001. All programs have been running on electronic data capture since that date.

Personal computers replace clip boards and pens as inspectors record information in real-time on electronic forms that have been developed in-house by the QA staff using Information Leader's form builder module. Each of these electronic forms has direct links to work instructions, standard operating procedures and other associated documentation relating to filling out the form.

Because monitoring is recorded in real-time, users and others responsible are alerted instantly when critical limits have been exceeded. Process Managers

monitor the captured data throughout the day to ensure systems are functioning to company requirements.

Historical forms and documents are now permanently stored electronically allowing instant recall, using Information Leaders integrated search engine, in a matter of seconds. The Information Leader reports module allows Oakey's Managers to easily generate reports and charts from the data collection process, allowing them to identify trends whether good or bad and put appropriate improvement or preventative actions in place.

By implementing Information Leader, Oakey Abattoir now has instant access to any piece of information recorded within their organisation. Real-time key performance indicators of their business operations, reports and trend charts are available. Managers are now better informed than ever to make decisions to help to improve people, processes and product.

The benefits
Management at Nippon & Theta Technologies have identified the following important benefits to Oakey Abattoir:

- The time saving has been huge, providing a quick return on investment
- Instant access to any piece of information recorded by inspectors, company wide
- An ability to make better informed decisions on product, processes and people
- The quality of recorded information has improved
- The sign-off of forms is immediate, not at the end of the day or next day
- There is automatic form and document version control
- Process limit alerts are automatic with timely notification of problems in real-time
- There are live links to company procedures and policies
- There is no more paper document storage and filing
- Reports and Trend Charts are available in real time
- The company is growing with the solution

The cost
The cost to develop and install the system at Oakey Abattoir is estimated at $32,000. On the basis of labour savings alone the payback period for this investment is estimated at six months.

The cost for hardware and software to implement a similar system at other processing plants is estimated at $44,000.

Beef carcass hot fat trimming device

Rockdale Beef - Yanco, NSW

The problem

A problem existed with gas bubble formation in vacuum packaged beef cuts, chiefly those from lot-fed cattle that were chilled for lengthy periods of time. This gas formation tended to give customers an impression that the affected bags were not sealed properly and thus leaking. The detection of a leaking bag by the customer means that not only the particular primal could be condemned, but also the whole consignment.

Most export vacuum packaged cuts require trimming of the subcutaneous fat, generally down to a thickness of around 10 mm. This trimming is traditionally performed in the boning room on the portions after they have been boned out from the carcass. The trimming is usually carried out with simple boning knives.

Food Science Australia meat scientists discovered that the chief cause of the bubble formation was that trimming the fat surface sets off a reaction causing the release of gas for a certain period of time. If beef cuts are packaged prior to an appropriate slowing down of gas formation, then bubbles will appear between the surface and the bag. One proposal emanating from these findings was for the excess subcutaneous fat to be trimmed at the end of the slaughter floor, when the carcass is still hot.

In changing fat trimming procedures, meat processors had to be aware that their customers have indicated that the quality of the surface finish as presented in the bag is an important feature when any consignment of vacuum packaged beef is assessed. Cold trimming generally gives an acceptably smooth minimum standard surface finish.

The solution

Rockdale decided they would try hot fat trimming of their lot-fed carcases. They accepted the submission by Food Science Australia to design and build a hot fat trimming device on their behalf, with a longer time view to assisting the meat industry in general. FSA engineers reviewed and trialed a wide variety of cutting methods. The initial proposal for the device included a fat-depth sensing and feedback apparatus that would adjust the cutting in real time to provide a specific fat thickness on the primal. Suitable sensing methods were also investigated in the initial stages of the project.

An initial pneumatically driven prototype was developed by FSA and trialed at Cannon Hill. A selection of cutting blades was also tested at this stage. Staff at Rockdale Beef were informed of the progress and were happy for work to proceed to the next stage.

A second hydraulic powered prototype was constructed by FSA and sent to Rockdale Beef after testing at Cannon Hill for trials to prove the equipment's potential. The second prototype is shown in photograph 1 below.

A third, commercial prototype was developed to improve performance and installed at Rockdale Beef by FSA engineers for in-house trials. This equipment has now been used in production for 3 years under the supervision of Quality

Assurance and plant management. Operation of the hot fat trimmer is shown in photograph 2 below. After the initial production trials proved to be highly successful, Rockdale Beef decided that there would be little gained through the addition of a depth sensing/feedback system and development of this equipment did not proceed.

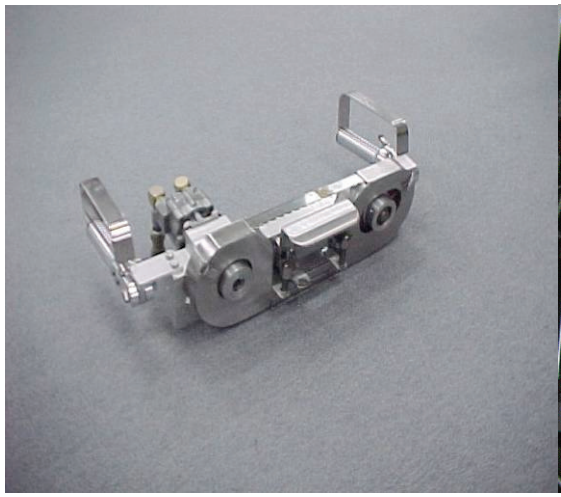


Photo 1. The hot fat trimmer prototype 2 with guards removed	*Photo 2. The hot fat trimmer in use at Rockdale Beef*

The benefits

The device has been used successfully for several years at the Rockdale Beef plant in Yanco, NSW. The problems associated with gas bubble formation in their vacuum packaged primal cuts have been virtually eliminated. The surface finish provided by the device is of a standard approved by the customers.

Staff using the device have reported that they have found the equipment simple to use, so long as the counterbalance is set up correctly. Use of the hot fat trimmer is applicable to any plant providing a suitable area is available between the end of the slaughter floor and the entry to the carcass chillers.

The long-term usage of the hot fat trimmer has proven the reliability of the device. A blade generally lasts sufficient time for several hundred beef sides to be trimmed. After a certain time blades may either break, usually from fatigue at the welded junction, or becomes dull.

A reduction in effort for the slicers to carry out their tasks in the boning room has also been identified. However Rockdale Beef have not capitalised on this through reducing the number of slicers.

Other potential benefits that could be realised from removing fat from the beef carcasses prior to chilling are

- Reduced carcass weight to chill
- Potential improvement in the carcass chill due to the reduction in fat cover thickness
- Reduced hard fat OH&S issues
- Opportunity to pack fat hot, allowing packaging efficiencies to be realised
- Eliminate the cooling & heating steps associated with rendering cold fat
- Reduction in work effort associated with cold fat removal
- Potential increase in customer product acceptance due to improved fat surface finish.

The cost
As the hot fat trimmer in use at Rockdale Beef is a production prototype, the commercial cost of purchasing this equipment is not yet known but is expected to be similar to the cost of other hydraulically powered meat industry hand tools.

RF Identification Bolus Recovery System

Norvic Food Processing, Wodonga, Victoria

The problem

The National Livestock Identification Scheme offers the Australian meat and livestock industry clear identification and traceability of product throughout the breeding, growth, processing and distribution chain, provided that readable tags can be secured to product throughout this chain. Radio frequency ear tags and boluses are available to provide livestock with unique identification.

Readable ear tags are more prevalent than boluses but can unfortunately be accidentally or deliberately removed resulting in loss of traceability for those animals. Anecdotal evidence suggests that approximately 1% of ear-tagged animals presented for slaughter have no radio frequency ear tag, significantly reducing the effectiveness of the NLIS system and maintenance of animal identity. The security of the meat industry relies on verifiable identity, which can only be provided by radio frequency boluses that are placed into the animals' stomachs and can not be removed until slaughter.

Boluses are initially more expensive than ear tags but can be reused a number of times making them cost effective. Unfortunately the boluses have been difficult to recover at slaughter and have created a problem by blocking effluent screening systems. They are also known to contaminate meat meal produced by rendering plants handling the gut material containing the boluses.

The solution

Norvic Food Processing slaughters up to 360 head of cattle per day and had previously wet dumped paunch contents directly to the effluent system along with significant quantities of water to flush out the paunches and to move the solids in the paunch contents through to the primary screening system. This was seen as an undesirable system due to:

- An inefficient use of water.
- The primary screen providing poor recovery of suspended nutrients as a result of the dilution with water
- A significant load of materials other than semi-digested grass that reduced the effectiveness of the primary screening.

A dry dumping system was installed to overcome these problems and reduce the volume of materials to be handled for bolus recovery. Paunches are manually opened directly from the slaughterfloor paunch chute. The paunch is emptied directly into a collecting hopper fitted with a vertical stainless steel water pipe to act as a water umbrella and clean the remaining solids from the dumped paunches. A hand hose with gun is used to rinse the outside of the paunches, the paunch table and the hopper. Water usage is minimal and assists in flushing the dumped solids along a short chute directly to the solids recovery system.

The dumped solids and small amount of water enters a simple 2 stage dewatering screw press system (photograph 1) to produce a soft cake at low moisture content (estimated at less than 40%). A breaker bar mounted on the discharge end of the screw flights initially breaks the cake, containing the boluses and other contaminants. The broken cake falls onto a shaker screen with 19 mm holes to separate the semi-digested grass solids from the boluses and other materials (photograph 2). The action of the shaking can be adjusted with

variable weight position to give maximum destruction of the clumps without damage to the boluses and the shaker itself.

Photograph 1. The bolus recovery system

Photograph 2. Boluses recovered on the shaker screen

The boluses and other contaminants can be manually recovered from the plate and sorted for reuse or disposal. The pressed grass solids fall into skips for removal to a composting facility (photograph 3).

The dewatering screw used in the prototype bolus recovery system has a solid shaft with drive from the discharge end and is mounted at an incline of 26° from horizontal. These design aspects occurred through necessity to fit with existing equipment and available space. While the press operates successfully under these conditions, a preferred system would use a shaft-less screw driven from the feed end and would be mounted horizontally.

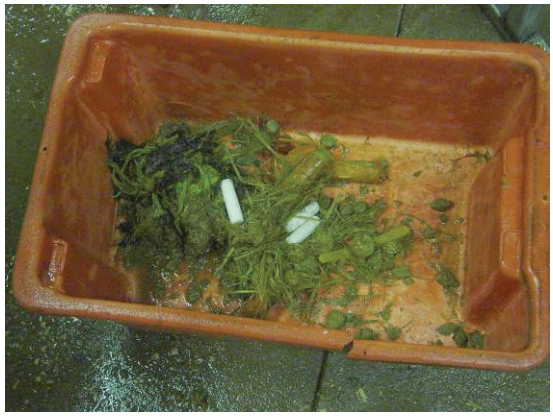
The benefits

Experience with the system at Norvic Food Processing shows that the screening system has been able to hold the boluses from a typical lot size without difficulty and numbers well in excess of Norvic's capacity could be safely retained on the hole plate.

The system has been successful in recovering a large range of contaminants as well as the boluses. Contaminants include string, baling twine, cobalt capsules, plastic bags, cloth, rocks and any other items that the cattle may have eaten during foraging (photograph 4). The inclusion of the breaker bar and larger motor have generally overcome any problems associated with contaminants causing jamming even in times of drought, when the contamination level is high.

Recovered boluses are generally not damaged by the dewatering press and screening system. Prolonged time on the vibrating screen does however result in some marking of the bolus surface. Experience with the bolus recovery system has shown that under production conditions bolus recovery is now at 100% with a readability rate also at 100%.

Photograph 3. Recovered paunch solids for composting



Photograph 4. Recovered boluses and other contaminants

Water usage is significantly reduced in paunch dumping. The reduction in water usage is estimated as 40 litres/minute or 192 kL/week on double shift operation.

More nutrients are removed from the screw press than the effluent primary screen as a result of the reduced dilution of paunch solids when dry dumping. A nutrient reduction of 4% of nitrogen and 18 - 20% of phosphorus has commonly been achieved by using a dry dumping system.

A monetary value has not been determined for this but it is a significant issue for all plants. For plants discharging to sewer this equates directly to discharge fee rates. For plants treating effluent and irrigating or discharging to a watercourse this relates to the sustainability of operations.

The cost
The cost of construction of the prototype system has been identified as:

Screw press construction, installation & commissioning	$43,200
Sweco shaker	$13,800
Modifications to existing equipment	$4,500
Total	**$61,500**

Identified savings per year are:

Recovered boluses (potential)	$81,600
Water reduction (actual)	$16,873
Nutrient reduction (actual)	not costed
Reduced maintenance on effluent screening system (actual)	not costed
Upgrading of meat meal and compost quality (actual)	not costed
Total	**>$98,473**

Potential payback on the recovery of boluses alone is <1 year.
Payback including water use reduction is <8 months

The environmental, social and economic benefits of water use, reuse and effluent management projects

Oakey Abattoir Pty Ltd – Oakey, QLD

The problem
Like many abattoirs, improvement in dealing with the many environmental aspects of the plants operations has been a major concern for Oakey Abattoir. Major issues include water usage, nutrient and oil/grease load, and efficient disposal methods for effluent. Over the last 12 months, attempts have been made to address some of these problems.

The solutions – 1. Water Reuse in Cattle Yards
A project set up to identify ways of saving water and/or reusing water around the plant identified a significant saving could be made by reusing steriliser water from the slaughter floor to wash down cattle and cattle yards. At present, Oakey are saving over 0.5 ML a week on water through washing down yards with the reused steriliser water. Soon, overhead sprays will be fitted to the entire receival yards, creating a 2 – 2.5 ML saving of water per week. An unexpected benefit from this project has been considerable reduction in work, attributable to the fact the warmer water is making it easier to shift dirt and manure from the floors of the yards.

The capital for this project was approximately $25,000. Running costs include electricity for 2 pumps. At $0.30/kL for pumping costs (out of the bores), this project has the opportunity to save the company up to $750 per week, or up to $37,500 per year.

Covered yards

Retro-fitted DAF

The solutions – 2. Dissolved Air Floatation System
Oakey's existing save-all was very inefficient at extracting excess fat from primary treated effluent. This lead to a heavily increased nutrient and oil/grease load on their wastewater treatment system. Consequences of this would have been: the existing system being unable to cope; high level of nutrients in tertiary treated effluent and having to build larger effluent treatment systems.

A decision was made to retro-fit the existing save-all with a Dissolved Air Floatation (DAF) system. As a result Oakey Abattoir is now extracting more fat and nutrients from the effluent stream than ever before. This has led to a reduction in the nutrient load being placed on the wastewater treatment ponds and has increased the rendering plant's daily tallow yield.

The capital for this project was approximately $45,000. Running costs include power to DAF system and save-all, and power for air. Oakey have the capacity for saving up to an extra 3 tonne of fat per day. Based on an average value of $200/tonne for inedible tallow, this equates to $600 per day, or up to $150,000 per year.

The solutions – 3. New Irrigation
The irrigation system that had been in place for over 10 years was severely undersized, and very inefficient. This meant that evaporation and storage dams were being filled to capacity. The water balance (amount of water going in versus the amount going out) did not equal, causing the evaporation pond to slowly rise in level as each year passed.

A new irrigation system was installed in August 2003. This system has given improved reliability, and the size and layout of the pipeline means greater efficiency of effluent output. The capital for this project was approximately $100,000. Running costs include labour costs for the changing of irrigation, tractor expenses, and a 30 kW electric pump and basic maintenance.

The solutions – 4. Cropping
Effluent was not being fully utilised by simply irrigating onto existing grass. One of the many holding paddocks was turned into a cultivated pasture using a grass and medic mixture. The plan is to grow it for feed for cattle, and then, in slower months when there aren't many cattle in the paddocks, to cut and bale the crop for future use.

Capital – approx $12,000. Running cost include labour for irrigation. All other working of the crop (deep ripping, scarifying, planting etc) was done by a local farmer/contractor.

It is too early to determine the crop value but at two cuts per season, and using an average yield, the paddock has the capacity to save approximately $35,000 per year in feeding costs.

Irrigated cropping paddock

Newly planted area of trees

The solutions - 5. Trees

Areas of trees have been planted around the abattoir site. This is being completed in stages, with two areas being planted over the last 18 months, and more areas to be planted this year, and in years to come. The majority of the trees are being irrigated using the plant's tertiary treated wastewater.

Benefits from the planting of these trees include:

- Improved visual amenity (the abattoir site is very flat and undulating)
- Improved condition of soil
- Utilisation of irrigation water
- Improved shade cover for cattle
- A form of future carbon credits

Capital – approx $12,000 so far. Running costs include labour costs and diesel irrigation pump.

Sodium Salt Reduction in Meat Processing Plants

Rockdale Beef, Yanco, NSW

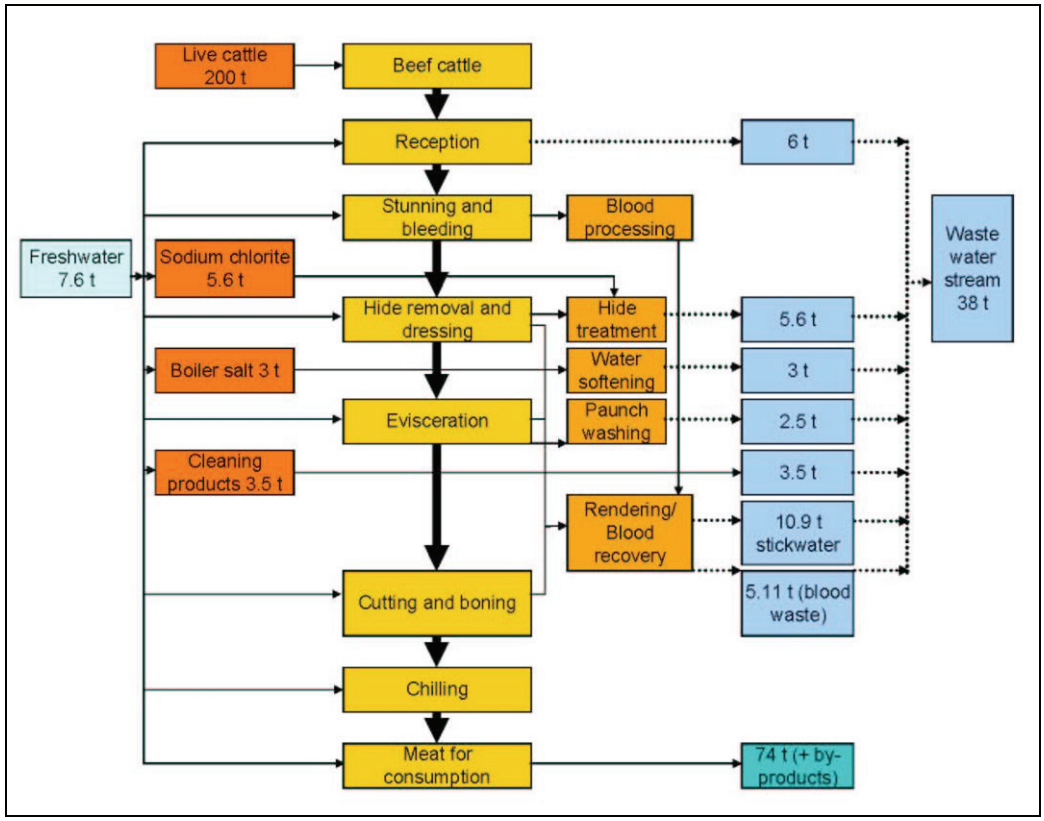
The problem

Water is a precious and finite resource, and can contribute substantially to costs associated with various Australian agricultural and production industries. Large volumes of water are consumed in meat processing plants, primarily for cleaning and waste conveyance. Throughout the production system, numerous by-products are added to the wastewater stream, creating a solution heavily loaded with a number of pollutants, including large quantities of sodium.

Licence conditions for many intensive livestock processing industries do not specifically focus on sodium loads to soils receiving waste waters. Instead, pollution reduction has focussed on the sustainable assimilation of water and nutrients, with a specific interest in organic matter, nitrogen and phosphorus. The detrimental impact of sodium loads to soils receiving wastewaters has largely been overlooked from an environmental perspective, as is the economic cost of applying ameliorants such as lime and gypsum to combat the effect of salts on soil. As a result the reduction of sodium salts in the wastewater stream is becoming a necessity for various production and agricultural enterprises.

The solution

The project aims were to identify methods to eliminate or substantially reduce the quantities of sodium going into water in meat processing, which are directly applicable to other abattoirs and processing facilities. The initial stage identified the key sources of sodium inputs from the meat processing plant at Rockdale Beef, a large feedlot and abattoir operation in southern NSW. A simple input-output mass balance of sodium loads indicated that more than 38 tonnes of sodium is contained in the wastewater stream from the processing plant each year. The high concentrations of sodium in the freshwater supply and various sodium-based chemical additives, in particular for hide treatment, as well as the wastewater streams from the blood-processing and paunch washing areas were established as the significant contributors of sodium.



Sodium Inputs and Outputs

The first stage of the project also investigated the impact of irrigating wastewater diluted with freshwater or recycled water prior to application. Calculations based on Rockdale Beef data indicate that the downstream cost of sodium is around $841.16/ha, or $8.96/kg of sodium that leaves the abattoir. These costs are associated with agricultural issues only, including reductions in crop yield, additional water requirements for deep drainage and the application of soil ameliorants such as lime and gypsum to combat sodicity. This downstream cost does not include the environmental costs associated with long-term soil structure decline or rising ground water resulting from drainage from irrigation applied to flush salts down through the soil profile.

Reducing the sodium load in waste streams from the abattoir is expected to produce a two-fold impact for Rockdale Beef. The immediate economic advantages in reducing the sodium load in the abattoir's wastewater stream, with direct cost savings expected downstream, and an additional long-term environmental benefit of reducing the quantity of sodium salts applied to soil.

Opportunities exist within various processing areas at the plant to reduce or even eliminate sodium salts in wastewater by capturing, retaining and recycling, or replacing, sodium salt solutions. These cleaner production options were assessed against three basic assessment criteria: potential for reducing sodium salt loads, efficiency, and potential economic & environmental impacts. The hide treatment area, resin regeneration and cleaning processes in the rendering plant were the three areas that cleaner production options should be trialed to quantitatively determine potential benefits. Initial investigations have indicated that potentially large reductions in sodium can be readily and cost-effectively achieved through the implementation of cleaner production options in those

areas. Identified alternative processes can be readily adopted at other meat processing plants and hide treatment facilities.

The benefits

To date, two of the three trials have been undertaken. Sodium based cleaning products used in the rendering plant have been replaced, where possible, with an alternative potassium-based cleaner. Over a six-month period, it was found that the volume of sodium was reduced by 1,900 kilograms, or almost 92%. While the potassium cleaning product does cost slightly more than the sodium based product, this cost was offset by the anticipated downstream savings. These downstream cost reductions are associated with on-farm costs, and may not be apparent in an immediate short term environmental improvement. It is estimated that around $0.48 per tonne (HSCW) is saved by using the alternative potassium product resulting in a large saving at the plant over a 12 month period.

Similarly, a potassium based product was used to replace the sodium chloride used for boiler salt regeneration. While this trial is yet to be completed, initial estimates indicate that up to three tonnes of sodium could be removed from the wastewater stream. Again while potassium chloride is more expensive than the sodium chloride, this cost is offset by downstream, on-farm savings.

Sodium chloride used for water softener regeneration

Hide Treatment Area

Potassium loads in wastewater are not expected to pose the same problems as sodium, given the general deficiency of potassium experienced in most Australian soils.

The last trial to be undertaken in the project involves replacing the traditional brine solution used for short-term hide preservation, with an alternative biocide. This replacement biocide must meet criteria determined by the receiving hide treatment facilities while still meeting the requirements of this project to reduce sodium salt loads.

While the project is still in progress, it is clear that significant reductions to the sodium load in the wastewater stream can be achieved by simple measures that are easy to implement.

Sustainable effluent management – one man's trash …..

Thomas Borthwick & Sons, Mackay Queensland

The problem
Around three years ago, Thomas Borthwick and Sons' meat processing plant, located at Mackay, was asked by the Queensland Environment Protection Agency to upgrade their wastewater management facilities as part of its licence agreement. Under this licence, another business could use the effluent from the abattoir, provided they implement a sustainable effluent management plan. This would enable Borthwicks to easily and responsibly dispose of its treated effluent.

The treated effluent was at that time being released into Bakers Creek, which flows into the Great Barrier Reef Lagoon. Although it is treated, the added nutrients in the water would, over a period of time, have damaged this precious natural resource.

At the same time, local turf growers Mackay Turfgrass were struggling with salt water intrusion problems which are common in the area. Salt levels in the underground water meant that the turf growers could not use bore water. The turf farm was also in the process of implementing an ongoing program to improve soil quality by minimising chemical usage and increasing the use of organic fertilisers.

The solution
Considering these complementary difficulties, a simple and practical solution was proposed for what could have been an extremely costly problem for both companies and for the local environment.

An arrangement was made between Mackay Turfgrass and Borthwicks to enable the abattoir's treated effluent to be pumped to the turf farm for irrigation purposes. A sustainable effluent management plan was implemented and this arrangement is still in place, with the abattoir pumping approximately 6,000 m^3 of water per week to the turf farm.

The benefits
- The abattoir has benefited from this arrangement as it has eliminated any difficulties regarding effluent disposal.

- This has also meant that the delicate local environment has benefited with the level of nutrients being discharged to marine waters and the Great Barrier Reef being significantly reduced.

- The benefits of the arrangement for the turf farm are substantial. Firstly, they have a plentiful supply of water year round, even during the dry season. This has eliminated any problems with salt water intrusion.

- Additionally, the water that the farm is receiving has added nutrients, that is, it is essentially "value added water". This has meant that the use of chemical fertilisers etc has been greatly reduced as the water is also acting as an organic fertiliser. Soil tests have shown that the quality of the soil has greatly

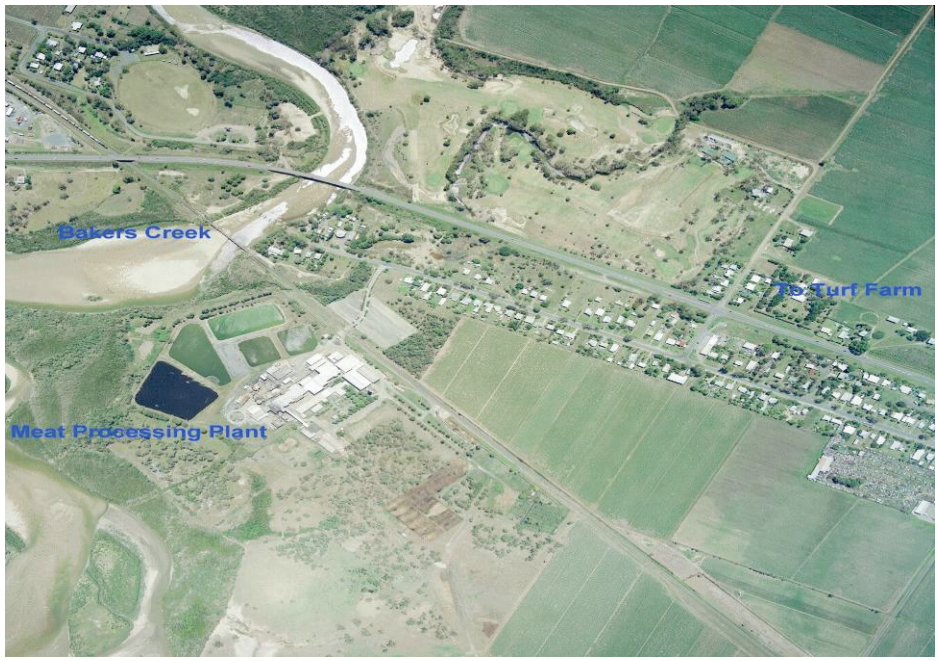
improved as a result of using this water. There have also been economic benefits for the farm as their need to purchase water and fertilisers has been all but eliminated.

- Both companies have received favourable publicity from this arrangement with articles appearing in several environment focussed publications such as the Australia & New Zealand "What's New in Waste Technology" magazine.

This is an example of innovative and creative "thinking outside the square" in regards to environmental management issues. There could always be another company in the community that is experiencing environmental difficulties where a complementary arrangement can be reached to the benefit of both parties. After all, one man's trash is another man's treasure.

The costs

The costs involved in the arrangement have been minimal. The pipeline joining the abattoir with the turf farm, the pumps and modifications required at either end together cost under $100,000. This arrangement has been extremely cost effective for the benefit it provides to both companies and the environment.



Aerial photograph of the Borthwicks plant and Bakers Creek area.

Electrocoagulation in wastewater treatment

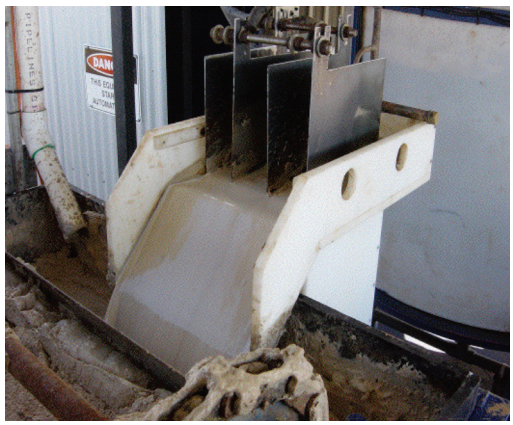
Burrangong Meat Processors – Young, NSW

Burrangong Meat Processors (BMP) faced typical environmental and wastewater treatment related issues that are common problems in the meat industry. In particular, they suffered from problems of odour control and nutrient removal. Difficulties existed in reducing phosphorus levels in the treated wastewater to meet industry standards and the EPA stipulated levels.

In response to increasing environmental pressures and regulations Burrangong Meat Processors took part in a research project conducted by EC Pacific Pty Ltd, investigating the application of electrocoagulation in the treatment of wastewater generated by the abattoir.

Following very encouraging preliminary tests an electrocoagulation unit with capacity of up to 8 kL/ hour was installed and trialed at Burrangong Meat Processors in May 2000. The method proved very effective particularly in the removal of phosphorus, reduction of BOD (COD), suspended solids and total grease from the wastewater generated by the BMP's low temperature rendering plant.

The EC based wastewater treatment plant at Burrangong Abattoirs



The EC unit showing the metal electrodes

Currently the electrocoagulation system is being up-graded and its future capacity will be 20 kL/hour, capable of treating the entire volume of the abattoir's stick water.

The effect that the electrocoagulation treatment has on odour from the abattoir and the demand on the wastewater treatment system's performance is significant. Previous problems have been reduced so significantly through the employment of the electrocoagulation unit that the odour problem, related to the challenged capacity of the anaerobic pond, has practically vanished.

Electrocoagulation technology
Electrocoagulation, the passing of the electrical current through water, destabilises suspended, emulsified or dissolved contaminants in wastewater. The electrical current itself provides the force causing the chemical reactions**.**

The electrode material (iron, aluminium), spacing and lengths, applied amperage, voltage and waste water characteristics (pH, standard redox potential, conductivity) can be varied and optimised for maximum removal efficiencies of specific contaminants. The polarity of the electrodes can be reversed periodically to assist in cleaning of the electrodes.

After the treated wastewater leaves the electrocoagulation chamber, the destabilised colloids are allowed to flocculate and then separated by flotation. The sludge can be further de-watered using a filter press, settling pond, or other de-watering techniques.

Sludge removal from the flotation cell after the EC unit

A typical sample of coagulated and settled stickwater/wastewater mix

Benefits of this method compared to chemical treatment are the ability to treat multiple contaminants, sludge minimisation, operating cost significantly lower than that of chemical coagulation, generally no chemical additions, low maintenance, minimal operator attention, consistent and reliable results**.**

The sludge generated during the treatment and collected from the treated wastewater can be returned back to rendering and recovered as meat meal and tallow.

Results
The removal rates achieved in the course of this project are extremely encouraging. When a 50:50 blend of stick water and general abattoir wastewater is treated by the unit:

- The typical **phosphorus removal** is above **90%** (up to **94%**).
- The **suspended solids and total grease removal** is quite effortless, with the removal rates typically in **90+%.**
- The **TKN removal** is on average **55%** but up to **74.1%** has been achieved.
- The level of **COD** is typically reduced by **90%**, with best results being up to **93.4%.**

Costs
The cost of the original plant at Burrangong Meat Processors prior to the upgrade was $148,000. To build a system to handle 20 kilolitres per hour the cost would be approximately $184,000.

Operating costs on a highly concentrated effluent (stickwater) are approximately $1.15 per kilolitre. Operating costs on screened kill-floor wastewater are approximately $0.40 per kilolitre.

The value of the recovered fats and proteins for return to tallow and meat meal has not been determined but would be expected to be significant.

Effective primary solids removal with the novel use of Baleen filters

Midfield Meats - Warrnambool, Victoria

The problem
Midfield Meats' plant in Warrnambool discharges wastewater to the municipal sewer system. With rising discharge costs and penalty charges looming a solution to reduce Total Suspended Solids (TSS) and Biological Oxygen Demand (BOD) was required. Midfield had employed, for a number of years, various levels of primary screening of the wastewater prior to discharge to the municipal trade waste system. TSS & BOD remained a problem with all conventional primary treatment systems trialed, as particle size removal was limited to approximately 1 mm.

Traditional anaerobic / aerobic lagoons were not an option due to the lack of space and the proximity of the plant to both the railway line and the city's residential area. Midfield was reluctant to spend significant capital on a chemical based wastewater treatment solution.

The solution
Baleen Filters, an Australian manufacturer, has developed an innovative self-cleaning filtration system that has been successfully employed over numerous industries and applications within Australasia and the Middle East but not in the abattoir industry. The Baleen unique self cleaning filter technology - mirroring the name and filter mechanism of the whalebone belonging to the group of filter-feeding whales. The Baleen filter removes suspended matter from virtually any water stream, whilst automatic reversal of filtrate-flow enables separated waste to be swept away for collection without the need for shutdown maintenance.

Comprehensive on-site trials were conducted during 2001 and a design suitable to the specific site requirements was developed. This included stream splitting. Low contamination 'white' processing water was split away from the highly contaminated 'green' stream. Several screen sizes were trialed and measurement of particle size distribution formed an important part of the analysis to determine the most effective screen size for this application. While Baleen filters have a capability to remove particles down to 25 microns particle size, the plant at Midfield has been designed to remove particles down to 100 microns.

Installation of site infrastructure began in April 2002 and the system was fully commissioned in August 2002.

The benefits

- The installation of the Baleen filter at the Midfield site has reduced the BOD and TSS by 30 and 45% respectively. Production levels have also increased considerably since the installation was commissioned yet the BOD and Suspended Solids have remained almost at the same levels.
- The material collected is combined with the coarse solids and is transported to the company's own compost facility. Trials will soon commence on the use of this composted material as an on farm substitute for commercial fertiliser on Midfield's own properties.
- 20-30 m^3 of solids in total are collected each day from the primary treatment system with 10 m^3 of fine spadeable solids collected from the Baleen filter from an outflow of 1.5 megalitres. These materials were previously going into the trade waste system.
- A daily average wastewater quality of approximately 600 and 700 mg/L BOD and TSS respectively has been achieved.
- Removal of these solids has reduced the trade waste charges significantly and has returned a payback in less than 18 months on the entire capital outlay.

The cost

Capital expenditure including a large fully enclosed building, drainage and infrastructure was recovered in less than 18 months.

Operating costs are restricted to compressed air, town water for the self-cleaning system and some labour to change the solids skips as they fill.

Future developments

Midfield Meats has scheduled trials for the next stage of this program. In these trials a suitable floc will be used to allow further collection of solids over a finer screen system. This recovered material will also be added to the compost program and will see a further reduction in trade waste charges in the future.

The Baleen filter system at Midfield Meat's Warrnambool abattoir

Typical spadeable solids recovered from the Baleen filter at Midfield Meat's Warrnambool abattoir

Track Back – Marel Boning System

Oakey Abattoir, Oakey, Qld

The problem

Oakey Abattoir, located at Oakey in South-East Queensland, provides value-added beef products to sensitive world markets. To enable Oakey Abattoir to consistently supply the US & Japanese markets with high-grade grain fed beef, the company must be able to assure that all products meet all required specifications. To do this a high degree of product identification and traceability is necessary throughout the entire slaughter, bone and pack operation. Also, as the viability of export meat processing is dependent on strict yield control, it is important that supervisors can not only accurately track the yields of each product but also the performance of each boner and slicer.

In the old boning system at Oakey, the boning and slicing system transported bones, fat and meat along conveyor belts to the points of recovery or disposal. Because product was transported on a random fall basis as it was boned and sliced, supervisors had difficulty in identifying each cut to its source body or to the boner and slicer who prepared it. The old system also allowed little opportunity for traceability of product from its origin.

Management at Oakey Abattoir recognised the need to have a system that allowed for accurate control and traceability of product within the boning room as a quality management tool for managers, supervisors, workers and customers.

The solution

In 2000, Oakey Abattoir conducted a search for existing technology with the potential to meet their needs. They identified that Marel HF in Iceland had a system that could be adapted to Australian needs. In 2002 they commenced a development program with Marel to design a suitable system to fit their operation. By involving management, engineers and the boning room workforce at Oakey with the engineering design team at Marel they developed an optimal material handling and trace system. A prototype model was built at Oakey in 2003. The system has been successfully commissioned and has met both its design capabilities and its traceability and management requirements. Each cut of meat can be traced to its source carcase and to the boners and slicers who prepared it.

The system operates on a quarter boning system. Quarters of beef are scanned into the processing system by reading the bar-coded identification tag attached to the carcase on the slaughterfloor. The system includes a tracking system for individual cuts of meat managed by a computer designating which operator should be carrying out specific tasks and by calculating where each cut is on the boning line by measuring and controlling the speeds of the conveyors.

Primal cuts are removed from the quarters in exactly the same sequence each time to give correlation. These primal cuts are allocated to each slicer who prepares the cuts to specification and registers the cuts on the master computer through a panel directly at the trimming table.

When the slicer has finished the cut it is placed into a designated compartment on the line and he triggers a release button to allow it to go back onto the

conveyor for packing. The computer knows precisely where each piece is on the conveyor at any time. Trim is also recorded against the individual operator. Fat and bones are identified on their belts against each operator to allow the supervisors to easily track each operator's performance. These are then automatically removed on conveyors for further processing.

Once the slicer has released the cut he was working on back onto the line, the system knows that that particular work-station is ready to take another piece for slicing. The computer tells the operator which pieces to work on, what cuts should be produced and what the end product is to be.

The slicer recording the cut at the slicing table

Primal cuts are then transferred to the specified packing station where the packer applies an identification label to each piece prior to packing. Packed cartons are automatically lidded and labelled with the label bar code completing the traceability chain.

The packer receiving the primal identification label at the packing station

The labelled primal entering the vacuum packing system

Each piece of meat is subjected to a randomly selected QA check. All data is stored on a centralised computer system that correlates data from each stage of the process to ensure traceability and quality. The system knows when cuts are sent to the quality control station and also when they return to the line, so that the traceability is not compromised.

The benefits
Management at Oakey Abattoir have identified the following important benefits to the company:

- An increase in yield estimated at >1%.
- A trace capability to allow customers to trace product to its origin.
- A system that is supervisor friendly because work performance and product specification are more clearly identified.
- A work force that has more job satisfaction because the system is physically easier to use, operator performance is more clearly identified and rewarded and the supervisor/worker relationship is improved.

This is truly a win-win solution with all parties' expectations satisfied by this development.

The cost
The cost to develop and install the system at Oakey Abattoir has been significant but the company is pleased that they have made this investment.

Robotic Y-Cutter

CRF (Colac Otway), Colac, Victoria

The problem

CRF (Colac Otway) is a Coles Supermarket dedicated food-processing facility, specialising in the production of prime lamb. The combination of a relatively low unemployment rate in the Colac and district community and CRF's rapid expansion in production and premises has resulted in extreme difficulty in attracting and retaining skilled labour. The issue of labour shortage and high turnover also has detrimental effects on the training and skill level of employees, increasing the risk of product being processed at a reduced level of quality. The viability of CRF would have been severely threatened if the issue of labour shortage was not addressed.

CRF believes that automation in red meat production is integral to the sustainability of the industry. Recent advances in visual imaging and robotics and a productive relationship with solution providers resulted in CRF partnering with Meat and Livestock Australia (MLA) and Machinery Automation and Robotics (MAR) to further develop and install the first Robotic Y-Cutter to be working in full production in an Australian small stock plant. The concept of a robotic Y-Cutter was first developed in New Zealand over a decade ago and work has continued to progress on the re-design and enhancement of the technology, resulting in the completion of the first successful New Zealand application in mid 2005.

It is now well understood that the variances between New Zealand and Australian lamb mean that the application of New Zealand technology into Australian production conditions is far from textbook.

The solution

To ensure that the Y-Cutter project had the best chance of success at CRF, a project team consisting of CRF members from production, technical services, IT, human resources and maintenance was developed to work in collaboration with the MAR team to manage the development, installation and commissioning of the project. The team met fortnightly over the life span of the project to develop and implement a project plan, benchmarking protocol, sign-off criteria, equipment design, operator training, risk assessments, installation plans and also ensured that the system adhered to AQIS regulations.

Prior to the Y-Cutter arriving on site, the team attended a site acceptance test at the MAR premises in Sydney where a trial of the system was conducted in an environment set up to reflect the production line at CRF. This included a makeshift chain and the use of lamb skins to reflect a carcase. The purpose of the site acceptance test was to ensure that members of the CRF project team were familiar with the Y-Cutter technology before it arrived on site and also to ensure that any design specifications requested by CRF had been met by MAR.

Project team at the factory

CRF and MAR received assistance from the New Zealand company, Industrial Research Limited, who were responsible for the successful installation of an automated Y-Cutter at the New Zealand based smallstock plant. The Y-Cutter was finally installed onto the process floor at CRF on the 20th August 2005 and therein followed a series of lengthy events as part of the commissioning process. After much hard work, frustration, heartache and celebration the Y-Cutter began its first day of unsupervised production on the 14th of March 2006.

The Y-Cutter performs the opening cut on both the leading and trailing leg and also completes the neck cut, something that had never been attempted before. The system is currently running at 8.9 per minute at 95% effectiveness. Further investigation is taking place into visioning technology, which may be applied in the future to help the system reach 100% efficiency and effectiveness.

The benefits

The benefits of the robotic Y-Cutter for CRF have been both tangible and intangible with the experience enriching everyone involved in the project and also those affected by its use.

The project has:

- greatly enhanced the relationships of those people involved in the project team;
- improved skill sets;
- increased knowledge regarding the variation in Australian lamb;
- improved the project management capabilities at CRF; and
- resulted in the development of a strong working relationship between CRF and MAR built on respect, trust, and an understanding and appreciation for each other's role and responsibilities within the project.

The robotic Y-Cutter has also resulted in:

- the improvement of skin quality and yield;
- a decrease in micro counts on the brisket area and forelegs; and
- the removal of one labour unit.

The successful installation of the robotic Y-Cutter at CRF has paved the way for other plants to consider a similar installation at a much reduced risk to their business of the project not returning on investment.

The cost
The project cost a total of $505,792, with MLA and CRF sharing the expense.

"Hard work" on the Y-cut at CRF

Level 1, 165 Walker Street
North Sydney NSW 2060
Ph: +61 2 9463 9333
Fax: +61 2 9463 9393

www.mla.com.au