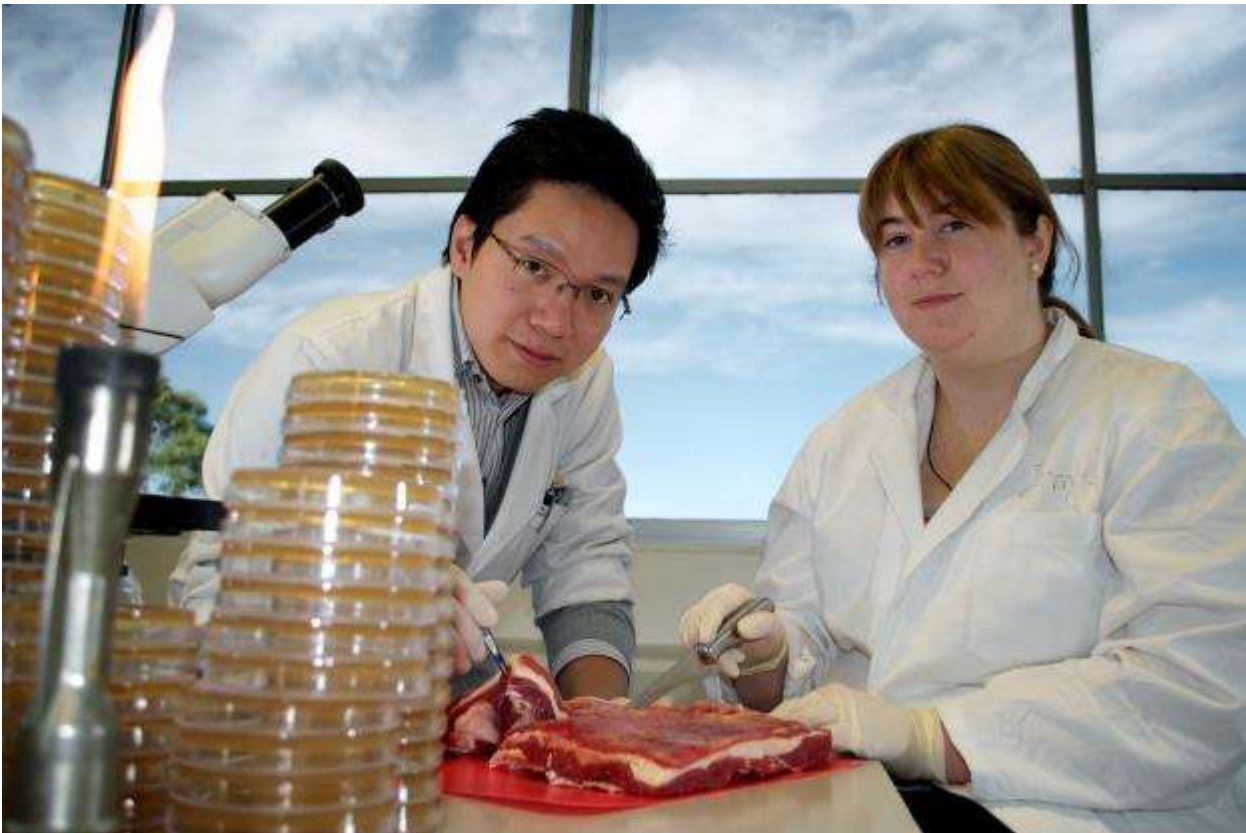


## Program Achievement Report

# Food Safety 2015-16

2nd edition



**Value Chain Innovation**  
**July 2016**



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cover photograph acknowledgement: Dr Anthony Baker, University of Tasmania



## Executive Summary

The Food Safety Program arises from the Meat Industry Strategic Plan, which identifies the need to ensure market access. The program supports the activities of SAFEMEAT, the primary role of which is to oversee and promote management systems that will deliver safe and hygienic product to the marketplace.

The SAFEMEAT strategy is mirrored in Meat and Livestock Australia's (MLA) objective to enhance product integrity, which has three research-oriented subprograms, which, in this document are collectively called the Food Safety Program. Those three areas of work are:

- Microbiological food safety
- Biotechnology
- Risk-based post mortem inspection

The R&D-oriented component can be divided into three types of activities:

- The use of scientific approaches to understanding food-safety risks
- The development of systems and new technologies to manage identified risks
- The development and dissemination of information relating to risk management

The Food Safety Program focuses on communicating knowledge about food safety risks in the red meat supply chain, and their control, so that industry, regulators and the marketplace worldwide are aware and satisfied that risks are understood in Australia and are being controlled effectively. The communications components ensure that the high level of food safety within Australian meat is acknowledged. Overseas offices, websites with a focus on food safety, and materials for industry/regulator use (brochures, downloadable reports and tools, etc.) are all key communication channels.

The industry's food safety reputation has been strengthened by the publication of the many scientific papers and presentations given to food industry and food safety conferences in Australia and USA. The understanding and acknowledgement of our food safety record by scientists is important for forming public opinion and shaping government policy.

Major outputs resulting from the food safety program over the past twelve months have been made available to the industry:

- The second edition of the book 'Shelf life of Australian Red Meat' has been completed containing new research results from CSIRO and University of Tasmania, as well as answering questions asked by users of the first edition
- A second edition of the 'Processor's Guide to Improving Microbiological Quality' was launched at the Meat Inspection Quality Assurance Conference - with processor QA managers presenting case studies from the new edition.
- Shelf life prediction model has been developed and trialled in supply chains and is demonstrating value for solving problems, helping supply chains consider their risks and redesign supply chains to reduce complexity
- Expert advice was given to FAO/WHO's Joint Expert Meeting on Microbiological Risk Assessment, concerning control of Salmonella in beef supply chains.
- Additions are being made to MLA's website to make it easier for stakeholders to locate information about food safety.
- Wide communication to our own industry as well as importing countries about the shelf life of Australian meat and prediction of shelf life in the supply chain
- Promising minimal intervention approach to effective control of microorganisms such as E. coli and Salmonella on beef carcasses.

A stakeholder survey revealed that 91% of respondents agreed that they were satisfied with MLA's performance.

# 1. Reason for Being

The Food Safety Program arises from the Meat Industry Strategic Plan<sup>1</sup>, which identifies market access as a strategic theme. Meat and Livestock Australia is required to incorporate MISP strategic themes into its own strategic planning and for the food safety area this requirement is met through the SAFEMEAT food safety program. The MLA program therefore supports the activities of SAFEMEAT, the primary role of which is to oversee and promote management systems that will deliver safe and hygienic product to the marketplace.<sup>2</sup>

The MISP does not have a section which addresses food safety specifically, which is seen to reflect the absence of market access failures relating to food safety and the maturity of the industry in incorporating food safety issues as a component of everyday business. In addition to the strategic theme of market access, almost all of the strategic themes of the MISP have relevance to the food safety program.

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<sup>1</sup> The Red Meat Advisory Council (RMAC) was formed in 1998 as a single industry touch-point for the Federal Government when dealing with cross-sectoral matters. RMAC comprises a membership of five Peak Industry Councils: Cattle Council of Australia, Sheepmeat Council of Australia, Australian Lot Feeders' Association, Australian Livestock Exporters' Council and Australian Meat Industry Council. The Goat Industry Council of Australia also maintains a link, but not as a member. Red-Meat Industry Strategic Plan, 2010-2015  
[http://www.rmac.com.au/strategic\\_plan.html](http://www.rmac.com.au/strategic_plan.html)

<sup>2</sup> SAFEMEAT is a partnership between the Australian meat and livestock industry and State and Federal governments. SAFEMEAT's primary role is to oversee and promote sound management systems. SAFEMEAT also initiates R&D projects, particularly in relation to microbiology and food-borne pathogens and examines emerging issues, such as gene technology, that could have an impact on the red meat industry at some point in the future.

## 2. Program Overview

The SAFEMEAT strategy is mirrored in MLA's Objective to Enhance Product Integrity, which has three research-oriented subprograms, which, in this document are collectively called the Food Safety Program. Those three areas of work are:

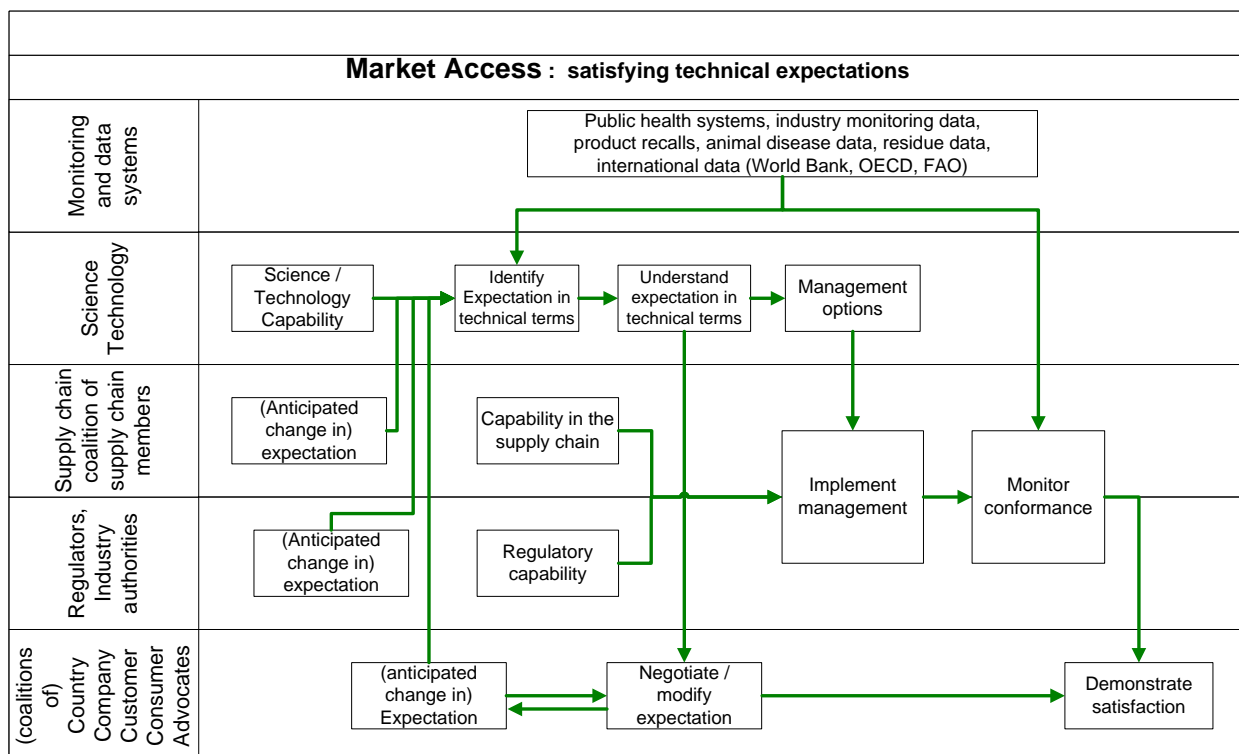
- Food safety
- Biotechnology
- Risk-based post mortem inspection

The *R&D-oriented component* can be divided into three areas of work:

- The use of scientific approaches to understanding food-safety risks
- The development of systems and new technologies to manage those risks.
- The development and dissemination of information relating to risk management

Other issues are monitored and managed when required.

The R&D is conducted within the framework of satisfying the expectations of customers (whether they be countries, companies or consumers) and considering the expectations of advocacy organisations. The needs may be expressed by customers, in which case there is usually a short-term need to satisfy the expectation. On the other hand, it is also the role of the program to anticipate future expectations, and to provide the scientific basis for meeting future expectations. The diagram below shows how the components of the science program interact with customers and the major stakeholder groups.

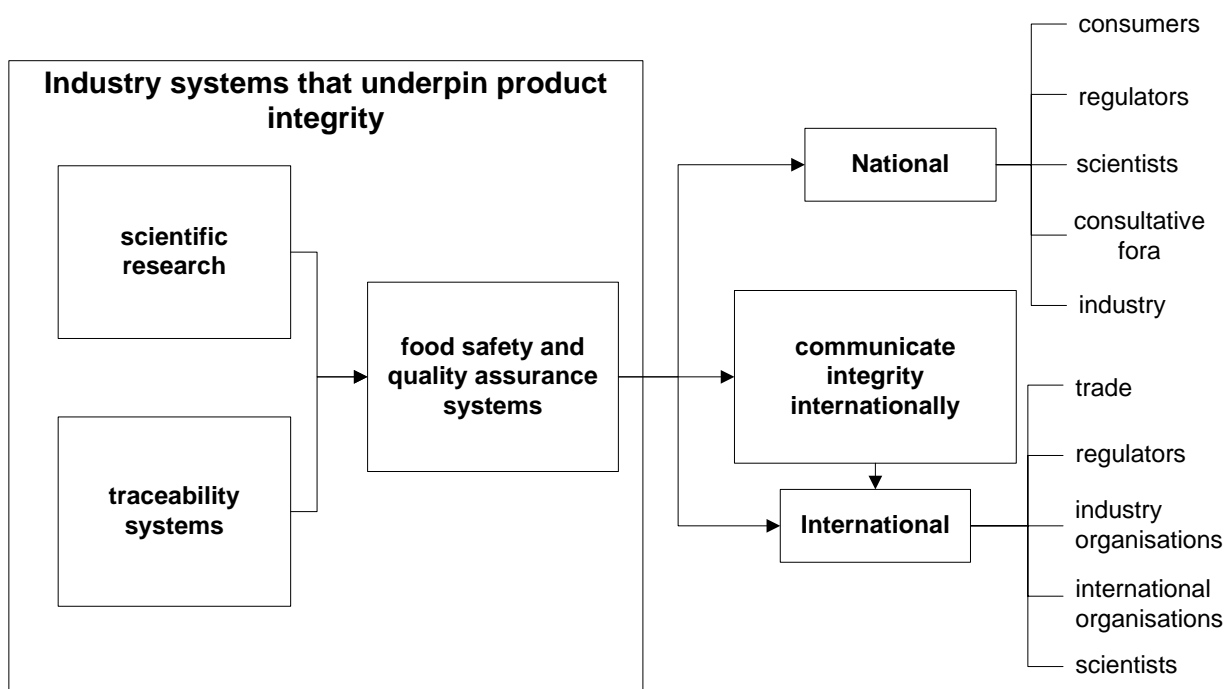


*Model for the cooperation of science providers, regulators, public health systems and industry in meeting customer requirements through the work of the food safety program*

The Food Safety Program focuses on communicating knowledge about food safety risks in the red meat supply chain, and their control, so that industry, regulators and the marketplace worldwide are aware and satisfied that risks are understood and are being controlled effectively. The communications components ensure that the high level of food safety of Australian meat is acknowledged. Overseas offices, websites with a focus on food safety, and materials for industry/regulator use (brochures, downloadable reports and tools etc.) are all key communication channels. The work of the program is often transmitted to the target audience through other sub-programs within Meat Safety/Issues Management. The diagram below illustrates the linkages between the MLA components of the objective of Enhancing Product Integrity and its audiences.



Section 4 of this report will describe the outputs of the scientific research program.



*How the science projects in the Food Safety Program lead to the development of systems to deliver safety, quality and integrity and are used to influence key stakeholders nationally and internationally.*



### 3. Program Objectives

The overall objective of Enhancing Product Integrity, as expressed in MLA's Corporate Plan<sup>3</sup>, is to reduce the risk of a food safety incident, ensure that potentially affected product does not pass to consumers and to communicate the superior food safety systems used in Australia. The research-oriented subprograms conduct research and communicate findings to facilitate the adoption of risk-management strategies for the benefit of the Australian industry and consumers.

The activities of the Food Safety Program will thus assist in maintaining market access and demand for Australian meat, through influencing national and international stakeholder groups. The Program will also seek to achieve these objectives in a cost-effective manner. The methodologies used to achieve these outcomes are:

- **Science-based** – producing credible scientific data and information to support its strategies.
- **Risk-based** – concerned with addressing real food safety issues and the protection of public health.
- **Efficient and effective** – are economic for industry to implement

The following table describes the initiatives in the current MLA Annual Operating Plan (AOP)<sup>4</sup>.

<b>Strategy</b>	<b>Initiatives within the food safety R&amp;D program</b>
Conduct scientific research to ensure food safety systems are at the leading edge of knowledge and practice	<ul style="list-style-type: none"><li>• Assess and maintain safety and integrity of product in the marketplace</li><li>• Develop and implement new techniques for delivering safe and wholesome product</li><li>• Develop risk-based post mortem inspection systems for animal health surveillance, and risk-based systems for the assessment of product safety and suitability.</li></ul>

<sup>3</sup> <http://www.mla.com.au/About-the-red-meat-industry/About-MLA/Company-overview/Corporate-documents>

<sup>4</sup> <http://www.mla.com.au/About-MLA/Planning-and-reporting/Annual-reporting>

## 4. Program outputs and Key Performance Indicators

The MLA Annual Operating Plan specifies Milestones for the objective of developing and delivering systems that underpin product integrity, of which food safety R&D plays a part. The milestones specific to the food safety program, and their achievement are:

Key Milestones	Status	Further information
Satisfaction rating of MLA's food safety activities by industry (processors and AMIC) rated more than 85%	Not yet measured	A stakeholder satisfaction survey will be conducted in July 2016
Develop a comprehensive information resource on shelf-life	Complete	The shelf life book, first produced in 2014, has been updated based on feedback received and new research that has been conducted after its publication.

More detailed Key Performance Indicators are agreed with SAFEMEAT.

2015-16 KPI	Status	Further information
<b>Information and Program Management</b> Scientific developments in meat food safety research are monitored and we are able to respond, as needed, to scientific developments internationally.	ongoing	The news digest of food safety research continues to be produced, circulated to interested parties and uploaded to the Food Safety Centre website. The scientific risk management panel met once in June, to provide advice on current and planned projects
<b>E. coli in beef</b> <ul style="list-style-type: none"> <li>• Determine the public health significance of non-O157 STEC isolated from cattle, which may lead to reduced concern about these organisms.</li> <li>• Investigate variations in non-O157 STEC that may allow improvements in diagnostic methods.</li> <li>• Virulence and variation of O157 internationally determined through the new technique of whole genome</li> </ul>	ongoing	Continued investigation indicates that, while Shiga toxin-producing E. coli O26 and O111 may be isolated from cattle in Australia, the other serogroups of interest in the USA (O45, O103, O121, O145) are not found in Australia. Variation in the type of toxin produced and the amount of toxin produced, suggests that there may be differences to strains isolated in the USA. Problems with false positive confirmation tests have been discovered. A number of isolates of O103 were found not to have an stx gene. The revised records will provide a more favourable position for the Australian industry. ** Whole genome sequencing studies by CSIRO are not being funded by MLA, but we have an interest due to previous involvement in strain collection and characterisation.

2015-16 KPI	Status	Further information
sequencing **		
<b>AMR in beef</b> AMR bacterial risks in the beef supply chain are investigated	ongoing	The antibiotic resistance of enterococci (concern as human pathogens and indicators of resistance) demonstrated low levels of resistance. Another scientific publication will be produced on resistance of enterococci. This will support the Australian red meat industry low levels of Antimicrobial resistance. Consultation as part of the national AMR resistance strategy continues.
<b>Salmonella in manufacturing beef</b> The risks of Salmonella in manufacturing beef are assessed to allow response to US data and possible US requirements	ongoing	<p>Two sources of Salmonella in ground beef are being considered in the USA - beef trim and lymph nodes. Our survey of Salmonella in 375g samples of manufacturing beef shows a prevalence of about 0.7% with US prevalence being 2-3 times higher.</p> <p>The survey on Salmonella in bovine lymph nodes indicates a low prevalence of Salmonella and other bacteria. This survey will allow us to respond to US customers and regulators who are considering the control of Salmonella in their beef supply.</p> <p>Large carcass surface swabbing to detect salmonella in beef and veal pre and post intervention has commenced and will continue into late 2016 . The reduction in prevalence between pre- and post- intervention shows processors have effective interventions. The results will be used to defend the industry position and will also be used to compare the effectiveness of our interventions during processing (see also, process control).</p> <p>MLA participated in an FAO/WHO consultation on interventions for Salmonella in beef supply chains. The report, has informed the development of the Code of Practice by Codex Alimentarius Commission. The conclusions of this consultation and the developing CoP are unlikely to have any impact on industry practices.</p>
<b>Biotechnology policy</b> Maintain an industry biotechnology (specifically, cloning and genetic modification) policy that helps the industry to respond to developing science and community attitudes.	concluding	Due to the low activity in the space of biotechnology within the industry, it is currently being circulated on a quarterly basis. MLA intends to stop producing the electronic biotechnology bulletin.

2015-16 KPI	Status	Further information
<p><b>Plant toxins</b> Prepare a position on pyrrolizidine alkaloids and plant toxins</p>	ongoing	No action has been necessary at the Codex level. MLA has decided not to continue funding work on the toxicology of indospicine, but keeps a watch on this area.
<p><b>Chemical residues</b> Continued watch on chemical residue issues to ensure market access is maintained</p>	ongoing	MLA continues to respond to TBT notifications on MRLs for the red meat industry. We have developed, and agreed with SAFEMEAT, a protocol for raising these issues to an industry level when a response is required. We have reviewed potential changes to Korean regulations and identified the chemicals that will cause the industry the largest problems. The Australian Government is making representations on MRLs in Korea.
<p><b>Process control</b> Investigating new data and analysis techniques for improving microbiological process control, product quality, and cost effectiveness of processing. Allow response to possible US requirements.</p>	complete	<p>A second edition of the Processor's guide to improving microbiological quality has been published and launched at the 2015 MIQA conference. The guide was well received by processors and clearly demonstrates that, with some assistance from MLA, processors are able to drive continual improvement.</p> <p><a href="http://www.mla.com.au/News-and-resources/Publication-details?pubid=6264">http://www.mla.com.au/News-and-resources/Publication-details?pubid=6264</a></p> <p>Eight one day workshops were conducted, in May/June 2016 on "Process Control Data and Analysis for Market Access". This workshop will be targeted at QA managers and staff, laboratory staff, industry consultants and trainers. The workshops will once again focus on process control such as revision of micro, setting up investigations, and problem solving.</p>
<p><b>New intervention strategies</b> Techniques for improving process hygiene and antimicrobial interventions are proposed that will reduce risks to public health and improve market access</p>	ongoing	A single plant trial has confirmed the positive impact of using an oxidising agent (such as acidified sodium chlorite or chlorine dioxide) during the (spray) chilling process on E. coli. An intervention during chilling is much more effective than the same intervention on the slaughter line. In the laboratory the same impact is noted for Salmonella. This intervention requires low capital investment and could potentially replace other interventions. Further work will be conducted to implement this intervention at a processing establishment.

<p><b>Shelf-life</b> Shelf-life models and information package is used through the supply chain to educate stakeholders and manage shelf-life issues.</p>	<p>ongoing</p>	<p>Prototype predictive tools have been developed, demonstrated at MIQA network meetings and one-day workshops for QA staff. It is hoped to source sufficient data from the processing community to validate these models.</p> <p>A guide to the determination of shelf life has been prepared so that data will be collected in a reasonably standard manner. The guide has been promoted in MIQA network meetings and specific QA training courses.</p> <p>Processors have been invited to share their shelf life data or questions about shelf life in supply chains with the University of Tasmania, to obtain advice. Establishments are sending enquiries which will help to build up an understanding of both supply chains and the impact on shelf life for temperature.</p> <p>The 2nd edition of the 'Shelf life of Australian red meat' has been completed.</p>
<p><b>Post mortem inspection</b> Evaluate potential for changes to post mortem inspection practice that will be effective, efficient and meet regulatory requirements</p>	<p>ongoing</p>	<p>Work on cadmium in adult sheep offals has progressed. The aim is to understand how the risk of exceeding international MRL's varies according to the geographic origin of sheep. NRS will run survey of liver samples through their "pilot" residue survey program. MLA has commissioned a survey to determine the correlation between cadmium in liver and kidney samples and is a complementary project to the NRS study. A strong relationship between levels of cadmium in kidney and liver will help avoid an extensive survey of kidneys.</p> <p>A risk-based review of post mortem inspection has commenced. This review proposes to determine the human health impact of post mortem inspection procedures. Specific work will address the efficient detection of Caseous Lymphadenitis (CLA) in ovines, risk management for <i>C. bovis</i> and <i>O. gibsoni</i> in bovines These projects aim to provide data that will allow revision of post mortem inspection schedules and gain acceptance from major trading partners.</p> <p>Work to develop ante mortem and post mortem information standards to facilitate data collection and feedback systems has commenced.</p> <p>A small project to update and publish a scientific/epidemiological assessment of Australia's tuberculosis freedom has commenced. The original work conducted in the Biosecurity CRC needs a little more work before it can be published - supporting minimal inspection of lymph nodes for tuberculosis.</p>

## 5. Communications and outcomes

The table below indicates, for each target group (identified in the diagram on p. 4), the kinds of activities and the nature of the activities conducted, either directly by the MLA staff working on the Food Safety R&D Program, or by the scientists who work most closely with the program.

### 5.1 Communication, education and promotion of food safety and integrity

Arena	Group	Activity	Nature of interaction
<b>NATIONAL</b>	<b>Consumers</b>	Website information	MLA's consumer website, <a href="http://www.beefandlamb.com.au">www.beefandlamb.com.au</a> , is used as a way of communicating specific meat safety messages to consumers. The FAQ section can be updated in response to consumer concerns.
		<b>Regulators</b>	Food Standards Australia New Zealand
	Standards Australia		Participating in the development and review of Australian Standards, as well as the development of International Standards through the International Standards Organisation.
	<b>Scientists</b>	Australian Association for Food Protection	A professional association, where the position of the Australian industry as technically competent is communicated.
		Food Safety Centre	Stay abreast of international developments and an opportunity to develop informed spokespeople.
		Australian Society for Microbiology	A professional association, where the position of the Australian industry as technically competent is communicated.
		Australian Institute of Food Science and Technology	A professional association, where the position of the Australian industry as technically competent is communicated.
	<b>Consultative</b>	SAFEMEAT	An opportunity to regularly update all red meat industry sector participants on the progress of the program.
		Export Meat Industry Advisory Committee	Provides an opportunity to gain agreement between export processors and Department of Agriculture on the application of MLA research to the industry. Sometimes responsive projects are developed.
		Export Meat Industry Advisory Committee Food Safety and Animal Health Subcommittee	The food safety subcommittee provides opportunities to discuss food safety and microbiological issues in detail. Some activities, such as revision of microbiological methods for the industry, will require professional input from MLA and consultants.

<b>NATIONAL</b>	<b>Industry</b>	Meat Inspection Quality Assurance (MIQA) Network, speaker	About 12 presentations were given in the past year to industry QA Managers in all states on antimicrobial resistance, trends in ESAM data and process control. Also an opportunity to learn about industry needs.
		MINTRAC MIQA Conference	This popular conference for industry QA Managers and trainers was an opportunity to share R&D relating to shelf-life, antimicrobial interventions, and process control and the changes that are being made by processors as a result of following the approaches developed.
		MLA publications	Contribution to articles in MLA's magazine, feedback, on how research contributes to optimising processing, improving hygiene and new regulations <i>See section 9.2 for further information.</i>
		Enquiry services	MLA provides an enquiry service for processors, exporters, customers, regulators etc. who require technical information on the safety of meat.
		E. coli panel	MLA runs an E. coli expert panel to interact with stakeholders on this important issue. MLA also provides advice to Department of Agriculture and Water Resources and AMIC in dealing with their own interests in this area.
<b>INTERNATIONAL</b>	<b>Trade</b>	Working relationship with North American Meat Institute, National Cattlemen's Beef Association	MLA keeps in touch with like organisations in the USA, as well as individual processors to discuss issues of common interest.
		Enquiry services	Enquiries are often directed through MLA regional offices to provide information, or technical support, on trade enquiries.
	<b>Regulators</b>	Australia's position at Codex Alimentarius	Reviewing the development of Codex documents, which are a basis for international trade, to ensure that they reflect Australia's approach to meat safety. Particular attention is being paid to documents on Salmonella in beef, the development of a standard for chilled and frozen meat, pyrrolizidine alkaloids and to guides on control of parasites in the supply chain.
		Opportunity to input into Australia's position at OIE	Reviewing the development of documents to ensure that they do not impinge negatively on Australia's meat safety approach.
		National food control systems	Opportunities, through MLA regional offices, to make technical representations to assist in policy development relating to Australian meat products.

<b>INTERNATIONAL</b>	<b>Industry organizations International organizations</b>	International Standards Organisation-ISO standards and working groups	Opportunity to comment on the development of International Standards, including participation on working groups, and obtaining advance notice of standards being developed.
		International Association for Food Protection (IAFP), member	A professional association, where the position of the Australian industry as technically competent is communicated.
	<b>Industry organizations</b>	International Commission on Microbiological Specifications for Foods	Scientists close to MLA are members of this group which is the leading international scientific food safety influencer.
	<b>International organizations</b>	Consultants to FAO/WHO	A number of scientists close to MLA work as consultants for the FAO/WHO food safety program.
		FAO/WHO Joint Expert Meetings on Risk Assessment (JEMRA)	Several scientists close to MLA are on the roster of experts for JEMRA. MLA has participated in JEMRA on the control of Shiga toxin-producing E. coli and Salmonella through the supply chain.
	<b>Scientists</b>	Editorial Board, <i>Applied and Environmental Microbiology</i>	AEM is a leading food microbiology journal and MLA staff are frequently asked to peer review papers prior to publication.
		Reviewer for <i>International Journal of Food Microbiology and Meat Science</i>	The IJFM and Meat Science are leading food safety and meat science journals internationally. MLA staff are frequently asked to peer review papers prior to publication.
		Editorial Board, <i>Food Protection Trends</i>	MLA staff have been invited to be members of this IAFP journal. It provides international recognition for the Australian industry.
		Invited speaker, international conferences	MLA staff and scientists working closely with MLA are frequently invited to be keynote and major speakers at international conferences (see details below).
		Publications and conferences	See details below.

## 5.2 Scientific / Technical Publications

Communication to scientists and technologists, both nationally and internationally holds a critical place in the strategy of the food safety program. There is a demand within government for risk-based and science-based transparent regulation with demonstrated cost-benefit. Communication through the scientific literature in peer-reviewed publications makes this information available to governments over a long period of time. It also influences scientific/technological thinking about meat safety and risk management

The following is a list of publications, poster and oral presentations made by scientists and technologists working on MLA-funded projects. Those in grey arise from projects not directly funded by MLA.



### Risk Assessment and Risk Management

- A. Kiermeier, J. Sumner, and I. Jenson. The effect of sampling plans on the risk of *Escherichia coli* O157 illness. *Journal of Food Protection*, 78(7)1370-1374
- Brookes, V.J., Jordan, D., Davies, S., Ward, M.P., Heller, J. *Escherichia coli* O157 contamination of beef carcasses: Saltelli global sensitivity analysis to identify risk factors and develop mitigation strategies in the beef harvest chain. *PLoS One* 2015, 10: e0146016.

### Understanding the behaviour of foodborne hazards

- Knight DR, Putsathit P, Elliott B and Riley TV. 2016. Contamination of Australian newborn calf carcasses at slaughter with *Clostridium difficile*. *Clin Microbiol Infect* 22:266.e261-267.

### Processing Quality and Improvement

- Zhang, P. (2016). Interactions between bacterial strains isolated from vacuum packaged Australian beef primals. PhD Thesis, University of Tasmania, Hobart, Australia.
- Zhang, P., Kaur, M., Bowman, J.P. and Tamplin, M. (2016). Effect of related environmental factors of vacuum-packaged beef on antibacterial compound production by *Carnobacterium maltaromaticum* (currently under revision for submission to *International Journal of Food Microbiology*).
- King, T., Kocharunchitt, C., Gobius, K., Bowman, J.P. and Ross, T. Molecular response of *Escherichia coli* O157:H7 Sakai during dynamic changes in growth kinetics induced by an abrupt downshift in temperature and water activity (currently under revision for resubmission to *Molecular and Cellular Proteomics*).
- Kaur *et al.* Inter-abattoir variation in bacterial community structure of vacuum-packaged beef primals and relationships to meat type and refrigerated storage.
- Porteus, B.F., Kocharunchitt, C., Bowman, J.P., Mellefont, L. and Ross, T. Oxidants targeting the reduction of *Escherichia coli* O157:H7 during carcass chilling.
- Kocharunchitt, C., Gardner, T., Mellefont, L., Bowman, J.P. and Ross, T. Viable but non-culturable state of *Escherichia coli* as induced by combined cold and water activity stresses.
- Kaur *et al.* Core microbial communities of VP Australian red meat, their spatial and temporal dynamics during storage at different temperature.
- Kaur *et al.* Potential and comparison of spectroscopic techniques in meat industry for shelf-life prediction of beef and lamb.
- Kaur *et al.* Monitoring metabolites in Australian VP beef and lamb stored at different temperatures.
- Zhang *et al.* Preliminary characterization of interaction mechanism among bacteria from vacuum-packaged refrigerated beef.

### Conference Presentations

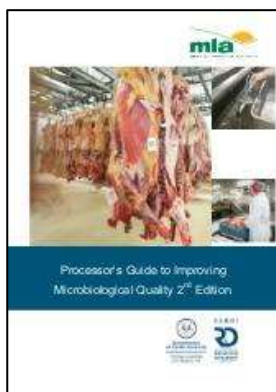
- Tamplin, M., Kaur M., Powell S. and Bowman J.P. (2015). Metagenomics reveals microbial communities in vacuum-packed meats. International Association for Food Protection annual meeting, 25 – 28 July, Portland, USA.
- Jenson, I (2015) Meat shelf life and international trade. International Association for Food Protection annual meeting, 25 – 28 July, Portland, USA.

- Gardner, T., Kocharunchitt, C., Ross, T. Wanted: dead or alive: exploring temporary culturability loss in *E. coli*. Australian Society of Microbiology Annual Meeting. Perth, 3-6 July
- Fegan, N., Besser, T. E., Shringi, S., Baker, K. N. K., Smith, H. V., Jennison, A. V., Gobijs, K. S. and Mellor, G. E (2015) Shiga toxin bacteriophage insertion sites, toxin subtypes and Stx production varies between Australian and U.S. *E. coli* O157 populations.
- Barlow, R. S., McMillan, K. E., Duffy, L. L., Fegan, N., Mellor, G. E., Delannoy, S. and Fach, P. (2015) Genomic characterization of atypical enteropathogenic *E. coli* (aEPEC) strains from Australian cattle
- Mellor, G. E., Fegan, N., Duffy, L. L., McMillan, K. E., Jordan, D. and Barlow, R. S. (2015) Enumeration of pathogenic Shiga toxin-producing *Escherichia coli* in Australian beef cattle feces at slaughter
- Mellor, G. E., Fegan, N., Duffy, L. L., McMillan, K. E., Jordan, D. and Barlow, R. S. (2015) National survey of Shiga toxin-producing *Escherichia coli* serotypes O26, O45, O103, O111, O121, O145 and O157 in Australian beef cattle feces at slaughter
- Mellor, G. E. , Fegan N., Duffy L. L., McMillan K. E., Jordan D., Barlow R. S. (2015) Comparison of two methods for the isolation of Shiga toxin producing *Escherichia coli* O157 from cattle feces at slaughter
- Barlow R. S., McMillan K. E., Duffy L. L., Fegan N., Jordan D., Mellor G. E. (2015) Prevalence, serovars and antimicrobial resistance of *Salmonella* from Australian cattle populations at slaughter

#### Industry forums and workshops

- Tan, J., 2015, In-plant Investigations: Ask SARDI, MINTRAC MI&QA Conference, Gold Coast
- Kaur, M., Ross T., Tamplin M. and Bowman J.P. (2015). Bacterial populations - how they change during the storage of VP primals? Annual MINTRAC meat inspection and quality assurance conference, Sunshine Coast, Australia (invited presentation).
- Kocharunchitt, C. and Ross, T. (2015). Chilling as an intervention: an update, Annual MINTRAC Meat Inspection and Quality Assurance Conference, 21-22 October 2015, Gold Coast, Australia (invited presentation).
- Kocharunchitt, C. (2016) Antimicrobial Interventions for the Red Meat Industry. 3M Meat and Poultry Food Safety Workshop. Hobart, 30-31 May 2016.
- Mellor, G. E. (2016) Applications of next generation sequencing to carcass hygiene monitoring: Know your risks and protect your market access AMPC/CSIRO seminar (Growing Value – Innovation Opportunities in Meat). 2016
- Chandry, P. S. (2016) Applications of next generation sequencing to carcass hygiene monitoring: Who is there and where did they come from

## 5.3 Publications for industry



### Processor's guide to improving microbiological quality

This booklet contains the reports of processing establishments that participated in investigation training for microbiological testing of meat. The aim is to inform staff at establishments about possible experiments that can be run to investigate ways to improve their process hygiene and control. The second edition now contains 39 case studies across the whole beef and sheep meat processing system.

<http://www.mla.com.au/News-and-resources/Publication-details?pubid=6264>

September, 2015

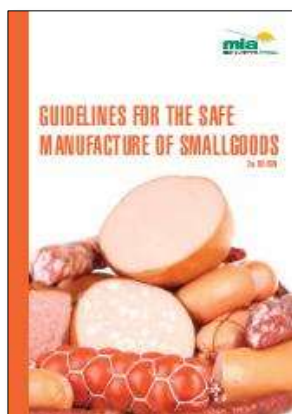


### Shelf life of Australian Red Meat - 2<sup>nd</sup> edition

Australian meat has a reputation around the world for excellent shelf life. The purpose of this book is to explain the important elements that contribute to shelf-life so that everyone in the supply chain can do their part to maintain a superior standard. It is also intended for Australian meat customers so that they can understand the technical aspects of the product, what to expect of Australian meat and how to set appropriate criteria for product acceptance. It aims to provide up-to-date information on the shelf-life of Australian meat for a range of users who operate in the technical, regulatory and marketing spheres. The second edition contains numerous research updates from CSIRO and University of Tasmania on shelf life of primals and sub primals, and on interventions. The shelf life predictor has also been developed to a stage where it has great potential value, especially for emerging markets where the cold chain infrastructure is not well developed

<http://www.mla.com.au/News-and-events/Publications>

July, 2016



### Guidelines for the safe manufacture of smallgoods - 2<sup>nd</sup> edition

The 2nd edition of the Guidelines for the safe manufacture of smallgoods, takes into account of changes in regulators requirements and scientific information over the past decade, to help you produce a safe product by covering the major categories of smallgoods products and the significant food safety hazards in each area. Accepted methods for controlling the identified hazards are also explained. The Guidelines aim to: 1. Update you on hazards and risks in the products you manufacture 2. Suggest ways you can reduce the risk to your customers 3. Supply scientific backing for your Food Safety Plan 4. Provide background information so you meet the regulatory requirements for the safe manufacture all your products.

<http://www.mla.com.au/News-and-resources/Publication-details?pubid=6433>

May, 2015



### Shiga toxin-producing Escherichia coli and beef production

Meat & Livestock Australia is a key contributor to internationally recognised research on STEC (Shiga toxin-producing Escherichia coli). Its Food Safety Program brings together public health, science and stakeholders to assess the health risk of STEC in meat and to determine the most effective risk mitigation strategies to protect human health and market access. MLA hosted a symposium at the Charles Sturt University, Wagga Wagga, New South Wales, on 9 and 10 March 2015 to share current issues and recent research with beef industry representatives, regulatory authorities and academics. This factsheet presents an overview of the discussion.

<http://www.mla.com.au/News-and-resources/Publication-details?pubid=6443>

June, 2015



### Antimicrobials and the cattle industry

The cattle industry has collaborated with the Australian Government and the research sector to commission and fund studies of antimicrobial use and AMR in the industry. A one-day symposium, hosted by Meat & Livestock Australia (MLA), was held in May 2014, to provide a forum for cattle industry representatives and stakeholders to present the results of their studies and to take a close look at antimicrobial resistance in the cattle industry. The symposium addressed animal management, prevention and control of infectious diseases, antimicrobial use and AMR in the industry, particularly in relation to risks to human health. This summary highlights key outcomes and discussion from the symposium.

<http://www.mla.com.au/News-and-resources/Publication-details?pubid=6412>

May, 2014



### Updated Food Safety website

The Food Safety website is currently going through significant changes. The new webpage will be part of the MLA website and provide a point of reference on all things related to food safety. Contents on the new website will be significantly streamlined, so as to provide an overview of all our activities and the range of information and resources available, with links to more detailed reports on the MLA comprehensive reports database.

The website will be available via MLA main website In August.

<http://www.mla.com.au>

## 6. Program evaluation: impact

### 6.1 Periodic program evaluation

Periodically, MLA conducts program evaluations<sup>5</sup> which have a role in determining the benefits that accrue from the research funds expended, and provide insights that are useful in designing future activities. MLA conducted a comprehensive impact assessment as part of the 2015 Performance Review of MLA.<sup>6</sup> For the food safety area, the evaluation<sup>7</sup> was conducted by external experts.

Food safety is part of the product integrity program (1.1) which was assessed as having a benefit-cost ratio of 8.3:1. The benefit of Australia's integrity systems to our clean, safe and natural image is valued at an additional \$107 million.

The consultants examined records for research conducted since 2000 and benefits that could be attributed to the program, particularly through interviews with industry stakeholders. The consultants estimated that the scientific research program will deliver net benefits of \$368.0 million in present value terms from the year 2000 with an associated benefit-cost ratio of 4.4 – over a 30 year forward horizon. The net benefits involve benefits of \$477.1 million and costs of \$109.1 million in present value terms. However, if BSE projects were excluded then the net benefits are \$148.3 million with a benefit-cost ratio of 2.4:1.

The types of benefits that have been delivered by the scientific research program include:

- cost savings for meat processors and/or avoided processing costs;
- increase in profits from higher meat sales;
- lower health costs which result from lower food safety incidents;
- disease testing cost savings for government (in the case of the TSE project); and
- a price premium on export sales.

The estimate of net benefits may be understated because the consultants were not able to quantify the benefits for some of the projects believed to have positive benefits. For example, consumer health benefits for some projects were not been quantified due to a lack of available data on red meat food safety outbreaks.

### 6.2 Research on maximising program impact

MLA staff are conducting research to better understand how research outputs are implemented (that is, become innovation). The innovation systems approach is being studied to determine how the components of an innovation system - the structures that need to be in place and the functions that need to be performed - can influence the success of conducting research and taking actions to ensure that innovation occurs and that there is benefit for the industry and society.



<sup>5</sup> <http://www.mla.com.au/About-MLA/Planning-and-reporting/Evaluation>

<sup>6</sup> <http://www.mla.com.au/About-MLA/Planning-reporting/Performance-review>

<sup>7</sup> V.LIM.1505 Ex-post benefit-cost assessment of MLA's product integrity programs.

Two approaches to innovation systems have been studied to determine their ability to predict innovation outcomes. Both innovation system theories are sufficient to explain innovation (or lack of innovation) in food safety in the Australian red meat industry. From the available data it also appears that all of the components of these systems need to be operating effectively for innovation to occur<sup>8</sup>. Through a range of MLA-conducted projects, similar weaknesses in the same structures and functions were found to be associated with failure to innovate, suggesting that greater attention to these factors would lead to greater innovation success.<sup>9</sup> The importance of effective involvement of a large number of groups, and especially the role of MLA were demonstrated.<sup>10</sup>

The result of this research is being implemented in the design of the program to respond to MISP 2020.

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<sup>8</sup> Jenson, I., Leith, P., Doyle, R., West, J., Miles, M.P., 2016. Testing innovation systems theory using Qualitative Comparative Analysis. *Journal of Business Research* 69, 1283-1287.

<sup>9</sup> Jenson, I., Doyle, R., Leith, P., West, J., Miles, M.P., 2016. Innovation system problems: causal configurations of innovation failure. *Journal of Business Research* <http://dx.doi.org/10.1016/j.jbusres.2016.04.146>

<sup>10</sup> Jenson, I., Doyle, R., Miles, M.P., 2016. The significance of actors in innovation system performance. *Technovation* submitted.

## 7. Government Research Priorities

MLA, as a part of the national innovation system, is responsive to government policies and frameworks on research, development and innovation.

### 7.1 Science and Research priorities

In May 2015, the Government established a set of Science and Research Priorities, and corresponding Practical Research Challenges.<sup>11</sup> These Priorities and Challenges will be reviewed every two years. Food is identified as one of the priorities. It is suggested that priority be given to research that will lead to:

1. knowledge of global and domestic demand, supply chains and the identification of country specific preferences for food Australia can produce.
2. knowledge of the social, economic and other barriers to achieving access to healthy Australian foods.
3. enhanced food production through:
  - novel technologies, such as sensors, robotics, real-time data systems and traceability, all integrated into the full production chain.
  - better management and use of waste and water; increased food quality, safety, stability and shelf life.
  - protection of food sources through enhanced biosecurity.
  - genetic composition of food sources appropriate for present and emerging Australian conditions.

With respect to food safety, MLA is responding to the priorities for research:

#### **Knowledge of global and domestic demand, supply chains and the identification of country specific preferences for food Australia can produce.**

It is fundamental to the planning process for the program, and also continued development in areas such as shelf life, that the program develops an understanding of safety and quality expectations and that we develop reliable ways of meeting those expectations.

#### **Knowledge of the social, economic and other barriers to achieving access to healthy Australian foods**

Some work in the program is devoted to technical barriers to trade and overcoming those barriers through the provision of information to government and educating supply chains about the safety and suitability of our products.

#### **Enhanced food production through novel technologies, such as sensors, robotics, real-time data systems and traceability, all integrated into the full production chain**

The program has a clear vision to utilise supply chain data and research results to enhance the quality and safety of food delivered to consumers.

#### **Enhanced food production through better management and use of waste and water; increased food quality, safety, stability and shelf life**

Increased meat quality, safety, and shelf life is at the core of the food safety R&D program at MLA. Appropriate attention is given to improving management to achieve outcomes and to reducing water use where possible.

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<sup>11</sup> <http://www.science.gov.au/scienceGov/ScienceAndResearchPriorities/Pages/default.aspx>

## **Enhanced food production through protection of food sources through enhanced biosecurity**

Attention is given in the food safety program, where appropriate, to the impact of microorganisms originating from animals, and how they can be best controlled through the supply chain.

### **7.2 Rural research and development priorities<sup>12</sup>**

#### **Productivity and Adding Value: improving the productivity and profitability of existing industries.**

The Food Safety R&D Program has a very clear focus on providing a sound scientific basis for continued development of quality systems within the Australian red meat industry. Providing a sound scientific basis for regulations allows the industry and regulators to control meat processing in a cost-effective way, by concentrating attention on the critical issues, and allowing the industry to innovate while maintaining food safety.

#### **Supply Chain and Markets: understanding and responding to domestic and international market and consumer requirements through the whole supply chain, including to consumers.**

MLA is leading or actively involved in a number of key initiatives designed to maintain and improve consumer confidence in the integrity of products produced by the beef and sheep meat industries based on sound science, risk analysis and the adoption and communication of research outcomes. The program also collects data that demonstrate the effectiveness of the Australian supply chain in producing quality products.

The sound scientific approach being taken to substantiate claims for market access is seen as a key factor for current and future market access. The Food Safety R&D Program develops information to support market access and also develops approaches to process validation and data collection and analysis to support future actions for technical market access.

#### **Biosecurity: protecting Australia's community from biosecurity threats.**

Threats in other countries are assessed and protocols for assessing their significance to Australia are part of the program's approach to pro-active management of food safety issues. Biosecurity is an approach that is relevant to ensuring that problems in overseas countries do not become established in Australia.

#### **Supporting the Rural Research and Development Priorities: improving the skills to undertake research and apply its findings.**

*Undergraduate training:* The program works with students and processors to work on projects that have real benefit to the industry, thus giving both parties the opportunity to innovate and see the potential for further innovation within the industry.

*Post-graduate training:* MLA continues to support investment in post-graduate training with PhD and masters students currently supported through our post-graduate scholarship program and project-based support.

*Researcher training:* Funds are provided to support researchers to attend leading conferences to present their R&D results and to network with the world's leading scientists in this area.

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<sup>12</sup> <http://www.agriculture.gov.au/ag-farm-food/innovation/priorities>



*Industry training:* Workshops, network (professional development) meetings, and tools are provided to the industry to increase their knowledge and skills in doing their jobs but also to increase their ability to take up the results of research.

**Supporting the Rural Research and Development Priorities: promoting the developing of new and existing technologies.**

Researchers working on MLA projects are using cutting-edge proteomic and genomic technologies to provide an understanding of food safety issues and possibly find breakthroughs in food safety. We continue to keep the Australian industry ahead of the world in application of new ideas and approaches to food safety.

**7.3 Agricultural Competitiveness white paper priorities<sup>13</sup>**

The Government released a white paper in July 2015 with the aim of strengthening the sector and ensuring it remains as competitive as possible.

The Government acknowledges that the RD&E system will give our farmers access to the latest innovations, new technologies and best management knowledge available to seize opportunities.

The food safety program responds to priorities in the white paper. In particular the food safety program responds by:

- developing and evaluating advanced technologies that lead to innovative processes and practices;
- evidence-based control of food safety risks for improving market access;
- emphasising the adoption of R&D through multiple channels

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<sup>13</sup> <http://agwhitepaper.agriculture.gov.au/>

## 8. Where to from here

### 8.1 MISP2020 and MLA Strategic Plan

The release of the new Meat Industry Strategic Plan, known as MISP 2020<sup>14</sup> signals a change to the positioning of the food safety program. Through the previous MISPs, there has always been acknowledgement of food safety and the significance of good systems and market acceptance of product. The significance of food safety has been clearly stated in the MISP 2020, without having a specific section dealing with food safety. This signals the maturity of food safety in the industry, with efficiency and communication becoming more important than improvement in performance.

MLA has developed a strategy in response to the MISP which clearly indicates MLA's responsibilities and activities over the life of the MISP to deliver on the objectives. The MISP is a clear organising tool and investments, outcomes and impacts will be measured against the MISP.



The future food safety program is informed by several sources including:  
the Meat Industry Strategic Plan (MISP2020)  
Government priorities  
the program evaluation  
research on innovation systems



There will be an increased focus on communication of program outputs to ensure increased rates of adoption and maximising outcomes and communication of Australia's food safety position to gain better market access and reduce technical trade barriers.

The 'food safety' program is now reflected in two areas of the MLA Strategic Plan:

Pillar 2: Market growth and diversification

Reducing technical barriers to trade

Conduct research to address key access issues and demonstrate technical quality of product & systems to trading partners and customers

Pillar 3: Supply chain efficiency and integrity

Livestock and product assurance through integrated integrity systems

Ensure integrity systems underpinned by rigorous food safety R&D and science-based evidence

<sup>14</sup> <http://rmac.com.au/>

## **8.2 Joint AMPC-MLA Program Management**

Over the past few years, the Australian Meat Processor Corporation (AMPC) has operated a food safety program. Since late 2015, MLA and AMPC have agreed to operate the food safety program jointly.

A joint approach to portfolio development and project contracting, management and extension will ensure that the strategic priorities of each sector can be addressed in an efficient manner while avoiding duplication of effort and resources. Similarly, adoption of outcomes from these portfolio areas typically impacts across the value chain and a collaborative approach between AMPC and MLA will serve to reinforce and underpin the importance of a whole-of-industry approach..

## 9. In detail

### 9.1 Communication with food safety Stakeholders

The Food Safety website is currently going through significant changes. The new webpage will be part of the MLA website and provide a point of reference on all things related to food safety. It will create awareness, and demonstrate the relevance and value of Food safety programs and activities to members and key stakeholders.

Contents on the new website will be significantly streamlined, so as to provide an overview of all our activities and the range of information and resources available, with links to more detailed reports on the MLA comprehensive reports database. This ensures everyone has quick access to newest available information, and latest research within the food safety program.

**This new page will become available on the MLA website in August 2016**

The screenshot shows the MLA website's 'Food Safety program' page. At the top, there is a navigation bar with 'CONTACT', 'SITEMAP', and a search box. Below this is a secondary navigation menu with categories: 'PRICES & MARKETS', 'RESEARCH & DEVELOPMENT', 'EXTENSION, TRAINING & TOOLS', 'MEAT SAFETY & TRACEABILITY', 'MARKETING BEEF & LAMB', and 'ABOUT MLA'. The main content area is titled 'MLA Food Safety program' and includes a search bar for R&D reports. A sidebar on the left lists various research topics such as 'RED MEAT INNOVATION', 'ANIMAL HEALTH, WELFARE & BIOSECURITY', and 'OFF-FARM FOOD SAFETY'. The main text describes the program's goals and mentions its partnership with AMPC. Below the text is a 'Publications' section with three featured articles: 'Guidelines for the safe retailing of meat and meat products', 'Australian Beef Food Safety Brochure', and 'Food safety when buying food'. There are also social media sharing options and a 'Related content' section.

## 9.2 Communication to producers

Feedback, Nov / Dec 2015

# Enhancing beef's safety

Australia's reputation for providing safe food is the foundation of our export industry. MLA, in collaboration with CSIRO and universities, is working hard to enhance this reputation by improving *E. coli* detection and control.



**M**LA is funding research into reducing incidences of Shiga toxin-producing *E. coli* in beef.

This potentially lethal group of bacteria has relatively little impact on Australian public health; however, its control is essential to our key beef export markets, particularly the US.

In 1993, the US experienced a high-profile outbreak of *E. coli*, attributed to under-cooked hamburgers sold by a restaurant chain. The outbreak caused more than 700 cases of food poisoning, including four deaths.

Subsequently, all imported beef is tested and the US has nil tolerance for *E. coli*.

MLA's Market Access Science and Technology Manager, Ian Jenson, said MLA had funded several research projects with CSIRO, the University of Sydney, Charles Sturt University and the University of Tasmania to investigate *E. coli* strains and find the best methods for control during processing and on-farm.

"At this stage, processors bear the burden and employ various control methods including cleaning protocols, hot water and acid washes," he said.

"So far, the most promising research project involves controlling *E. coli* through the chilling process and it is ongoing with the University of Tasmania.

"Researchers found under commercial spray chilling conditions, using chlorine dioxide, *E. coli* cell numbers reduced 100-fold in 24 hours and a further 10-fold after 72 hours. Further research found certain chemicals could be applied using anti-bacterial wipes, a technique accepted widely in international markets due to minimal residue.

"It is hoped this process will be trialled commercially early next year."

With MLA support, CSIRO is continuing its work on detection and risk assessment of various *E. coli* strains found in Australian cattle. Ian said the good news so far was that many Australian isolates of O157, one of the most severe but not common variants of *E. coli*, are in the lower risk category for human health.

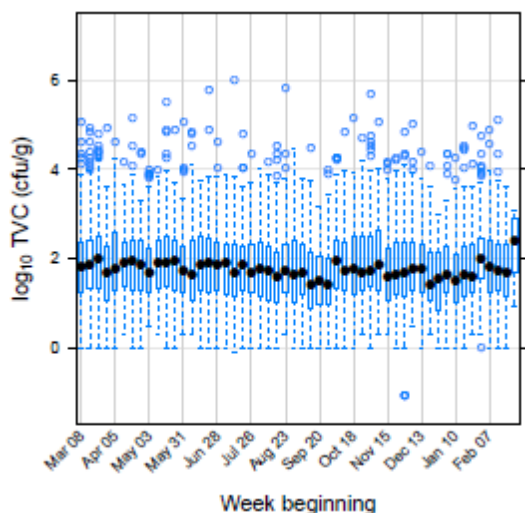


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## 9.3 Confidence for markets, efficient processes: Improving process hygiene

### Confidence in Markets

Control of the hygiene of slaughter processes has been of interest to importing countries since the introduction of HACCP systems in the mid-1990s. In the USA, particularly with the tightening control of pathogenic E. coli (for example, E. coli O157), increasing attention has been paid to the ability to detect product which may be of higher risk of contamination with bacteria considered to be adulterants (that is, not allowed at all in the product).



MLA has funded the production of national data on a monthly basis, providing feedback to processing establishments on the performance of their establishment against national averages. These reports are not only useful to the establishment, but also to explain to importing countries and customers, the confidence that can be placed in the hygienic quality of Australian product.

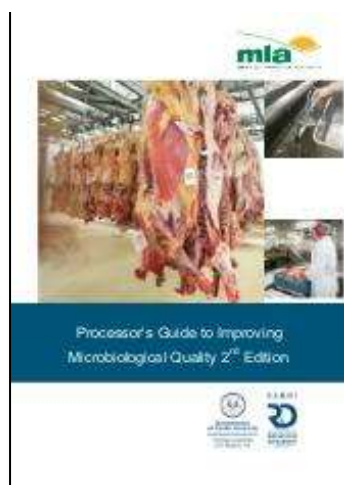
### Efficient processes Process investigations

The analysis of routine data and reporting by SARDI is supported by a service that provides answers to questions asked by processor QA staff. This may lead to investigations of the type

reported in the 'Processor Guide to Improving Microbiological Quality'. This book provides instruction on how to conduct investigations into process control - and also provides a large number of case studies, many provided by company QA staff.

Presentation about process control were made by Jessica Tan from SARDI and QA managers from several establishment at the 2015 MIQA Conference, attended by a large number of industry QA managers and industry trainers.

A new edition is planned for release in 2017 with additional case studies, and possibly, shelf life / cold chain management case studies.



### Carcass baseline study

Pressures will continue for improving process control. The processing sector needs to implement effective controls in an efficient and cost-effective way. We know that the US, Food Safety Inspection Service is implementing a process control baseline study (see box), and that this potentially will be used to make changes to regulatory requirements, or will certainly, drive commercial interest.

MLA is currently conducting a similar baseline study so that the industry will be ready to respond to future regulatory and commercial pressures.

FSIS will use the data from Beef and Veal Carcass Baseline Survey

- to estimate the national prevalence of select microorganisms,
- to develop industry performance guidelines,
- to assess process control across the industry, and
- to inform additional policy considerations.

## 9.4 Confidence for markets, efficient processes: Control of *Salmonella* and enteric pathogens in supply chains

*Salmonella* are estimated to cause 93.8 million cases of acute gastroenteritis and 155,000 deaths globally each year, approximately 85% of which are estimated to be foodborne. As a result, *Salmonella* have a significant public health and economic impact on society. While beef products are a less significant source of disease in many countries, they have been implicated in several large outbreaks in recent years. Contamination of beef and pork with *Salmonella* can also negatively impact the agri-food and trade sectors due to costly recalls of products and by limiting market access.

### Confidence for markets

#### INTERNATIONAL ACTIVITY

Codex Alimentarius (a Joint FAO/WHO body that sets food standards - and thus sets requirements for international trade) has been developing a Code of Practice for control of *Salmonella* in beef supply chains

The World Organisation for Animal Health (OIE) is also considering on-farm control of *Salmonella*. The US Food Safety Inspection Service has expressed concerns about *Salmonella* in ground meat (including beef). A citizens' petition has requested that certain strains of *Salmonella* be declared as adulterants (that is, not allowed) in ground meat

#### WHAT MLA IS DOING

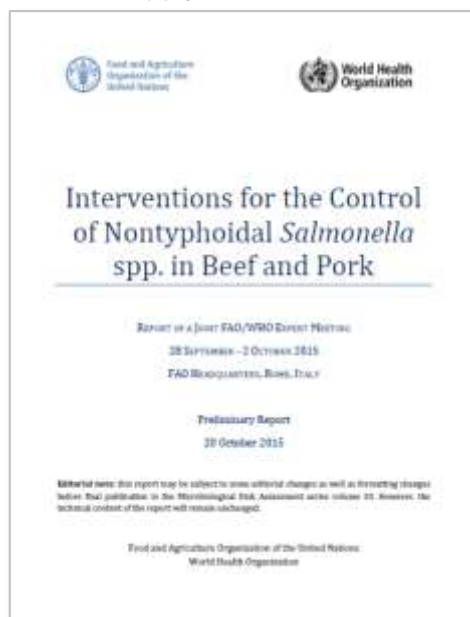
MLA's ongoing research program, publication of articles in the international scientific literature and in-house expertise have contributed to the industry's response to the ongoing international concerns about *Salmonella*. Codex requested that FAO/WHO provide advice on *Salmonella* control in beef supply chains. The Joint FAO/WHO Expert Meeting on Microbiological Risk Assessment provide independent scientific expert advice to the Codex Alimentarius Commission and its specialist Committees.



MLA provided a submission to a request for information relating to *Salmonella* in beef supply chains. Generally, this information needs to be published in peer-reviewed scientific journals. An MLA staff member was also invited to be part of the expert committee that produced a report on possible interventions for *Salmonella* in beef supply chains.

During the meeting, the experts considered any intervention for which there was available evidence that could be applied to prevent, reduce or control *Salmonella* in the production and processing of fresh beef. It was noted that there are a range of contextual factors that will guide decisions on whether a particular intervention is implemented and that efficacy will also vary according to the conditions at the point of implementation. It was agreed that all interventions should be verified at the local establishment of implementation.

With regard to beef, no specific hazard-based interventions were identified in primary production, although the experts agreed that biosecurity could contribute to general on-farm control of *Salmonella* and other zoonotic foodborne infections.



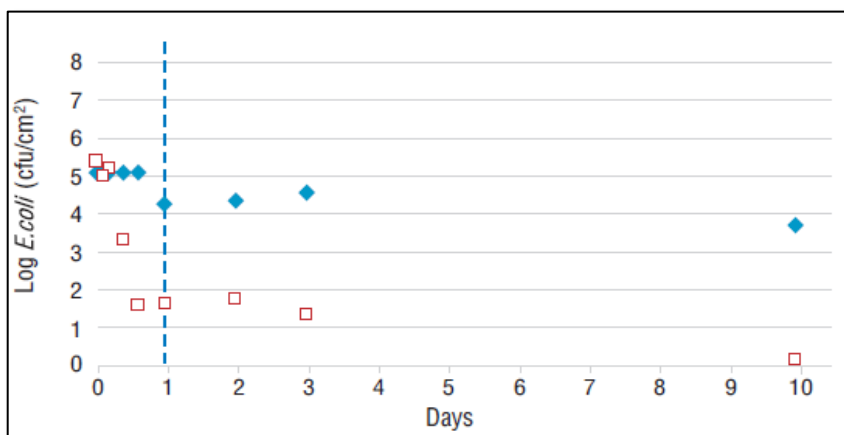
In the recent past surveys have been conducted to determine the level of Salmonella likely to be found in Australian product. Currently, additional surveys are being conducted of beef carcass processing standards and Salmonella in lymph nodes, which may be incorporated into ground beef. The results of these surveys will be published, and potentially form part of Australia's response to future requests for information, or proposed changes to regulations by importing countries.

## Efficient processes

Studies of new interventions indicate that it is possible to make beef carcasses safer through an effective and efficient process, that has minimal effect on carcasses quality. Current research by the University of Tasmania found that *E. coli* is susceptible to oxidative damage during certain stages of chilling, which has become a novel intervention during spray chilling<sup>15</sup>. Trials have shown chlorine dioxide, ( $\text{ClO}_2$ ) is very effective against *E. coli* and Salmonella when included in the spray chilling regime. Using chlorine dioxide in the spray chilling process resulted in an approximately 3 log reduction in *E. coli* at the end of chilling (Red squares). This research highlights the potential for the proposed intervention to be implemented as a decontamination step for *E. coli* and related pathogens during carcass processing. This is important for exporting to countries which have Zero tolerance for STEC such as the USA.

Not only can it inactivate target pathogens it was evident that  $\text{ClO}_2$  could also suppress the growth of normal microorganism on the carcass as well, which may be effective at extended shelf life by this intervention under certain conditions.

The results of the trials to date indicate that spray chilling water containing  $\text{ClO}_2$  can also be an effective intervention against *E. coli* and Salmonella on beef carcasses, and the intervention is being developed in the commercial setting.



<sup>15</sup> Kocharunchitt, C. (2012). Effects of cold temperature and water activity stress on the physiology of *Escherichia coli* in relation to carcasses. PhD Thesis, University of Tasmania, Hobart, Australia.



## 9.5 Confidence for markets, efficient processes: Shelf life for technical market access

MLA's work on shelf life has included the development of some up-to-date science and information and the ability to predict vacuum packed chilled shelf life. This work provides a platform for businesses to improve their shelf life and supply chain performance, and for MLA, AMPC, and the Australian Government, to discuss restrictive shelf life regulations with importing countries.

The shelf life of our products allow us to reach distant markets with confidence and gain a premium price. Greater value for supply chains can be gained by better managing shelf life (for example, reducing wastage) and gaining approval for longer shelf life.

### Confidence for markets

#### Shelf life book

The publication of "The shelf life of Australian red meat"<sup>16</sup> was the first technical book to combine and included shelf life related research, industry knowledge and red meat industry history from the national and international platform into one document related to Australian red meat. There was enormous success from the publication and great feedback was received from industry and stakeholders.

The book was published to assist industry to better understand shelf life and supported by research. Additionally to supply the wider industry a document to reference and set a standard which enables industry to extend shelf life and improve current processes. It also allows government and industry to use as a negotiation tool with export markets.

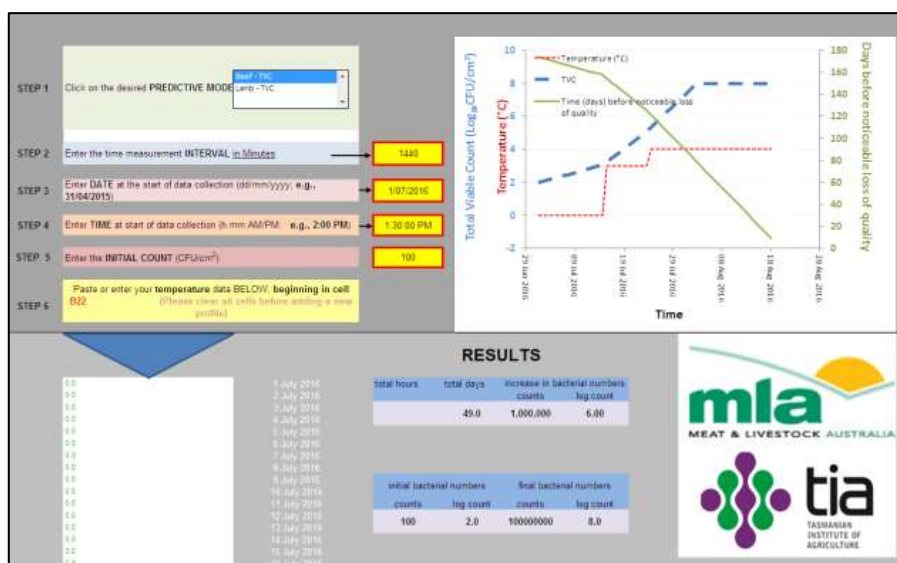
The document is a way to promote the Australian red meat industry. It highlights the potential of Australian red meat shelf life, and emphasise we have an in depth understanding of red meat and constantly doing large amount of research. This helps us establish our position in the international market and gives export markets confidence on how we achieve long shelf life.

The second edition contains research updates from CSIRO and University of Tasmania on shelf life of primals and sub primals, guidelines on determining shelf life and interventions. The shelf life predictor has also been developed to a stage where it has great potential value, especially for emerging markets where the cold chain infrastructure is not well developed

### Efficient processes

#### Shelf life prediction

MLA commissioned University of Tasmania to develop a spoilage predictor tools for vacuum packaged beef and lamb primals. The tool is based on the growth and development of TPC and spoilage odour as a function of storage temperature. An establishment will need to know the TPC at packing, plus the temperature:time record of meat in the container. When these parameters are entered into the tool, predictions of TPC at the



<sup>16</sup> <http://www.mla.com.au/News-and-resources/Publication-details?pubid=6411>

end of the journey, together with days remaining until detection of off odours; this latter can be estimated for a range of temperatures. Ultimately this tool can aid decisions by analysis of the situation and gives the ability to respond with confidence based on science. Leading to fewer products discarded or devalued due to cold chain disruptions.

## Confidence for markets

### How does MLA further communicate about shelf life?

Trade restrictions relating to shelf life- either imposed by importing country regulations, or supply chain guidelines - are considered to be financially significant technical barriers to trade.

Face-to-face communication with multiple stakeholders is part of the communications strategy for promoting Australian product, changes to supply chain practice and removing unnecessary barriers to trade.



**June 2015**- presentations were made in **China** to an International Import & Export Food Policy, Laws and Regulations Summit, organised by the China Entry-Exit Inspection and Quarantine Association, and attended by the trade as well as government officials. A presentation was also made to an importer and trade audience. These presentations supported the chilled beef trade, promoted outcomes based regulation and correct handling of product.

**July 2015** - The International Association for Food Protection meeting in **Portland** held a symposium entitled 'Shelf life of meat: changing the dogma', arranged by MLA with two Australian speakers, to inform a primarily **US** scientific audience about the research conducted through MLA.

### **August 2015**

A workshop was conducted for **Chinese government officials** with the aim of:

- increasing the knowledge about Australia's chilled exports systems and procedures;
- informing key Chinese Government officials about Australia's cold chain, food safety, traceability and meat quality systems; and,
- gaining a better understanding of Chinese Government requirements around chilled export cold chain and shelf life.

### **October 2015**

Discussions were held with the Gulf Standards Organisation about holding a technical seminar with their standards committee on shelf life. Presentations were also made at the Dubai International Food Safety Conference on the shelf life of Australian red meat.

### **January 2016**

Workshops were held with key Chinese importers, distributors and retailers on cold chain integrity to promote trade in chilled meat and lobby to expand market access for all China eligible export plants. The workshops were held in Shenzhen, Shanghai and Beijing. The response for attending was overwhelming with each workshop featuring around 100 Chinese participants.

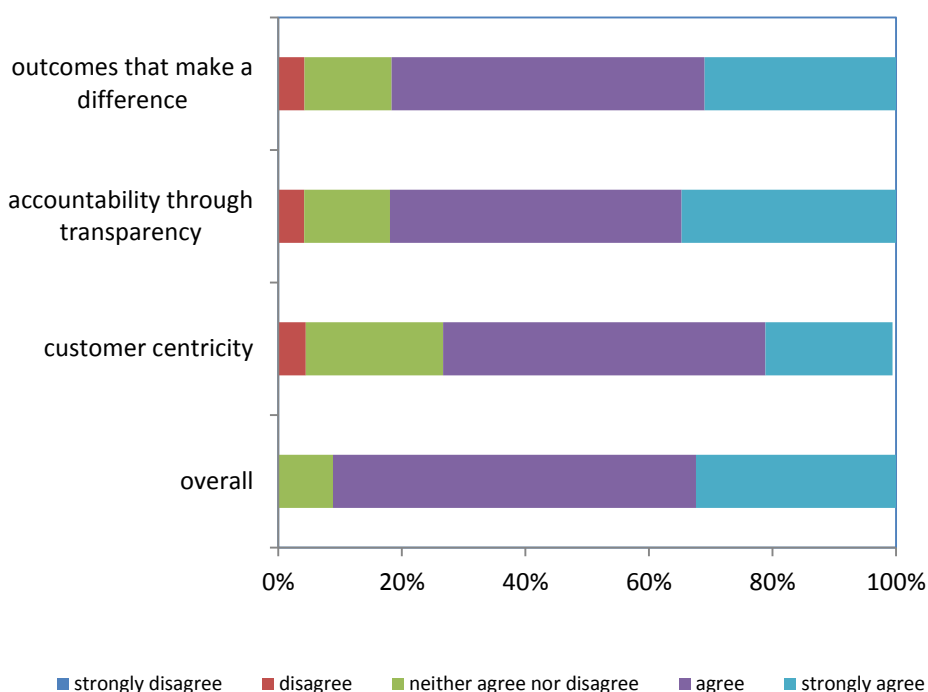
The chilled meat workshops appeared to be well received by all Chinese stakeholders present and formal questionnaires on its usefulness backed up this assertion. The workshops prompted some reasonable and insightful questions, which demonstrated varying degrees of understanding by those present. When asked about any problems, it was clear there are some consistent themes with the Chinese market for the challenges around cold chain management. These included a lack of understanding about handling chilled product, a lack of understanding about the value of vacuum-packing and some significant logistical limitations along the cold chain.

## 9.6 Stakeholder satisfaction with the program

A stakeholder survey was conducted which focussed on whether the program was conducted in a way that demonstrated MLA values, and with overall satisfaction. Respondents were representatives of peak councils, government, processor companies and researchers, who had some involvement with the program during the year.

Thirty-six responses were received, 50% of which were from industry organisations and meat processing company representatives. Questions were largely asking for agreement with a statement, on a 5-point Likert scale, supplemented by open-ended responses.

Overwhelmingly, respondents agreed positively (agree or strongly agree) that the program demonstrates MLA values and overall satisfaction with the program.



Respondents claimed to be aware of food safety publications and the MLA R&D reports database. Some additional work may be needed to better meet stakeholder needs through the R&D report database.

Positive comments received included:

- it is well managed and known to be pro-active, to engage externally and share information.
- programs are well done and are used as industry benchmarks
- a good team and very knowledgeable

Points that might be addressed to increase stakeholder satisfaction with the program include:

- faster turnaround on releasing research findings to stakeholders and ensuring value inputted into R&D is delivered through to a commercially applicable stage
- would benefit from a larger proportion of set allocation to core research and/ or leveraging of other parties core research that could benefit the meat industry
- program needs to be better coordinated to ensure industry outcomes are achieved
- some projects could benefit from input by individuals or groups familiar with the industry or the issue

In response to a question on how MLA could work with stakeholders on the program, suggestions included:

- be kept informed on projects through email updates on areas of interest - prompts to visit the website to see research reports
- earlier consultation on key project areas and also better alignment with processing sector's priorities
- greater consultation on the program so that industry is aware of the benefits that is delivering
- through communication on scientific / technical developments and request for advice
- through network meetings, on line publications and one to one site of key stakeholders from time to time

In response to a question on what areas of research / development / adoption / impact MLA should focus on, the following responses were received in areas within the scope, but not being currently addressed, by the program:

- ag vet chemical trials to support minor use applications to APVMA for minor species
- antibiotic resistance issues,; bacterial transfer of antimicrobial resistance determinants from animal via the food chain to the consumer
- continue the current work, but not just with focus on export
- risk communication to the multiplicity of stakeholders should be a formal part of projects
- shelf life issues - on co and by-products
- shelf life of processed meats and safe production of smallgoods not usually made in Australia