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A HACCP based approach to food safety certification.

HACCP based approach to justification and design of the level 1 food safety certification scheme for Australian cattle, sheep and goat industries.

QA.005 FINAL REPORT

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HACCP-Based Approach to Justification and Design of the Level 1 Food Safety Certification Scheme for Australian Cattle, Sheep and Goat Industries

1. PURPOSE

A review of On-Farm Quality Assurance (QA) in the Australian Livestock Sector was undertaken by Meat and Livestock Australia (MLA) in 2002. The published report from the review[1] recommends, amongst other things, a two-tiered QA system for the livestock sector with a mandatory Level 1 Food Safety Certification Scheme. In anticipation of this recommendation being adopted, it is prudent to identify the food safety aspects that should be effectively controlled on farm in the Level 1 Scheme. As part of the process, a comprehensive HACCP-based analysis of production of cattle, sheep and goats has been undertaken to justify and support the design of the Scheme.

The purpose of this document is to summarise the approach taken and provide a sound basis for the further development of industry standards which will become the Level 1 Food Safety Certification Scheme. The approach taken was to develop a generic industry HACCP Plan which is broad enough to apply to all cattle, sheep and goat enterprises. Various Level 2 schemes will address specific customer requirements over and above food safety and food safety related market access issues and are not covered in this paper.

This document considers food safety risks that have an epidemiological link to foodborne illness and food safety-related market access risks and identifies on-farm controls necessary to be included in a Level 1 Scheme for the Australian red meat industry. It is **not** proposed that individual enterprises must develop their own HACCP plans for Level 1, rather further development work will be undertaken on standards for Good Agricultural Practice for Level 1 using this HACCP plan. The HACCP plan is a scientifically valid pre-cursor for this work.

2. HACCP TEAM

In order to develop the HACCP Plan, an authoritative HACCP team with specialities in HACCP methodology, food safety hazards (veterinary public health; microbiology; epidemiology of foodborne diseases) and prevention mechanisms, and livestock production expertise was assembled.

The team included:

1. Ian Jenson, M.Sc FASM MAIFST, Food Safety Research and Development Manager, MLA;
2. Andrew Pointon, B.V.Sc. M Sc (Micro), Program Leader, Food Safety Research, South Australian Research & Development Institute;
3. Denis Brett, B.V.Sc., General Manager Standards and Technical Operations, AUS-MEAT Limited;
4. Bruce Gormley, B. Rur Tech, Manager Agribusiness QA Services, AUS-MEAT Limited;
5. Peter Horchner, B.Agr.Sc, Managing Director, Alliance Consulting & Management Pty Ltd; and
6. Ms Vicki Noy, Qualifications, B.Tech(Bio), Research & Development, Alliance Consulting & Management Pty Ltd.

Full details of the HACCP team's qualifications and experience are included in Appendix 1.

All members of the HACCP team have either had formal training in HACCP; prior experience developing, implementing and reviewing HACCP Plans; applying the risk assessment approach to meat and livestock production; managing on-farm certification programs; or delivering training to the food and agricultural industries in HACCP to Codex Alimentarius principles. A reference panel of industry stakeholders provided review and guidance on the HACCP Plan development.

An extensive library of resource information was available for the compilation of this HACCP Plan, including the draft final report of the MLA funded food safety risk profiling project[2] and reference documents used in the project.

3. METHODOLOGY FOR HACCP-BASED APPROACH

The term "HACCP plan" implies the Codex based HACCP methodology[3] should be used. Whilst the approach was based on the Codex approach the HACCP team modified the conventional layout of HACCP plans in order to meet the needs of this project. Specifically, since the Level 1 Food Safety Certification Scheme has to apply to cattle, sheep and goat enterprises, the approach includes a risk profile at an overall livestock sector level rather than only an individual enterprise level (i.e. consideration has been given to interventions downstream which deal with identified hazards, where applicable). The HACCP plan had to be broad enough to cover all situations and therefore may not necessarily pertain to a given "typical" enterprise. Therefore, a "HACCP-based" approach was taken to this situation[4]. In summary, the steps used by the HACCP team for this assignment were:

1. Assemble the HACCP team
2. Describe the scope; product and intended use
3. Construct a process flow diagram to cover livestock production
4. Identify food safety and food safety-related market access risks at the industry level
5. Determine risks which should be controlled by the livestock sector in a Level 1 Scheme
6. List the possible hazards associated with each step in the livestock production process, conduct a hazard analysis and consider any control measures required. Both hazards and control measures must be scientifically proven in order to be considered at this stage of the Scheme.
7. Determine critical control points
8. Establish critical limits for the control measures at each CCP
9. Establish requirements for an effective on-farm monitoring system for critical limits at the CCPs
10. Establish corrective actions to be taken by livestock producers when monitoring shows the CCPs are out of control
11. Establish suitable verification requirements at both the industry and livestock enterprise levels
12. Identify records and documentation required to support the requirements at the livestock enterprise level (Level 1 Food Safety Certification Scheme and livestock movement document will be developed separately).

Further details of the methodology and results are provided in the respective sections below.

3.1 Definitions

A ***Hazard*** means there is valid scientific evidence that the identified hazard has an epidemiological link to the occurrence of disease in human populations.

A ***Public Health Risk*** is defined as a recognised hazard that causes disease as a result of eating meat or meat products.

Foodborne hazards include biological (microorganisms, natural toxins), physical (foreign matter, animal derived) or chemical (residues, metals) agents, in, or condition of, food with the potential to cause an adverse health effect.

Biological hazards include microbiological and macrobiological hazards. Microbiological hazards typically arise from direct ingestion of pathogenic cells or from toxins produced by bacteria, fungi or moulds. Other microbiological hazards are viruses, protozoa and parasites. Examples of macrobiological hazards in this document include organisms or pathology associated with certain animal parasites and disease.

Chemical hazards include residues from chemicals in the environment, used on-farm and/or in processing, including those which may be safe in small amounts but have a Maximum Residue Limit (MRL) and/or Export Slaughter Interval (ESI) in place.

Physical hazards may enter the product at any stage of processing and examples are glass, stone, metal, plastic, rubber and pests.

Food Safety-Related Market Access Risks are potential hazards related to food safety which may or may not be valid hazards but are technical requirements to trade perceived as food safety linked in Australia's major meat and livestock markets. *Note: Stock feeds possibly containing GM crops and grains were not an issue at the time of conducting this study but are recognised by the HACCP team as an emerging issue and need to be reconsidered at a future time.*

Potential hazards include those that may result in public health, social and/or economic impact but for which evidence is lacking.

The ***entire food chain*** is defined from meat production on farm through to food preparation, consumption and considers consumer susceptibilities.

Technical requirements to trade are defined as standards applied by importing countries, additional to those considered to have direct public health implications.

Risk Profile is defined as 'a description of a food safety problem and its context developed for the purpose of identifying those elements of a hazard or risk that are relevant to risk management decisions'. (Codex CX/FH 01/7-Alinorm 03/13)

Risk Analysis. The Codex Alimentarius Commission (1999) has the Draft Principles and Guidelines for the Conduct of Microbiological Risk Assessment that applies to risk assessment of microbiological hazards in food. Risk assessment, along with risk management and risk communication, forms the process of risk analysis. Risk assessment itself comprises the steps: i) hazard identification, ii) hazard characterisation, iii) exposure assessment and iv) risk characterisation.

Hazard identification – The identification of biological, chemical and physical agents capable of causing adverse health effects and which may be present in a particular food or group of foods. (Codex Alimentarius Commission, 1999)

4. SCOPE, PRODUCT DESCRIPTION AND INTENDED USE

The scope of this HACCP study is limited to production of cattle, sheep and goats, including animals being produced for meat and live export for Australian and international markets with the intended use of human consumption by the general population.

It covers the process from inputs (animals, feed, water, treatments, site, husbandry practices) through to dispatch from property. Actual transport will be covered by other schemes and not within the scope of this study since it is often out of the control of the livestock owner. This HACCP study therefore excludes

intensive feeding (to refer Feedlot QA) and the production of milk and milk products (to refer Dairy QA).

The hazards of interest are foodborne hazards and food safety-related market access risks concerned with the production of livestock intended for human consumption.

The scope of the investigation excludes steps outside the livestock production process such as livestock transport after dispatch and downstream processes such as saleyards and processing facilities (refer to approach to CCP determination, Section 7.1).

5. PROCESS FLOWCHART

An overview of the livestock production process is provided in Figure 1. Further detail on the activities associated with each of these general steps, including any species differences is provided in Table 1. Both Figure 1 and Table 1 are generic enough to cover all species and production systems within the scope. Verification of this process flowchart and the activities in Table 1 was undertaken by desktop review by industry stakeholders, including members of the respective meat and livestock peak industry councils and other industry groups.

Figure 1: Overview of the livestock production process.

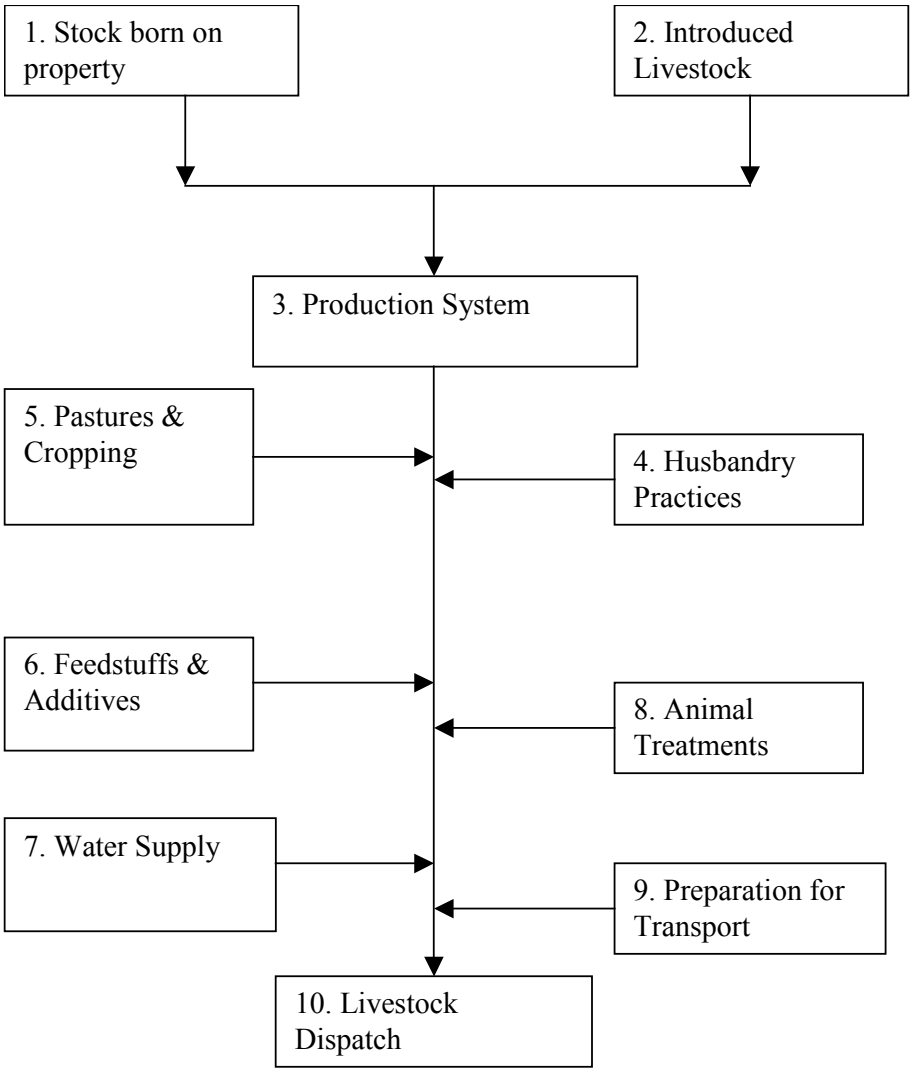


Table 1: Activities Associated with each Step in Livestock Production Process Flow Diagram

Process steps	Activities associated with this step	Species Differences
01 Animals born on property	Establish Identification and Traceability of animals	Individual vs mob/property
02 Introduced livestock	Purchase or Obtain animals	May include feral animals for each species.
	Receival of animals	
	Establish Identification and Traceability of animals	Individual vs mob/property
03 Production system	Historical/previous land use	
	Contaminants from external enterprises	
	Intensive vs extensive system (includes range fed, supplementary fed, dairy farms and hobby farm systems and feral animal harvesting)	Possible range of production systems for each species
04 Husbandry Practices	Mating/breeding and reproduction program, including pregnancy testing	Variable use of Artificial Insemination and Artificial Breeding
	Weaning	
	Marking	Branding vs other Identification methods
	Handling – mustering, yarding	De-horning; Shearing, crutching, mulesing, milking
	Movements – on property, between properties, droving	
	Manage nutritional requirements	
	Animal health program	Dipping; Drenching; Injecting; Vaccinating
	Culling	
	Euthanasia and Carcass Disposal	
05 Pastures & Cropping	Manage pasture and/or crop quality	
	Purchase pasture and/or crop treatment chemicals	
	Receival of pasture and/or crop treatment chemicals	
	Storage of pasture and/or crop treatment chemicals	
	Preparation of pasture and/or crop treatment chemicals	
	Approval of pasture and/or crop treatment for use	
	Application of pasture and/or crop treatment chemicals (incl contractors)	
	Disposal of chemicals	
	Identification and traceability of treated pastures and/or crops	
	Manage withholding periods/ESI	
06 Feedstuffs	Manage alternative feed sources	
	Selection of feed type	
	Purchase of feed	
	Receival of feed	
	Identify and trace feed	
	Storage of feed	
	Treatment of feeds	
	Preparation of ration	
	Distribution of feedstuff	
	Supplementation program	

Process steps	Activities associated with this step	Species Differences
	Feed disposal	
07 Water supply	Water source	
	Water quality/contamination	
	Storage	
	Distribution system	
08 Animal treatments	Growth promotants	
	Agricultural and veterinary chemicals/prescription drugs	Limited approval of chemicals for use on/in goats
	Parasite controls	
	Purchase of chemicals	
	Receival of chemicals	
	Storage of chemicals	
	Preparation of chemicals	
	Approval for use/off label use	Limited approval of chemicals for use on/in goats
	Application of chemicals (incl contractors)	
	Disposal of chemicals	
	Identification and traceability of treated animals	
09 Preparation for Transport	Assessment and selection	
	Assembly and drafting	Crutching, cleanliness
10 Livestock Dispatch	Selection of transport method (rail, road, sea, stock route)	
	Selection of transporter	
	Holding, Loading & Transhipment	
	Completion of movement documentation	

6. PRINCIPLE 1: CONDUCT A HAZARD ANALYSIS

The hazard analysis (Principle 1 of Codex) was conducted at two levels – for the livestock sector overall relative to other steps in the supply chain; and within an individual livestock enterprise to later determine critical control points.

6.1 Identification of Potential Hazards

As a first step in the hazard analysis, the HACCP team reviewed all the potential hazards in the red meat industry (all sectors), especially in relation to those which had presented public health risks. MLA has funded a through chain risk profile for the Australian red meat industry (Project PRMS.038c). The draft report from the project was made available to the HACCP team and two of the HACCP team members are managing the project.

The risk profiling report describes all the hazards that were considered including the following:

- food safety risk - types (biological, chemical, physical)
- food safety-related market access risks – identified separately in the hazard analysis

Foodborne disease outbreaks are usually the result of contamination with pathogenic microorganisms, or animal related diseases such as BSE. Chemical contamination may occur at any stage in the farm to fork continuum. Hazards may arise at primary production, for example with the introduction of chemicals into the product or during processing, eg through contamination by bacteria from the animal's gut and the environment; or by broken needles as a result of animal treatments; or by chemicals during processing and handling.

There is a fundamental difference between chemical and microbiological hazards in food. Generally, the level of a chemical does not increase once a food is contaminated and the risk it poses stays largely the same until the time of consumption (although some biotoxins may increase in potency when subjected to the low pH of the human gut). Microbial contamination and associated risk to human health, on the other hand, can either increase or decrease depending on the handling/processing of the food downstream of the contamination[5, 6].

Chemicals are detoxified by live animals (including humans) and excreted. Therefore, on the human side, it is possible to determine maximum daily intake levels based on excretion and accumulation - which leads to Maximum Residue Limits being set for certain chemicals in meat. On the animal side, withholding period (WHP) and time interval prior to slaughter (ESI) can be set as a means of reducing chemical residues where applicable.

Appendix 2 provides a summary of the microbiological, chemical and physical hazards of concern to the red meat industry summarised from the draft report on through chain risk profile for the Australian red meat industry (Project PRMS.038c). **Appendix 3** includes a copy of the current list of approved chemicals which have a WHP and ESI for cattle, sheep and goats.

Table 2 below includes a list of all the specific groups of microbiological, chemical and physical hazards which were assessed in Project PRMS.038c and further discussed and evaluated by the HACCP team for this assignment.

6.2 Risks at the industry level

An assessment was firstly conducted on the livestock sector as a whole to determine if there were food safety hazards and food safety-related market access risks that should be controlled by the livestock sector and therefore justification for control of the hazard in the Level 1 On Farm Food Safety Certification Scheme. A decision tree was developed specifically for this purpose.

As shown in Figure 2, the decision tree developed for the livestock sector overall was used to see whether:

1. identified hazards were a food safety risk;

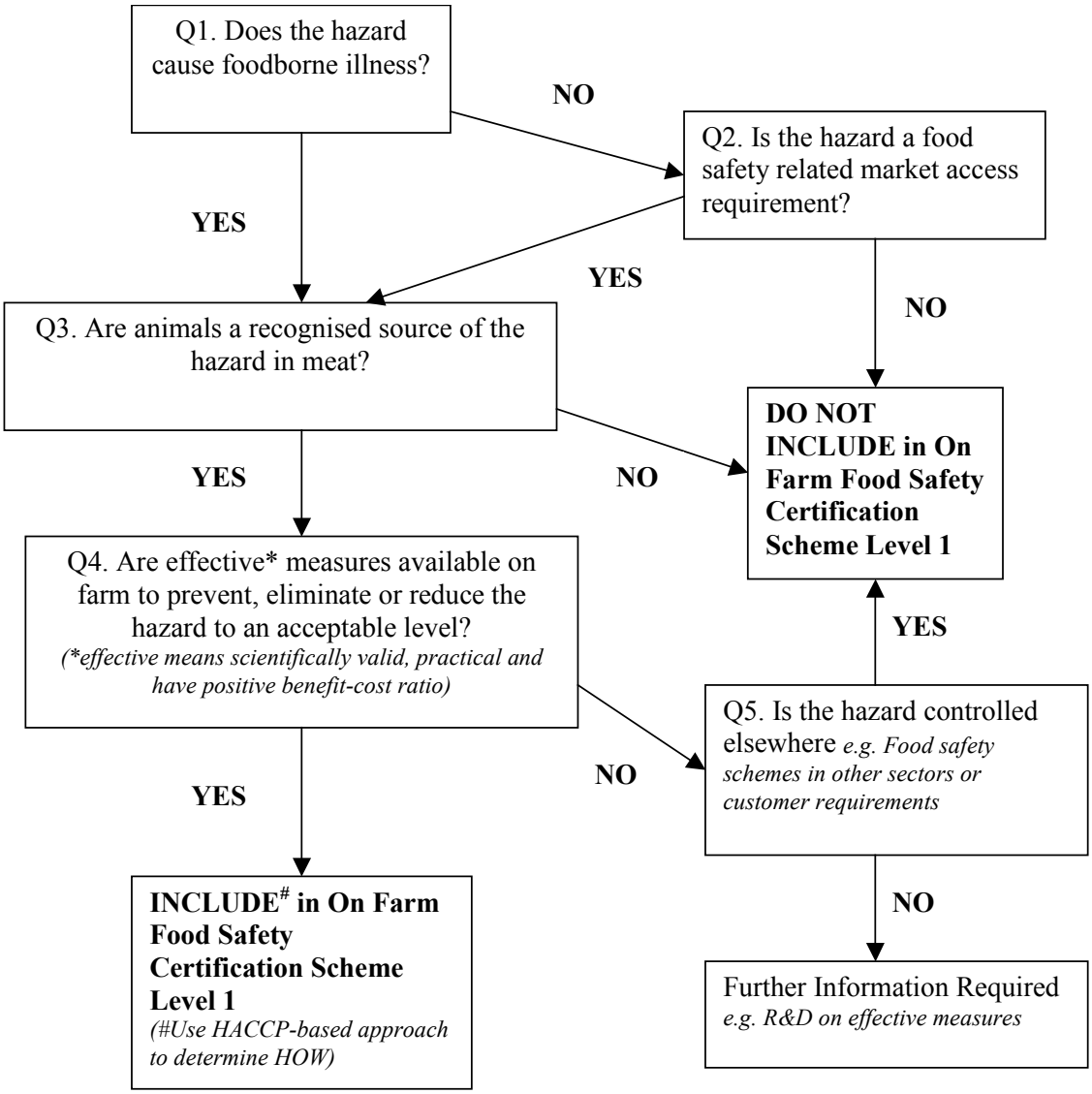
2. identified hazards were a food safety-related market access requirement;

3. animals are a recognised source of the hazard in meat; and

4. there are control measures available on farm to prevent, eliminate or reduce the hazard to an acceptable level.

As indicated on Figure 2, hazards which result in a “Do not Include in Level 1” recommendation may be either effectively controlled elsewhere in the supply chain or may require further research to understand and/or control the hazard. The risk profiling project PRMS.038c identified over 40 different potential biological, physical and chemical hazards associated with the red meat industry. Each of these hazards was assessed using the decision tree (Figure 2) to determine whether it should be included in the Level 1 Scheme. The results of the assessment are included in Table 2.

Figure 2: On Farm Food Safety Certification Scheme Hazard Decision Tree



There was considerable discussion regarding the inclusion of indicator organisms in the microbiological hazards (Table 2). Indicator organisms are the subject of regulatory testing in meat processing plants as a measure of process hygiene. Although levels of indicator bacteria such as *E.coli*, coliforms, and Total Viable Count (TVC) have established links with pre-slaughter cleanliness of livestock, the complexity of developing effective procedures before slaughter to minimise contamination of carcases with pathogens is underscored by recent results on *E. coli* O157 carriage at slaughter. Historically, *E. coli* has been used as a surrogate for the likely contamination with faecal pathogens. A national survey of 155 grass-fed and 155 grain-fed cattle found no correlation between the generic *E. coli* count and the *E. coli* O157 count in faeces at slaughter (PRMS.030, 2003[7]). Reliance on procedures developed to minimise microbial loads on carcases (TVC, Coliforms, *E. coli*) will assist in achieving pathogen control but it is not possible to set critical limits for indicators that are both easily achievable and ensure that pathogens are absent.

Therefore, inclusion of hide/fleece/skin cleanliness in the Level 1 Food Safety Certification Scheme would be on the basis of current regulations. Further summary comments are provided in Table 2 to give guidance as to the rationale for the HACCP team's consideration of hazards using the decision tree in Figure 1.

Table 2: Hazard Identification Step for the Meat and Livestock Industry Overall

Hazard	Q1. Hazard? Y/N	Q2. Food Safety Market Access Issue Y/N	Q3. Animals primary source (A=Animal) (P=Processing)	Q4. Effective Measures On-Farm Y/N	Q5. Effectively Controlled Elsewhere? Y/N	Consider further in Level 1 Y/N
1. BIOLOGICAL						
1.1 MICROBIOLOGICAL						
Campylobacter jejuni/coli	Y	N	A	N = Potential controls but not yet validated	Y = Processing controls	N
Clostridium perfringens	Y	N	P/A	N	Y = Processing controls	N
Indicator bacteria e.g. Generic E.coli; TVC; Coliforms	N	Y	A/P	Y = Valid and practical measures established; clean livestock	Y = Processing controls in place but made easier if clean livestock	**Y**
E. coli (EHEC)	Y	Y	A	N = Potential controls identified but not yet validated	Y = Processing controls in place to reduce incidence and monitor	N
Listeria monocytogenes	Y	N	P	N	Y = Processing controls	N
Salmonella	Y	Y (Sweden)	A	N? = Feed type, animal type, transport and time off feed links contribute but practicality of on farm control is questionable	Y = Processing controls in place but reduce incidence if pre-slaughter factors adopted by producers	N
Staphylococcus aureus	Y	N	P	N	Y= Processing controls in place	N
Yersinia enterocolitica	Y	N	A	N = Potential controls but not yet validated	Y = Processing controls in place	N
Aeromonas hydrophila	N?	N	P/A?	N	Y = General processing controls in place	N
Antimicrobial resistant bacteria	Y	N?	A	Y = Suspected causes during animal treatments but links not fully known	N	N
Mycobacterium paratuberculosis (BJD, OJD)	N?	N? Economic production issue	A	Y = BJD/OJD Market Access Programs	N	N
Bacillus cereus	Y	N	A/P	N	Y = General processing controls in place	N
Toxoplasma gondii	Y	N	A	N	N	N
Bacillus anthracis	Y (milk)	Y	A	Y = Vaccination at high risk times	N	N

Hazard	**Q1. Hazard?** **Y/N**	**Q2. Food Safety Market Access Issue** **Y/N**	**Q3. Animals primary source** (A=Animal) (P=Processing)	**Q4. Effective Measures On-Farm** **Y/N**	**Q5. Effectively Controlled Elsewhere?** **Y/N**	**Consider further in Level 1** **Y/N**
BSE	Y	Y	A	Y = prohibition on feeding meat and bone meal	N	Y
1.2 MACROBIOLOGICAL						
Tuberculosis	Y for milk only	Y	A	Y	Y = Inspection, TFAP	N
CLA	N	N	A	Y	Y = Level 2	N
Gross abnormalities	?N	Y	A	Y	Y = Inspection	N
Beef measles	Y	Y	A	Y = Valid, practical, simple preventive measures exist	Y = Inspection to detect but more effectively controlled on farm	**Y**
Sheep measles	N	N = Not public health problem, economic issue only	A	Y = Valid, practical, simple and inexpensive controls exist	Y = Inspection	N
Hydatids	N = as human infection is not from consumption of meat	N = Not food safety problem, economic issue only	A	Y = Valid, practical, simple and inexpensive controls exist	Y = Inspection	N
Sarcocystis	N	N = Not public health problem, economic issue only	A	Y = Valid, practical, simple and inexpensive controls exist	Y = Inspection	N
Plant associated toxins	N?	N	A	N	N	N
Corynetoxins	N?	Y (hay)	A	Y = stock feed controls	Y = feed programs and codes of practice	N
Pyrrolizidine alkaloids	Y	N	No = stock feeds only	Y = stock feed controls	Y = feed programs and codes of practice	N
Mycotoxins	Y	Y?	No = stock feeds only	Y = stock feed controls	Y = feed programs and codes of practice	N
2. PHYSICAL						
Broken Needles	Y	Y	A	Y = Good Husbandry Practices	Y = inspection may detect; some product subject to metal detection but more efficient to control on farm	**Y**

Hazard	Q1. Hazard? Y/N	Q2. Food Safety Market Access Issue Y/N	Q3. Animals primary source (A=Animal) (P=Processing)	Q4. Effective Measures On-Farm Y/N	Q5. Effectively Controlled Elsewhere? Y/N	Consider further in Level 1 Y/N
Lead Shot	N	N?	A	Y = Good Husbandry Practices	Y = inspection may detect; some product subject to metal detection but more efficient to control on farm	**N**
3. CHEMICAL						
Hormones	N*	Y	A	Y = Safe use and ID of treated animals. Restricted supply to specified markets.	N	**Y**
Organochlorines	N*	Y	A	Y = Controlled use of Ag & Vet Chemicals	N	**Y**
Organophosphates	N*	Y	A	Y as above	N	**Y**
Macrolytic lactones	N*	Y	A	Y as above	N	**Y**
Synthetic pyrethroids	N*	Y	A	Y as above	N	**Y**
Benzoyl ureas	N*	Y	A	Y as above	N	**Y**
Antimicrobial residues	Y	Y	A	Y as above	N	**Y**
Cadmium	Y?	Y?	A	Y = Property risk assessment	Y = Restricted sourcing of offal from classes of livestock	N
Anthelmintics	N*	Y	A	Y = Controlled use of Ag & Vet Chemicals	N	**Y**
NSAIDs	N*	Y	A	Y	N	**Y**
ß-agonists	Y	Y	A	Y	N	**Y**
Lead	N*	Y	A	N	Y	N
Mercury	N*	Y	A	N	Y	N
Dioxins	N#	Y	Y	N = contamination is from unrelated industries	Y = but effectives of other controls to be confirmed	N
Processing Chemicals	N	Y	P	N	Y	N

**** Not at levels found in meat (National Residue Survey) # No previous data available, new routine monitoring by NRS and Environment Aust***

6.3 Hazard Analysis at the Enterprise Level

As described above, an enterprise level hazard analysis was conducted applicable to a typical livestock enterprise for each of the process steps and activities. This second phase of hazard analysis was conducted by reviewing the draft report on through chain risk profile for the Australian red meat industry, (Project PRMS.038c) for each of the hazards identified in Table 2 above as “Consider further in Level 1”.

The Draft Report for PRMS.038c was reviewed by the HACCP team to identify any on-farm control measures that could prevent, eliminate or reduce the hazard to an acceptable level and the steps or activities within a livestock enterprise at which controls could be applied. Predisposing factors which influence the occurrence of the potential hazard were identified either in the PRMS.038c report; described in existing quality assurance programs; or based on the HACCP team members knowledge of livestock operations and hazards.

Table 3 summarises the results of the hazard analysis at the livestock enterprise level, together with control measures and justification for the control measures. Where possible the justification makes reference to the original source/s used to compile the Draft Report for PRMS.038c.

Table 3: Hazard Analysis, Control Measures and Justification for Control Measures at the Livestock Enterprise Level

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
01 Animals born on property	Establish Identification and Traceability of animals	Individual vs mob/property	Nil			
02 Introduced livestock	Purchase or Obtain animals	May include feral animals for each species.	Chemical: Chemical residues in the incoming stock, especially: Persistent chemicals (heavy metals and O/Cs) Metabolisable chemicals HGP's	Animals of unknown chemical status for proven food safety and market access related chemicals covering all species and age groups	Prevention: Only buy animals of a known history Reduction: Elimination:	Appendix 3.3 of PRMS.038c

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
	Receival of animals	May include induction process for more intensive systems	Biological: Biological hazards as per Table 2, especially: Beef Measles (*Cys. bovis*)	Animals of unknown disease status for proven food safety and trade related detectable gross abnormalities - all species and age groups. Beef measles in animals from land treated with human effluent	Prevention: Don't purchase animals from land treated with human effluent. Reduction: Elimination: Consign to slaughter (legislative requirement)	Infection of cattle has been, not exclusively, associated with cattle raised on sewage farms (reviewed by Cole 1986[8]) Problem in determining the prevalence of *Cys. bovis* is the difficulty in finding the cysts during routine meat inspection procedures (McCool 1979[9]). Through conducting a risk assessment (van der Logt et al, 1997[10]) routine incision at inspection for beef measles is no longer required in NZ (Anon 2002[11])
	Establish Identification and Traceability of animals	Individual vs mob/property	Chemical: Chemical residues in the incoming stock, especially: Persistent chemicals (heavy metals and O/Cs) Metabolisable chemicals HGP's	Animals of unknown chemical status for proven food safety and trade related chemicals covering all species and age groups	Prevention: Establish an identification and traceability system for livestock and a hold and release system. Reduction: Holding and release to herd Elimination: Hold past maximum ESI or WHP for the species applicable to metabolisable chemicals only.	On-farm QA Manual[12], Elements L2 and L3

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
03 Production system	Historical/previous land use	(**Note**: only applicable to specific enterprises where property risk assessment identifies potential exposure to land treated with human effluent)	Biological: Biological hazards as per Table 2, especially: Beef Measles (*C. Bovis*)	As above for Receival of animals	As above for Receival of animals	Appendix 3.2.2 of PRMS.038c
			Chemical: Organochlorines, including Endosulfan	Reuse of sites previously used for cotton, horticultural use (eg bananas, sugar, potatoes, tobacco) for livestock production presents an exposure risk for animals grazing in contaminated paddocks (OCs) and other persistent chemicals.	Prevention: Risk assessment process on previous history of land, current practices and intended use Reduction: Implement a property management plan to control OC's Elimination: Exclude livestock from contaminated sites. Remove contaminants from site where practical means exists.	Appendix 3.3.2 of PRMS.038c

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
	Contaminants from external enterprises		Chemical: Organochlorines Organophosphates Macrocyclic lactones Synthetic pyrethroids	OC contamination through exposure to broad acre and point of source contamination Contamination of pasture from spraydrift or direct application (OP based crop treatments). macrocyclic lactones used for crop application - indirect exposure of livestock through ingestion. Synthetic pyrethroids residues from spray drift onto non-target pastures grazed by livestock	As above for Historical/previous land use	Appendix 3.3.2, 3.3.3 , 3.3.4.1, 3.3.4.2 of PRMS.038c
	Intensive vs extensive system (includes range fed, supplementary fed, dairy farms and hobby farm systems and feral animal harvesting)	Possible range of production systems for each species	As above for Historical/previous land use	As above for Historical/previous land use	As above for Historical/previous land use	
04 Husbandry Practices	Mating/breeding and reproduction program, including pregnancy testing	Variable use of Artificial Insemination and Artificial Breeding	Chemical: Veterinary treatments	As for Treatments below	As for Treatments below	

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
	Weaning					
	Marking	Branding vs other Identification methods				
	Handling – mustering, yarding	De-horning Shearing, crutching, mulesing, milking	Chemical: Organochlorines	OC point of source contamination associated with old dips, timber treated for termites around stockyards and power poles treated with OCs for termite control.	As above for Historical/previous land use	Appendix 3.3.2 of PRMS.038c
	Movements – on property, between properties, droving		Biological: Beef Measles	As above for Receival of animals	As above for Receival of animals	Appendix 3.2.2 of PRMS.038c
			Chemical: As above for Contaminants from external enterprises	As above for Contaminants from external enterprises	Prevention: Movements on property, between properties and droving planned to prevent exposure to sites treated with OCs or pasture contaminated from OP spraydrift. Reduction: As above for Contaminants from external enterprises Elimination:	On-farm QA Manual, Element L3
	Manage nutritional requirements					

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
	Animal health program	Dipping Drenching Injecting Vaccinating	Chemical: Vet treatments including Anthelmintic and other residues above MRL	As for Veterinary treatments below. Use of higher doses of anthelmintics in animals to deal with worm resistance problems (the set WHP is therefore inadequate)	As for Veterinary treatments below.	Appendix 3.3.5 and 3.3.7 of PRMS.038c
	Culling		Chemical: Chemical residues from animal treatments of culled stock, especially: antimicrobial residues	Where culling is based on animals which are chronic poor performers and/or have been treated and may not be outside WHP or ESI	Prevention: Establish an identification and traceability system with hold and release process for livestock. Reduction: Hold past ESI or WHP Elimination:	
	Euthanasia and Carcass Disposal					
05 Pastures & Cropping	Manage pasture and/or crop quality		Biological: Beef Measles	Treatment of pasture with human effluent	Prevention: Don't graze animals on treated pasture.	
	Purchase of pasture and/or crop treatment chemicals		Chemical: As for Animal Treatments, purchase of chemicals	As for Animal Treatments, purchase of chemicals	As for Animal Treatments, purchase of chemicals	
	Receival of pasture and/or crop treatment chemicals					
	Storage of pasture and/or crop treatment chemicals		Chemical: As for Animal Treatments, storage of chemicals	As for Animal Treatments, storage of chemicals	As for Animal Treatments, storage of chemicals	

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
	Preparation of pasture and/or crop treatment chemicals		Chemical: As for Animal Treatments, preparation of chemicals	As for Animal Treatments, preparation of chemicals	As for Animal Treatments, preparation of chemicals	
	Approval of pasture and/or crop treatment for use		Chemical: As for Animal Treatments, approval for use/off label use	As for Animal Treatments, approval for use/off label use	As for Animal Treatments, approval for use/off label use	
	Application of pasture and/or crop treatment chemicals (incl contractors)		Chemical:	Chemical applied to the wrong pasture and/or crop Application rate exceeds manufacturer's recommendations Pasture contaminated due to spray drift	Prevention: Treatment areas identified Pasture and crop treatment records maintained Approved chemicals used Manufacturer's application rates observed Reduction: Withholding period from grazing Elimination:	On-farm QA Manual, Element C3
	Disposal of chemicals		Chemical: As for Animal Treatments, disposal of chemicals	As for Animal Treatments, disposal of chemicals	As for Animal Treatments, disposal of chemicals	
	Identification and Traceability of treated pastures and/or crops		Chemical:	Treated pasture and/or crop inadvertently used for grazing/feed. Loss of pasture and/or crop traceability.	Prevention: Treatment areas identified. Pasture and crop treatment records maintained Reduction: Withholding period from grazing Elimination:	On-farm QA Manual, Element C3

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
	Manage withholding period		Chemical:	Status or location of treated stock not known. Time period since treatment unknown.	Prevention: Reduction: Establish a system to ensure withholding period on crops/pastures can be observed. Elimination:	On-farm QA Manual, Element C3
06 Feedstuffs	Manage alternative feed sources					
	Selection of feed type		Biological: BSE	Animals fed meat and bone meal contaminated with BSE agent.	Prevention: Quarantine controls. Feed type restrictions (MBM ban)	AFFA, 2002 in Section 3.1.14 of PRMS.038c report
	Purchase of feed		Biological: BSE	As for Selection of feed type	As for Selection of feed type	As for Selection of feed type
			Chemical: Organophosphates Synthetic pyrethroids Benzoyl ureas	OP contamination through feed from the treatment of grains (OP grain protectants). Consumption of treated grain treated with SPs (deltamethrin and until recently bioresmethrin were popular grain protectant chemicals), Contaminated feed containing benzoyl ureas	Prevention: Reduction: Purchase only from suppliers who provide Commodity vendor declarations (CVD)s. Elimination: Targeted feed and animal testing program where required.	Appendix 3.3.3, 3.3.4 of PRMS.038c
	Receival of feed					
	Identify and trace feed					

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
	Storage of feed		Chemical:	Feed with chemical contaminants stored with uncontaminated feed	Prevention: Purchase only from suppliers who provide Commodity vendor declarations (CVD)s Reduction: Isolate, conduct risk assessment and make decision.	On-farm QA Manual, Element L8
	Treatment of feeds		Chemical: Residues & toxicity	Feed treated with the wrong chemical Incorrect dose rate used	Prevention: Record all feed treatments, including any withholding periods Reduction: Withholding period used. Hold and release system.	On-farm QA Manual, Elements C3, L6 and L8
	Preparation of ration		Biological: BSE As above for Selection of feed type	As above for Selection of feed type	As above for Selection of feed type	
	Distribution of feedstuff					
	Supplementation program		Chemical: HGP Levels are above detectable limits, where a valid test is available	Non-approved or prohibited substances e.g. stilbenes are contained in supplement.	Prevention: Only use approved substances (e.g. No stilbenes) CVDs as above	Appendix 3.3.1 of PRMS.038c
	Feed disposal		Biological: BSE Chemical:	Feed contaminated with BSE agent and/or undesirable chemical agents not properly disposed of and exposed to livestock	Prevention: Quarantine controls. Feed type restrictions (MBM ban). Risk assessment on feed disposal options. Monitor feed purchase, storage, preparation and treatment to minimise disposal Reduction: Elimination:	On-farm QA Manual, Element L8

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
07 Water supply	Water source		As for site risk assessment	As for site risk assessment	As for site risk assessment	
	Water quality/contamination					
	Storage					
	Distribution system					
08 Animal treatments	Growth promotants	Limited approval of chemicals for use on/in goats. HGP for ear implementation in cattle only No β-antagonists registered for growth promotant use in Australia.	Chemical: HGP Levels are above detectable limits, where a valid test is available Chemical: Antimicrobial residues above MRL β-antagonist residues in product from illegal use as a growth promotant	Treated animals inadvertently sold as untreated Treated animals sold prior to WHP Antimicrobials used to improve the weight gain performance of animals particularly when fed high energy rations	Prevention: Implant must contain a palpable carrier which remains for life of the animal. Reduction: WHP in place for S6 and S4. Correct implantation and appropriate conditions	Appendix 3.3.1 of PRMS.038c Henricks ad Torrence (1977)[13] Lamming et al (1987)[14] Appendix 3.3.7 PRMS.038c
	Agricultural and Veterinary chemicals/prescription drugs	Bobby calves and cull cows likely to have a higher risk. Export 'at risk' animals animals include 'suspects', surgery recovery, injection site granulomas etc.	Chemical: Antimicrobial residues at levels above MRL. NSAID residues β-antagonist residues	Insufficient time for animal to metabolise chemical. Extra-label dose was administered Drug retained or sequestered at the injection site.	Prevention: Antibiotics, NSAIDs and most sulfonamide drugs require supervision of a registered veterinarian. Correct usage of antimicrobials. WHP/ESI As above.	Appendix 3.3.5 of PRMS.038c Appendix 3.3.7 of PRMS.038c

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
	Parasite controls	Not registered for goats Neither the US or Canada have set a MRL for macrocylic lactones in sheep tissue.	Chemical: Macrocylic lactones above MRL in cattle and sheep, or present at detectable levels in goats. Residues of Synthetic Pyrethroids (particularly where no MRL is set). Benzoyl urea	As above for metabolisable chemicals Benzoyl urea chemicals through direct treatments for ectoparasites	Prevention: WHP in place for cattle and sheep. Do not use macrocyclic lactones in goats.	Appendix 3.3.4.1 of PRMS.038c Appendix 3.3.4.2 of PRMS.038c Appendix 3.3.4.3 of PRMS.038c
	Purchase of chemicals		Chemical: Unknown effects of unregistered chemicals, chemicals not in original containers, chemicals past expiry dates, cross contamination of chemicals.	Uncontrolled treatments due to unknown condition and history of purchased chemicals due.	Prevention: “Over the counter” chemicals purchased from Agsafe accredited retailers. “Prescription only” chemicals purchased from registered veterinary surgeon or who has knowledge of the animal for which treatment is sought. Reduction: Elimination:	On-farm QA Manual, Element C2

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
	Receival of chemicals		Chemical: as above	Uncontrolled treatments as above for purchase of chemicals or label incomplete or instructions illegible. If seal broken may contain other ingredients Chemical decanted into another container	Prevention: Chemicals inspected upon receipt Chemicals with incomplete labels returned to supplier unused. Reduction: Elimination:	On-farm QA Manual, Element C2
	Storage of chemicals		Chemical: as above	Uncontrolled treatments due to contamination of chemicals in storage; chemical effectiveness reduced due to temperature abuse; chemicals past use by date	Prevention: Secure chemical storage facility established. Chemicals stored in their original containers Effective temperature controls established Farm chemical inventory maintained and stock takes conducted. Reduction: Elimination:	On-farm QA Manual, Element C2
	Preparation of chemicals		Chemical: as above	Overdosing by operators	Prevention: Manufacturer's recommendations read and observed. Reduction: Elimination:	On-farm QA Manual, Element L6

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
	Approval for use/off label use		Chemical: as above	Incorrect use on animals Overdosing	Prevention: Approved chemical uses observed. Written instructions provided by veterinarian for all off label uses Reduction: Hold and release to herd after extended time. Elimination:	On-farm QA Manual, Elements L6 and C3
	Application of chemicals (incl contractors)		Biological: Biological hazards (abscess)	Vaccination and injection site abscess due to blunt, dirty, broken needles.	Prevention: Trained operators give injections. Reduction: Identify and observed defective treatments. Elimination:	
			Chemical:	As above for Approval for use/off label use	As above for Approval for use/off label use	
			Physical: Physical hazards (metal)	Needles break off during vaccination and injection process	Prevention: Use sharp, clean, needles of recommended gauge. Reduction: Identify animals. Notify customer of potential defect. Elimination:	Appendix 3.2.1 of PRMS.038c
	Disposal of chemicals		Chemical: as above	Chemicals from old containers enter the environment or animal	Prevention: Manufacturer's instructions regarding disposal. Local authority contacted to discuss safe disposal options Reduction: Elimination:	On-farm QA Manual, Element C2

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
	Identification and traceability of treated animals		Chemical: as above	Identity or status of treated animals is lost and animals inadvertently sold.	Prevention: Effective identification and traceability system with hold and release process is maintained. Reduction: Isolate animals of unknown status, hold and release after extended time.	Appendix 3.3.of PRMS.038c
09 Preparation for Transport	Assessment and selection		Biological: Beef Measles	Animals of unknown status for Beef measles from land treated with human effluent.	Prevention: Identification of animals grazed on land treated with human effluent Reduction: Must be consigned to slaughter Elimination: Inspection and removal at slaughter.	Appendix 3.2.2 of PRMS.038c
			Chemical: Residue status	As above for Identification and traceability of treated animals. Intentional illegal treatment of lame animals going to slaughter to mask their lameness	As above for Identification and traceability of treated animals. Reduction: Status of stock destined for sensitive markets known and identified.	Appendix 3.3 of PRMS.038c Appendix 3.3.7 of PRMS.038c
	Assembly and drafting	Crutching, hide cleanliness	Biological: Indicator bacteria, including *E.coli*	Dirty livestock are associated with poor carcase hygiene	Prevention: Reduction: Deliver livestock as clean as practicable. Observe curfew recommendations. Elimination:	Appendix 3.1.0 of PRMS.038c Lammerding et al, 1999[15] Vanderlinde, 1996[16] MRC project MSHE.006[17]

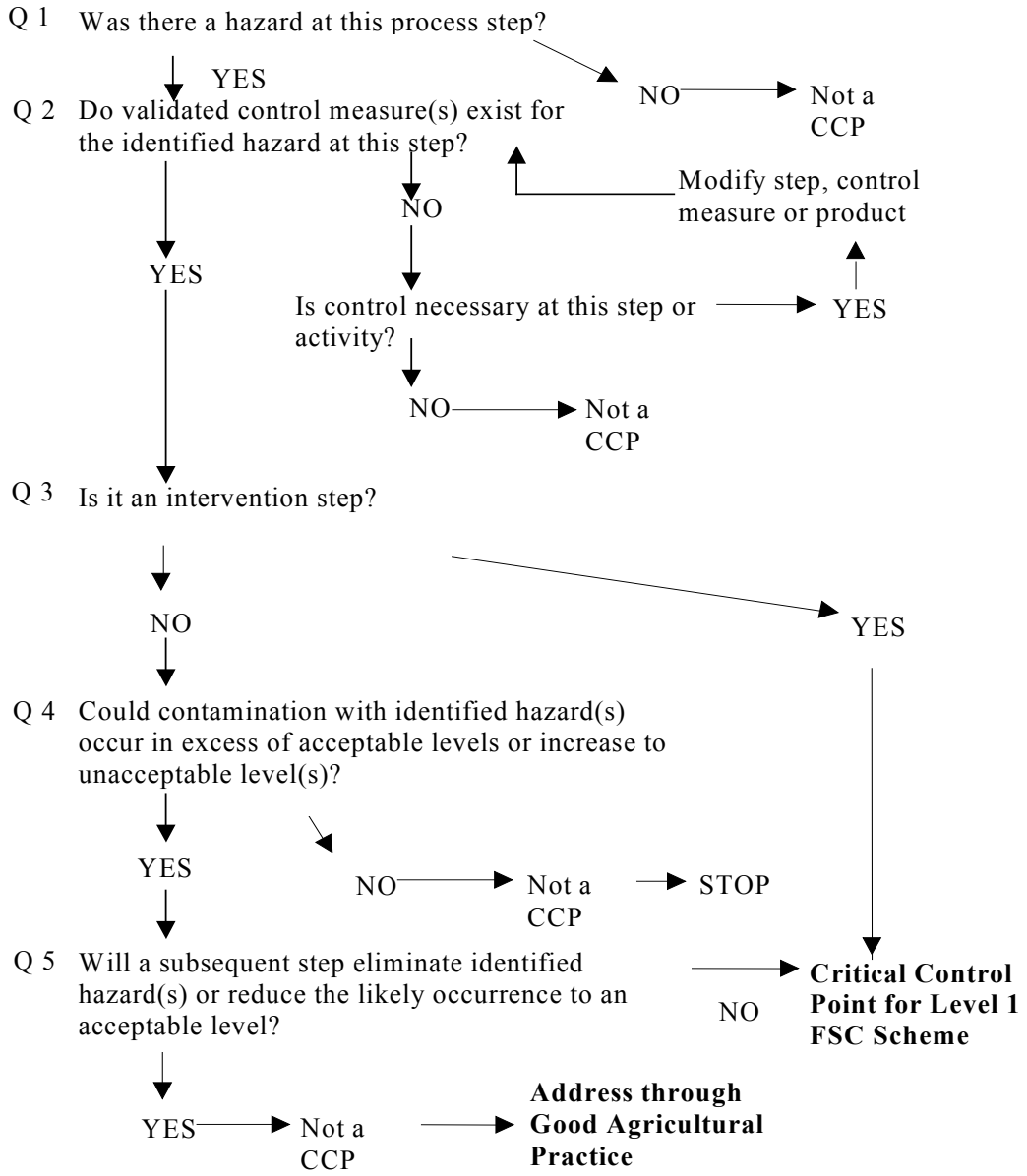
Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
10 Livestock Dispatch	Selection of transport method (rail, road, sea, stock route)					
	Selection of transporter		Biological: Indicator organisms	Cross contamination where transport company does not clean crates between consignments or as required	Prevention: Select compliant transporter, incl. Truckcare operator Reduction: Clean crates before loading livestock Elimination:	On-farm QA Manual, Element L5
	Holding, Loading and Transhipment		Biological: Indicator organisms	As above for Assembly and drafting	As above for Assembly and drafting	
			Biological: Salmonella	Spread of organisms from the gut of animals.	Prevention: Heat treatment of pelletised feed Reduction: Intensive rearing facilities should be managed using an all-in all-out production system with cleaning and disinfection between batches. Minimise time off feed and transport time Elimination:	Association has been established between *Salmonella* and extended time off feed Appendix 3.1.5 of PRMS.038c

Process steps	Activities associated with this step	Species Differences	Hazard	Predisposing factor/s	Control Measures	Justification for Control Measures
			Biological: Microorganisms of public health concern (i.e. "Y" to Real hazards in Table 2)	Spread of organisms from the gut of animals.	No effective control established for pathogens. Further information required to identify controls (further research to be conducted to establish further info on effect of feed types, curfews, transport distance, stress, feed after curfew, etc).	Association has not been established between most pathogens such as EHEC, *Campylobacter*, *Yersinia* and pre-slaughter factors. Not enough known about effectiveness of controls on Farm for most organisms. Ref :FSIS guidance document on *E.coli* Appendix 3.1.0 of PRMS.038c
	Completion of movement documentation		Biological: Unknown status Chemical: Unknown status Physical: Unknown status	Ambiguous information presented to customers Animals of unknown status included in consignment Documentation not checked against records	Prevention: Movement documentation accurately completed. (NVD) Only dispatch animals with a known history. Reduction: Elimination:	On-farm QA Manual, Elements L3 and L5

7. PRINCIPLE 2: DETERMINE THE CRITICAL CONTROL POINTS (CCPs)

Having conducted the detailed hazard analysis for both the overall livestock sector and the process steps within a livestock enterprise, the HACCP team then determined the steps which could be designated as Critical Control Points (CCPs). A decision tree (Figure 3) was used for this task. To better link with the risk assessment, the decision tree was modified from the one included in the Codex HACCP guidelines.

Figure 3: Critical Control Point Decision Tree



Note on Q3: An intervention step is one which has been specifically included to control an identified hazard. It does not refer to a preventive measure applied at a process step undertaken for another purpose.

As a result of using the CCP Decision tree shown in Figure 3, the HACCP team identified several CCPs. Table 4 summarises the decisions taken regarding CCPs for the Level 1 Food Safety Certification Scheme for a livestock enterprise. All hazards shown under the heading "hazard" in Table 4 are the same as those that were considered in Table 3.

Table 4: Decisions taken on CCPs for Level 1 Food Safety Certification Scheme

Process steps	Activities associated with this step	Hazard	Q1	Q2	Q3	Q4	Q5	CCP or CP
01 Animals born on property	Establish Identification and Traceability of animals	Nil	N	-	-	-	-	-
02 Introduced livestock	Purchase or Obtain animals	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Receival of animals	Biological:	Y	Y	N	Y	Y	CP (GAP)
	Establish Identification and Traceability of animals	Chemical:	Y	Y	N	Y	Y	CP (GAP)
03 Production system	Historical/previous land use	Biological: Beef Measles	Y	Y	N	Y	Y	CP (GAP)
		Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Contaminants from external enterprises	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Intensive vs extensive system	As above for Historical/previous land use	Y	Y	N	Y	Y	CP (GAP)
04 Husbandry Practices	Mating/breeding and reproduction program, including pregnancy testing	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Weaning		N	-	-	-	-	-
	Marking		N	-	-	-	-	-
	Handling – mustering, yarding	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Movements – on property, between properties, droving	Biological: Beef Measles	Y	Y	N	Y	Y	CP (GAP)
		Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Manage nutritional requirements		N	-	-	-	-	-
	Animal health program	Biological:	N	-	-	-	-	-
		Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Culling	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Euthanasia and Carcass Disposal		N	-	-	-	-	-
05 Pastures & Cropping	Manage pasture and/or crop quality	Biological: Beef Measles	Y	Y	N	Y	Y	CP (GAP)

Process steps	Activities associated with this step	Hazard	Q1	Q2	Q3	Q4	Q5	CCP or CP
	Purchase of pasture and/or crop treatment chemicals	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Receival of pasture and/or crop treatment chemicals		N	-	-	-	-	-
	Storage of pasture and/or crop treatment chemicals	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Preparation of pasture and/or crop treatment chemicals	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Approval of pasture and/or crop treatment for use	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Application of pasture and/or crop treatment chemicals (incl contractors)	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Disposal of chemicals	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Identification and Traceability of treated pastures and/or crops	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Manage withholding period	Chemical:	Y	Y	N	Y	Y	CP (GAP)
06 Feedstuffs	Manage alternative feed sources		N	-	-	-	-	-
	Selection of feed type	Biological: BSE	Y	Y	N	Y	Y	CP (GAP)
	Purchase of feed	Biological: BSE	Y	Y	N	Y	Y	CP (GAP)
		Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Receival of feed	Biological:	Y	Y	N	Y	Y	CP (GAP)
	Identify and trace feed		N	-	-	-	-	-
	Storage of feed	Biological:	Y	Y	N	Y	Y	CP (GAP)
		Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Treatment of feeds	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Preparation of ration	Biological: BSE	Y	Y	N	Y	N	**CCP**
	Distribution of feedstuff		N	-	-	-	-	-
	Supplementation program	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Feed disposal	Biological: BSE	Y	Y	N	Y	Y	CP (GAP)
		Chemical:	Y	Y	N	Y	Y	CP (GAP)

Process steps	Activities associated with this step	Hazard	Q1	Q2	Q3	Q4	Q5	CCP or CP
07 Water supply	Water source		N	-	-	-	-	-
	Water quality/contamination		N	-	-	-	-	-
	Storage		N	-	-	-	-	-
	Distribution system		N	-	-	-	-	-
08 Animal treatments	Growth promotants	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Agricultural and Veterinary chemicals/prescription drugs	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Parasite controls	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Purchase of chemicals	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Receival of chemicals	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Storage of chemicals	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Preparation of chemicals	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Approval for use/off label use	Chemical:	Y	Y	N	Y	Y	CP (GAP)
	Application of chemicals (incl contractors)	Biological: Biological hazards (abscess)	Y	Y	N	Y	Y	CP (GAP)
		Chemical:	Y	Y	N	Y	Y	CP (GAP)
		Physical: Physical hazards (metal)	Y	Y	N	Y	Y	CP (GAP)
	Disposal of chemicals	Chemical: Residue Status	Y	Y	N	Y	Y	CP (GAP)
	Identification and traceability of treated animals	Chemical: Residue Status	Y	Y	N	Y	Y	CP (GAP)
09 Preparation for Transport	Assessment and selection	Biological: Beef Measles status	Y	Y	N	Y	N	**CCP**
		Chemical: Residue status	Y	Y	N	Y	N	**CCP**
	Assembly and drafting	Biological: Indicator bacteria, including *E.coli*	Y	Y	N	Y	Y	CP (GAP)
		Biological: Salmonella	Y	Y	N	Y	Y	CP (GAP)
		Biological: Microorganisms of public health concern	Y	Y	N	Y	Y	CP (GAP)

Process steps	Activities associated with this step	Hazard	Q1	Q2	Q3	Q4	Q5	CCP or CP
10 Livestock Dispatch	Selection of transport method (rail, road, sea, stock route)		N	-	-	-	-	-
	Selection of transporter	Biological: Indicator organisms	Y	Y	N	Y	Y	CP (GAP)
	Holding, Loading and Transhipment	Biological: Indicator organisms	Y	Y	N	Y	Y	CP (GAP)
		Biological: Salmonella	Y	Y	N	Y	Y	CP (GAP)
		Biological: Micro-organisms of public health concern	Y	Y	N	Y	Y	CP (GAP)

7.1 Discussion on CCP Decisions

The treatment of Question 5 in Figure 3, regarding subsequent steps as a means of controlling hazards, is always difficult for enterprises early in the food chain, chiefly because the product is not yet in the form that will be consumed by the general public. There is always debate about later steps being more effective for control. With most chemical hazards, this question is easier because there are no subsequent steps able to control the hazard. For microbial and many of physical hazards, the question is more difficult.

The approach taken by the HACCP team was to consider the controls that are required by regulations later in the chain. For example, controls in the Australian Standard for Hygienic Production and Transportation of Meat and Meat Products for Human Consumption[18] applies to all meat processing enterprises, whereas controls in voluntary schemes such as Truckcare are not implemented across all transport operators.

For the purposes of this HACCP plan preparation, validation of CCPs and critical limits have been based on scientific evidence as presented in the risk profiling project PRMS.038c.

8. REMAINING HACCP PRINCIPLES APPLIED TO CCPs

The HACCP Team's application of remaining Codex HACCP Principles is as follows:

- Critical limits must be specified and validated if possible for each CCP. In some cases, more than one critical limit may be required for a particular step since they could be performance based or absolute criteria.

- Monitoring is the scheduled measurement or observation of a CCP relative to its critical limits. The monitoring procedures must be able to detect loss of control at the CCP. The monitoring should provide the information in time to make adjustments to ensure control of the process (in order to prevent occurrences outside the critical limits). The amount of monitoring therefore must ensure that the CCP is in control.

- Corrective actions were developed for each CCP to deal with deviations when they occur. The action must ensure that the CCP has been brought under control and must also consider disposal of the product. These should be documented in the HACCP record keeping – the documentation

requirements for CCPs will be described in industry standards once developed.

- To determine whether the actual HACCP system is working correctly, verification procedures must be established. These could include auditing/review of procedures and in some cases tests including random sampling and analysis. The frequency of verification should be enough to ensure that the HACCP system is working effectively.

- Accurate and efficient record keeping is essential to application of a HACCP system. Documentation examples include the hazard analysis, all the reference documents used in the risk assessment, CCP determination and critical limit determination. Examples include deviations and corrective action reports.

Table 5: HACCP for Level 1 Food Safety Certification Scheme

Process Step & Activity	CCP No.	Hazard	Control Measure	Critical Limits	Monitoring Procedure	Corrective Action	Verification Methods
06 Feedstuffs - Preparation of ration	CCP 1	Biological: BSE	Prevention: Quarantine controls. Feed type restrictions on animal products (except for certain exclusions) to ruminants.	Nil tolerance for feeding animal products (except for exclusions) to ruminants	100% of material fed to ruminants monitored for exclusion of animal products (except for exclusions) to ruminants.	Exclude from human food chain any ruminant suspected of consuming animal products.	Regular review of on farm procedures and competency of operators
09 Preparation for Transport - Assessment and selection	CCP 2	Chemical: Residue status Status of stock destined for sensitive markets	Prevention: Effective identification and traceability system with hold and release process is maintained. Reduction: Isolate animals of unknown status, hold and release after extended time. Status of stock destined for sensitive markets known; identified; and customer notified.	Nil tolerance for animals released within WHP/ESI except where customer notified of status	100% monitoring of release of animals in accordance with treatment and exposure records.	Exclude non-conforming animals from consignment or notify customer of correct status Review procedure for identification and traceability, assessment and selection	Regular review of on farm procedures and competency of operators

Process Step & Activity	CCP No.	Hazard	Control Measure	Critical Limits	Monitoring Procedure	Corrective Action	Verification Methods
09 Preparation for Transport - Assessment and selection	CCP 3	Biological: Beef Measles status (**Note**: only applicable to specific enterprises where property risk assessment identifies potential purchase of stock or exposure to land treated with human effluent)	Prevention: Don't purchase from or feed animals on land treated with human effluent. Identify animals grazed on land treated with human effluent Reduction: Must be consigned to slaughter Elimination: Inspection and removal at slaughter (not fully effective).	Nil tolerance for purchase and grazing of animals from land treated with human effluent - exception is under controlled conditions where 100% of animals consigned to slaughter as per regulations.	100% monitoring of release of animals in accordance with treatment and exposure records.	Exclude non-conforming animals from consignment. Notify customer of incorrect status. Consign to slaughter under controlled conditions. Review procedure for identification and traceability, assessment and selection.	Regular review of on farm procedures and competency of operators

9. VERIFICATION AT THE INDUSTRY LEVEL

Table 6 provides a summary of the various methods that will be used for verification of the outcomes of the Level 1 Food Safety Certification Scheme at an industry level.

Table 6: Proposed Approach to Verification for the Livestock Sector Overall

Hazard	Include in Level 1 Y/N	Verification Methods
1. BIOLOGICAL		
1.1 MICROBIOLOGICAL		
Campylobacter jejuni/coli	N	National Notifiable Diseases Surveillance System (NNDSS) (human infections). OzFoodNet may help to clarify some of the chains of transmission in Aust.
Clostridium perfringens	N	
Indicator bacteria e.g. Generic E.coli; TVC; Coliforms	Y	Prevalence data for *E. coli* on carcases at the completion of slaughter are collected at export establishments as part of the AQIS ESAM (E. coli Salmonella monitoring) program.
E. coli (EHEC)	N	Collection of carcase samples as part of the ESAM program. NNDSS (human infections of Haemolytic uraemic syndrome)
Listeria monocytogenes	N	NNDSS (human infections).
Salmonella	Y	Prevalence data for *Salmonella* on carcases at the completion of slaughter are collected at export establishments as part of the AQIS ESAM (*E. coli Salmonella* monitoring) program. National Enteric Pathogen Surveillance Service. National Notifiable Diseases Surveillance System (NNDSS) (human infections)
Staphylococcus aureus	N	
Yersinia enterocolitica	N	
Aeromonas hydrophila	N	
Antimicrobial resistant bacteria	N	Australia's surveillance system for antimicrobial resistance and antimicrobial usage in livestock is being planned.
Mycobacterium paratuberculosis (BJD, OJD)	N	Animal Health Australia's Johne's Disease Market Assurance Programs
Bacillus cereus	N	
Toxoplasma gondii	N	National Animal Health Information System (NAHIS) OIE data
Bacillus anthracis	N	National Animal Health Information System (NAHIS) OIE data
BSE	Y	NTSESP Monitoring and surveillance program DNA testing work being improved through R&D
1.2 MACROBIOLOGICAL		
Tuberculosis	N	BTEC/TFAP Program Australian meat inspection system

Hazard	Include in Level 1 Y/N	Verification Methods
CLA	N	
Gross abnormalities	N	Australian meat inspection system
Beef measles	Y	Australian meat inspection system
Sheep measles	N	Australian meat inspection system
Hydatids	N	Australian meat inspection system
Sarcocystis	N	Australian meat inspection system
Plant associated toxins	N	
Corynetoxins	N	
Pyrrolizidine alkaloids	N	
Mycotoxins	N	FSANZ Australian Total Diet Survey (aflatoxins only)
2. PHYSICAL		
Broken Needles	Y	
Lead Shot	Y	
3. CHEMICAL		
Hormones	Y	NRS conduct random sampling of cattle and sheep for the registered hormone growth promotants and the illegal stilbenes
Organochlorines	Y	NRS targeted (National Organochlorine Residue Monitoring and random monitoring programFSANZ Australian Total Diet Survey
Organophosphates	Y	A range of OPs are tested for in the current NRS monitoring and surveillance testing programs for beef, sheepmeat and goat meat. FSANZ Australian Total Diet Survey
Macrolytic lactones	Y	NRS random sampling of cattle, sheep and goats. Goats only for moxidectin.
Synthetic pyrethroids	Y	NRS random and targeted sampling of cattle, sheep and goats. FSANZ Australian Total Diet Survey
Benzoyl ureas	Y	NRS random sampling of cattle, sheep and goats.
Antimicrobial residues	Y	National Residue Survey routine testing in beef, sheep and goats. The NARM (National Antibacterial Residue Minimisation) program is conducted by States and Territories at domestic abattoirs. It focuses on calves and a variety of cattle from high risk categories including cull dairy cows, hospital penned feedlot cattle, bulls and 'suspect cattle'. The TART (Targeted Antibacterial Residue Testing) program at export abattoirs targets animals or carcases that the veterinary officer suspects may contain violative levels of antibacterial residues. The Calf Antibacterial Testing Program at export abattoirs. Calves intended for export must be screen tested according to sampling plans which range from 2% to 100% of calves.
Cadmium	N	FSANZ Australian Total Diet Survey

Hazard	Include in Level 1 Y/N	Verification Methods
Anthelmintics	Y	NRS residue monitoring program was in place but as a result of the accumulated testing record for benzimidazoles and levamisole in beef and sheep, these chemical groups were dropped from the respective NRS residue monitoring programs in 2002̃03, except for triclabendazole, which is specifically used for the treatment of liver fluke.
NSAIDs	Y	NRS residue monitoring program
ß-agonists	Y	NRS residue monitoring program
Lead	N	FSANZ Australian Total Diet Survey
Mercury	N	FSANZ Australian Total Diet Survey
Processing Chemicals	N	

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