Visual monitoring of carcases and carton meats – a system for the 21st century

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1.0 EXECUTIVE SUMMARY

Project Description
The current system of visual monitoring is onerous both in terms of resources and costs and has been developed via a series of add-ons largely required by the Australian regulator. The present project involved a team of industry representatives to design a system of visual monitoring that reflects the relative risk of the products each establishment sells.

Project Content
Data on visual monitoring of product was used from the previous project (AMPC 2018-1070) – a total of 1,645,537 data points from carcases, bulk meat, primals and offal. Analysis of the data, coupled with extensive industry consultation and a 2012 Departmental review assisted in the development of three position papers:

1. Options for a visual monitoring system
2. What other countries do
3. The evolution of the Australian visual monitoring system.

These papers informed an iterative process involving industry and the Department to develop a draft Meat Hygiene Assessment 3 (MHA 3) guideline, together with a Principles and Guidance document that underpins the rationale and statistical elements of MHA 3.

Key aspects of MHA 3 are:

- A focus on food safety, based on Zero Tolerance (ZT), pathology and contamination-related defects.
- The elimination of non-food safety (Minor and manufacturing) defects.
- Retention of pre-boning room inspection checks.
- Retention of ZTs and pathology as per current definition.
- Ascription of risk-based ratings to individual products.

A summary of carcase, carton meat and offal MHA are given in the below table.

Carcase	*No change from current system*	• Monitoring frequency • ZT automatically rates the lot as unacceptable • Corrective action • Pre-boning inspection • Record ZTs and pathology
	Changes in MHA 3	• Remove reduced and intensified sampling frequency • Record Contamination as the sum of Majors + Criticals • Calculate defect rating as number of defects/number of checks • Revised limit of acceptability is 0.25 – equivalent to current limit • No Marginal category
Carton meat	*No change from current system*	• Record ZTs and pathology • ZT automatically rates the lot as unacceptable

	Changes in MHA 3	• Each product classified as Low or High risk
		• Sample all product in the selected carton
		• Sample every 60 minutes:
		  ○ Every high risk product
		  ○ Low risk products on a rotational basis
		• Record Contamination as sum of Majors + Criticals
		• Acceptability criterion: No more than 1 defect from all sampled cartons per high-risk category or across all low-risk products in a shift
		• Corrective action: Re-inspect all available product type and, if one or more defects found (so not an isolated incident), proceed to defrost re-inspection

Offal	*No change from current system*	• Record ZTs and pathology • ZT automatically rates the lot as unacceptable
	Changes in MHA 3	• Each product classified as Low or High risk • Sample 12 pieces of offal • Record Contamination as sum of Majors + Criticals • Acceptability criterion: Defect rating of 0.083 • Corrective action: Re-inspect all available product type and, if one or more defects found (so not an isolated incident), proceed to re-inspection.

Project Outcome

The project outcomes are the following documents:

- Position papers
  - Options for a visual monitoring system
  - What other countries do
  - The evolution of the Australian visual monitoring system
- Meat Hygiene Assessment: Product Monitoring (3rd edition)
- Meat Hygiene Assessment (3rd Edition): Principles and Guidance document

Benefit for Industry

This project has developed a Meat Hygiene Assessment system that is risk-based, allowing an establishment to focus on food safety plus areas of risk to their business while making more efficient use of labour. Meat Hygiene Assessment: Product Monitoring (3rd edition) has in-principle agreement from industry and the Department of Agriculture.

2.0 INTRODUCTION

The current version of the "Meat Hygiene Assessment (MHA): Objective Methods for the Monitoring of Processes and Product" was developed in 2002 and owed much to the USA system of assessing visual defects on meat and offal.

Since 2016, a program of work and research has been undertaken by the Australian meat industry and SARDI in two major projects:

- Process Control Monitoring – Is There A Better Way (AMPC Project 2017-1068)
- Process Monitoring for the Australian Meat Industry – A Comparative Industry Trial (AMPC Project 2018-1070).

During the latter project, data were gathered from twelve operations (six beef, three sheep and three pig), with establishments providing microbiological monitoring and visual data to SARDI. In terms of visual assessment checks provided by industry, the SARDI database comprises of 1,645,537 data points – 476,160 from carcases, 176,399 from bulk meat, 104,161 from primals and 888,817 from offals. The database has provided detailed information for this project, from which, in close conjunction with industry representatives, a new MHA system has been developed.

3.0 PROJECT OBJECTIVES

The objective of this project was to develop, in consultation with industry and regulatory stakeholders, a visual assessment system more attuned to the modern industry.

4.0 METHODOLOGY

Position papers

Three position papers were written as a result of investigating the historical background to the development of the MHA and CMA systems, assessing the requirements of other jurisdictions (for example, New Zealand, United States of America and the European Union) and suggesting options for a modified visual monitoring system. The three papers included in Appendix 1 are:

- Options for a visual monitoring system;
- What other countries do; and
- The evolution of the Australian visual monitoring system.

Industry consultation

Feedback from industry was sought and received throughout this project. Industry representatives were consulted regarding the three position papers and two industry workshops were held on the 11th and 12th of November 2019 (Brisbane and Melbourne), involving Willie Rijnbeek, Rod Mitchell, Tony Beadle, Monica Carr, John Langbridge, Michael Johnston and Trevor Moore. Participants developed key aspects of an alternative system for visual assessment, using a "blank sheet of paper" approach.

One key action from the workshops was the drafting of a "Meat Hygiene Assessment: Product Monitoring (3rd edition)".

A writing day with industry and AMPC to further develop an alternative MHA system and draft and updated MHA document was held in Melbourne on the 18th of December 2019. Two more meetings with industry were held on the 4th and 5th of February 2020 (Brisbane and Melbourne) to finalise key aspects of the proposed MHA system and a supporting "Principles and Guidance" document. The industry representatives were Noel Kelson, Willie Rijnbeek, Michael Johnston, Trevor Moore and John Langbridge.

Workshop with industry and Department of Agriculture

A workshop in Melbourne involving Willie Rijnbeek, Noel Kelson, Michael Johnston and Jason Ollington and Mark Salter from the Department of Agriculture, Water and the Environment (DAWE) on 19th February 2020 considered the proposed MHA 3 and developed a system suitable to all parties.

Export Meat Industry Advisory Council (EMIAC) Food Safety and Animal Health Subcommittee

A summary of Meat Hygiene Assessment: Product Monitoring (3rd edition) was presented by the SARDI team to the EMIAC Food Safety and Animal Health Subcommittee in Canberra on 27th of February 2020.

Meat Hygiene Assessment 3rd edition and Principles and Guidance documents

The "Meat Hygiene Assessment – 3rd edition" (Appendix 2) is equivalent to the Product Monitoring section in the 2nd edition. It describes methods to assure consistency in the assessment of visual defects on meat products: carcases, carton/bulk meat and offals. For all export establishments, the objectives of MHA are to confirm that each product type meets the outcomes defined by critical limits and to describe corrective and preventative actions when monitoring indicates that critical limits have been exceeded.

The proposed system differs from the current in several important ways, in that, it:

- Is risk-based – offering the opportunity for an establishment to identify those products that require more (high risk) or less (low risk) monitoring.
- Includes only Zero Tolerance (ZT), pathology and contamination-related defects that were considered to be Major or Critical defects as part of MHA 2.
- Does not include Minor defects in the defect rating since these were described as: "Affects appearance; not food safety" in MHA 2.
- Uses industry data to advise establishments on how to ascribe a risk category to their individual products.

The purpose of the "Principles and Guidance" document (Appendix 3) is to explain the underlying principles behind the proposed system, together with the rationale and statistical bases supporting it. The guidance document also explains calculations and decision-making processes, such as determining low- and high-risk products.

Outcomes from a departmental review (Pearse, 2012) and documentation of the New Zealand system (NZMPI) were also used in the development of Meat Hygiene Assessment: Product Monitoring (3rd edition).

5.0 PROJECT OUTCOMES

The project outputs are the attached documents:

- Position papers (Appendix 1)
- Meat Hygiene Assessment: Product Monitoring 3rd edition (Appendix 2)
- Meat Hygiene Assessment (3rd Edition): Principles and Guidance document (Appendix 3)

The specifics of the proposed MHA 3 system are outlined in Appendix 2.

The outcomes from this project are:

- Industry and DAWE in-principle agreement on the revised MHA.
- Recommendation by the EMIAC Food Safety and Animal Health Subcommittee that MHA 3 be progressed and adopted.

6.0 CONCLUSIONS/RECOMMENDATIONS

After discussions detailed above, Meat Hygiene Assessment: Product Monitoring (3rd edition) has in-principle agreement from industry (company and AMIC) and DAWE. To test its utility, both industry and DAWE recommended a trial of Meat Hygiene Assessment: Product Monitoring (3rd edition), making use of the ten establishments which participated in the industry trial in AMPC Project 2018-1070.

The scope of this project encompassed Product Monitoring; MHA 2 also has a Process Monitoring section which has not been reviewed and revised to date. Currently, very limited data are available for a review of Process Monitoring and the DAWE stated they would need more data to support the removal of Process Monitoring from MHA. The ultimate aim would be to justify the removal of Process Monitoring from MHA and its incorporation in a company's Approved Arrangement.

7.0 BIBLIOGRAPHY

AQIS (2002). Meat Hygiene Assessment – Objective Methods for the Monitoring of Processes and Product, 2nd Edition, Canberra.

NZMPI (New Zealand Ministry of Primary Industries) (2018). Post Slaughter Activity – Red Meat Code of Practice Chapter 9.

Pearse, B. (2012). Data Collection and Analysis Project Report – Meat Hygiene Assessment (presentation), Department of Agriculture, Fisheries and Forestry, Canberra.

APPENDIX 1: POSITION PAPERS

OPTIONS FOR A VISUAL MONITORING SYSTEM

What might a good visual product inspection system (VPIS) look like?

For regulatory purposes, a good VPIS would:

1. Be integrated with a real-time process monitoring system
2. Monitor only ZTs on carcases and record against a performance standard
3. Monitor and record only ZTs on pieces of meat
4. Result in the remove all ZTs

For business purposes, a good VPIS would:

1. Monitor final products at a frequency aligned with likelihood of contamination with defects of importance to the business
2. Maintain a record and control system
3. Have a simple monitoring medium capable of being entered directly into a database – this would be up to the company to decide their recording system/database and so is more of a "would like" suggestion.
4. Involve ability to respond to immediate and medium term changes – again, up to the company to decide and implement

Question 1: Do you agree with the above? What can you add to develop these principles?

In light of the principles of a good visual monitoring system, what are some options:

- Removal of manufacturing defects from regulatory monitoring
- Removal of Carton Meat Assessment (as per Pearse 2012 review)
- 100% checking and recording of carcases for ZTs at MHA stand, but nothing else (for regulatory purposes)
- Consistency in scoring systems
- Consistency between definition of minor/major/critical defects for defect categories between carcase/carton/primals/offal
- Inclusion of primals
- Concentration on 'high risk' lines for primals and offal, not a blanket approach to all product types
- Changing the frequency of checks

Removal of manufacturing defects from regulatory monitoring of carcases, carton meat and offal

Australian regulators should be concerned with food safety issues and hence only monitor visual defects that have food safety implications. Manufacturing defects will still be monitored by the company, but it would be a commercial decision as to the sampling program and focus in order to meet customer specifications.

A potential classification of visual defect categories is given below.

Manufacturing	Contamination	Pathology
Bruises and blood clots	Rail dust, specks, hide and wool dust	Pathology
Seeds	Smears and stains (inc. bile, oil and grease), discoloured areas	
Bone fragments	Hair and wool strands	
Detached cartilage and ligaments	Hair and wool clusters, hide, scurf and toenails	
Foreign objects and extraneous tissue	Off condition	
Scar tissue		
Other		

From the trial data, depending on the species and product type (carcase/bulk meat/primals/offal), manufacturing defects did make a considerable proportion of the defects, such as 87% for beef bulk meat. However, there are other instances, such as beef carcases where manufacturing defects only make up 6% of the recorded defects and so their removal from the regulatory monitoring would have minimal impact.

Question 2: Would the removal of manufacturing defects be significant for you? Is the input large for a small return, currently?

Removal of CMA

The DAWR review in 2012, led by Baden Pearse, found that "*Carton meat assessment and offal product and process monitoring are not adding value to the MHA data set but are obviously important aspects for the company to monitor; these activities will be deregulated and removed from MHA*". The trial data supported this statement, finding that minor defects accounted for 99% of the total defects for CMA, with manufacturing defects far outweighing contamination related defects.

Question 3: Should CMA be removed altogether and left to the company to do as part of their commercial arrangements?

100% checking and recording of carcases for ZTs, but nothing else

Where do the ZTs occur? From the trial data, the majority of ZTs are detected on carcases – makes sense as that is the first point on the chain where they would be picked up and hence, expect less ZTs further along the chain. Some offal also have many ZTs – also not surprising.

Table 1. Number of ZTs from the industry trial

	Carcases	Bulk meat	Primals	Offal
Beef	25	5	5	16 + 191
Sheep	17	1	0	0
Pigs	14	2	0	0

This is what NZ do.

Inclusion of primals

Question 4: Is it worth including primals under MHA (currently not a requirement), since a (very) low proportion of primals had any defects identified. Do not want to add more checking, unless it is valuable/useful.

This would depend on the frequency of checks and ability to concentration on higher risk product lines, not a blanket approach for all primals. One way to do this is to require companies to monitor their primals intensively for one month, say, and based on the results, come back to a minimal system or somewhere in between.

Concentration on 'high risk' lines for primals and offal, not a blanket approach to all product types

An approach could be that each establishment establishes which are their 'high risk' (combination of multiple defect categories and prevalence) product lines for primals and offal and have a more regular sampling plan for these product lines, whilst still maintaining a less-intense monitoring program for the lower risk product lines.

Establishment	Species	Primal Type (not in order)
Plant A	Beef	Bolar blade, Tenderloin, Striploin, Rump, Cube Roll
Plant C	Beef	Topside, Outside
Plant D	Beef	Striploin, Silverside, Rump, Cube Roll, Chuck, Brisket
Plant E	Beef	Topside, Inside, Rump, Striploin, Outside, Shank
Plant F	Beef	Topside, Shank
Plant G	Sheep	Full carcase cuts, Leg, Shoulder, Backstrap
Plant I	Sheep	Shank, Flap, Leg, Shoulder
Plant J	Pigs	Shoulder, Leg, Tenderloin, Chopper
Plant K	Pigs	Trotter/Hock, Forequarter, Neck
Plant L	Pigs	Jowls, Shoulder, Trotter/Hock

*Note, what would be considered a high prevalence for one abattoir (e.g. 5%) would be considered low for another abattoir (e.g. 60%)

Establishment	Species	Offal Type (not in order)
Plant A	Beef	Tongue/Tongue Root, Lips
Plant B	Beef	Tongue/Tongue Root, Kidney, Liver
Plant C	Beef	Lips, Mountain Chain, Tongue/Tongue Root, Tail, Honeycomb, Abomasum-Scalded, Cheek, Head Meat, Tripe
Plant D	Beef	Honeycomb, Tail, Lips, Tongue/Tongue Root, Tendons
Plant E	Beef	Tongue/Tongue Root, Lips, Throat Trim
Plant F	Beef	Tendons, Tail, Ligamentum Nuchae, Membrane
Plant G	Sheep	Tripe
Plant H	Sheep	Kidney, Liver
Plant I	Sheep	Liver
Plant J	Pigs	Jowls, Ear
Plant K	Pigs	Ear, Head meat, Snout, Tail, Trotter, Tongue/Tongue Root, Mask
Plant L	Pigs	Ear, Jowls, Snout, Kidney, Trotter

*Note, what would be considered a high prevalence for one abattoir (e.g. 5%) would be considered low for another abattoir (e.g. 60%)

Consistency in scoring systems

Carcase and offal scores are calculated based on a daily average score, but for the current CMA system, acceptable performance is not based on an average score but a more complicated moving window system for minor, major and critical defects. If CMA is retained, CMA could also be based on an average defect score, thus harmonising the various components of visual assessment.

Frequency of checks

The aim is to reduce and harmonise the frequency of visual defect monitoring as shown in the below table, given the overall good performance of industry. These are suggested as a minimum, but establishments should have the option to intensify their monitoring for different product lines.

Category	Samples per set	Sets per day	Product types per category
Carcase (SF)	10	3	
Bulk meat	10	3	Sample sets are rotated randomly across product types.
Primals	10	3	Sample sets are rotated randomly across product types.
Offal	10	3	Sample sets are rotated randomly across product types.

Key findings of the analysis of the industry trial are:

- For carcases:
  - The majority of defects were minor and there were very few zero tolerance defects.
  - The quantity of minor defects recorded varied widely between establishments, from beef Establishment D (5.9%) to Establishment G (78.2%).
  - Records of pathology also varied widely with Establishment E and I (the same establishment) being responsible for 76% of all pathology detections.
- For CMA, minor defects accounted for 99% of total defects, with manufacturing defects far outweighing contamination related defects.
- For primals, there were very few recorded defects, again with 99% being minor.
- Similarly, for offals, most records were for Minor defects, with the exception of Establishments E and I (the same establishment, different species) where 93% of pathology defects were recorded, and Establishment C, which recorded 191 ZTs (all for mountain chains).
- Overall, visual requirement limits are breached very infrequently.
- Under simulation of the alternative system, three establishments would have one alert every ten years from carcase MHA.
- By contrast, for CMA under the alternative system, the use of a daily average would have resulted in more frequent failures for some plants, the majority of which involved manufacturing defects.
- Visual checks for primals, which are not a requirement under the current system, would result in occasional alerts under the alternative system.

Consistency between definitions of minor/major/critical defects for defect categories between carcase/carton/primals/offal

This is the current system.

	Minors			Majors			Criticals		
	Carcase	**CMA**	**Offal**	**Carcase**	**CMA**	**Offal**	**Carcase**	**CMA**	**Offal**
Bruises Blood Clots	2-5cm	≤6cm & 2cm deep 4-15cm	<1cm	> 5cm	>6cm or 2cm deep or > 5 minor bruises >15cm or > 5 minor plots	1-2cm	2 or more majors	Extensive Extensive	>2cm
Seed	5-10	≤ 3	NA	11-20	4-10	NA	> 20	> 10	NA
Rail Dust, Specks, Hide & Wool Dust	5-10 scattered specks	5-10 scattered specks	NA	11-20 scattered specks	11-20 scattered specks	NA	> 20 scattered specks	> 20 scattered specks	NA
Smears & Stains	≤1 cm diam	1-4cm	<1cm	1-2cm diam	>4cm or >5 minor stains	1-2cm	> 2cm diam	Extensive	>2cm
Hair & Wool Strands	5-10 strands	5-10 hairs	≤2	11-20 strands	11-20 strands	3-8	> 20 strands hair/wool	>20 strands hair/wool	>8
Hair & Wool Clusters, Hide, Scurf, Toenails	1 cluster of hair Hide < 1cm diam	1 cluster of hair Hide < 1cm diam	1 (cluster is numerous strands in a 10mm circle)	2-3 clusters hair/wool Hide 1-5 cm diam	2-3 clusters hair/wool Hide 1-5cm diam	2	> 3 clusters hair/wool Hide > 5cm diam	>3 clusters hair/wool Hide > 5cm diam	>2
Foreign Objects & Extra Tissue	1 incidence	Harmless material <4 sq cm	1 incidence	2 incidence	Harmless material >4 sq cm and small insects	2 incidence	3 incidence	Any foreign substance that will cause injury or illness	3 incidence

Scar Tissue	NA	NA	<4	NA	NA	5-8	NA	NA	>8
Bone Fragments	NA	Hard bone ≤4cm or slivers (rib) < 7cm	NA	NA	Hard bone >4cm diam or 5 fragments	NA	NA	Any fragments that would seriously affect the product	NA
Detached Cartilage Ligaments	NA	>2.5cm long and free from muscle tissue	NA	NA	>5 minor defects that would not seriously affect the product	NA	NA	Any cartilage or ligament that would seriously affect the product	NA

Question 6: What would a consistent system look like?

HOW DO OTHER COUNTRIES MONITOR THE VISUAL CONDITION OF MEATS PRODUCED BY THEIR OWN INDUSTRIES?

USA

The requirements, as far as we can find, are laid down in the FSIS "6000 Series: Slaughter Inspection" Directives[1], particularly:

- 6410.1 Rev 1 (3 November 2017): Verifying Sanitary Dressing and Process Control Procedures by Off-Line Inspection Program Personnel (IPP) in Slaughter Operations of Cattle of Any Age; and
- 6420.2 Rev 2 (19 December 2019): Verification of Procedures for Controlling Fecal Material, Ingesta, and Milk in Livestock Slaughter Operations

Directive 6410.1 defines contamination of carcasses and parts to be either:

1. Substances not inherent to the species being slaughtered (e.g. volatile oils, points, rail dust, rust, etc.), or
2. Substances inherent to the species being slaughtered (e.g. digestive tract content, bile).

However, the directive notes that "*Not all contamination is directly associated with food safety. Sound judgment must be used when determining whether the conditions observed during the slaughter process are part of the slaughter process or are present as an unavoidable consequence of the slaughter process. Evaluation on a case-by-case basis will be needed to determine whether the conditions observed have resulted in either the creation of an insanitary condition or the adulteration of product.*"

It appears that the actual activities undertaken by each establishment are left up to the establishment to decide and document, as the Directive notes: "*Establishments may elect to maintain written sanitary dressing and process control procedures as part of their HACCP Plan, Sanitation SOP, Good Manufacturing Practices (GMP), or other pre-requisite programs.*"

Under the directive, IPPs are to verify that "*establishments handle beef carcasses, organs, and other parts in a sanitary manner to prevent contamination with fecal material, urine, bile, hair, dirt, or foreign matter*" and that establishments:

- Prevent cross-contamination through adequate separation of carcases, parts and viscera
- Routinely clean and sanitize equipment
- Prevent contact between successive carcases and prevent hide flapping and spatter which could cause carcase contamination
- Ensure works frequently wash hands and aprons
- Implement decontamination and antimicrobial interventions.

In particular, the Directive specifies that IPP are to undertake carcase contamination verification after the "post-mortem FSIS final rail inspection" by observing zero-tolerances in accordance with Directive 6420.2; observation of other contamination (e.g. rail dust, etc) should be documented as a noncompliance in accordance with the "Operational SSOP Review and Observation" task.

[1] https://www.fsis.usda.gov/wps/portal/fsis/topics/regulations/directives/6000-series

Directive 6420.2 provides criteria for identifying contaminants (faeces, ingesta and milk) for livestock species and provides the following carcase / carcase side inspection frequencies, based on the expected slaughter volume for a shift.

Livestock Carcase Sample Size		
Number of animals slaughtered per shift	**Number of carcasses to be sampled per shift**	**Number of sides (hind and forequarter) to be sampled per shift**
100 or fewer	2	4
101 to 250	4	8
250 to 500	8	16
More than 500	12	24

There is also first-hand information from establishments that have links with the USA stressing that ZTs are important at the carcase-monitoring stage:

- Establishment A in the USA check for ZT contamination but rely on control by interventions such as decontamination. The ZT verification sampling rates are driven by the relevant FSIS notice to their own FSIS staff.
- The USDA requires ZT to be achieved at the final carcase inspection.
- The USDA expectation directive on sanitary dressing allows the plant to set up their own system and standards. If a plant doesn't have a system in place the risk is USDA inspectors can then make their own determination around what they are seeing in product and process hygiene procedures. It's in a plant's best interest to document their systems.
- MHA focus on carcase areas, ZT on its own, and other defects grouped into dressing defects (single defects are counted).
- End of the line USDA inspector inspects carcases for ZT defects.
- Cuts, Folds and Flaps Audit - facilitate hot water intervention.
- Carcase Spacing Standards.

New Zealand

Focus on ZTs at carcases monitoring stage.

MPI documents (New Zealand Ministry of Primary Industries, 2018, Post Slaughter Activity – Red Meat Code of Practice Chapter 9) state that:

1. There is a performance criterion (% faeces) for carcases at PM inspection for different species/categories
2. All ZTs must be removed
3. Process control is statistically based via control charts
4. Manufacturing meat and primals are sampled according to production volume (kg)
5. Defect criteria are classified in Table 10 – there is a column for "insignificant"

EU

Contacts in the EU provided information on the requirements for carcase and carton checking:

"*There is no legal or specific requirements for checking products that have been packed in cartons.*

In EU the food business operators (FBO) at the abattoirs and processing plants are responsible for not to bring any food on the market, which can be hazardous or unfit for human consumption. Each

company has developed and implemented own check programs based on the HACCP principles, which is audited by the authorities. Each company has procedures to ensure that the products they receive and forward is sound and fit for human consumption and a system to secure full traceability back and forward. In the EU legislation it is stated that all visible contamination e.g. faeces or other matters, has to be removed before cooling and before applying the health mark on the carcass.

Some companies, voluntarily or because of costumer demands, make extra checks on e.g. bulk meat for minced meat."

Various EC Regulations of relevance include:

- Regulation (EC) No 852/2004 (29 April 2004): On the hygiene of foodstuffs;
- Regulation (EC) No 853/2004 (29 April 2004): Laying down specific hygiene rules for food of animal origin; and
- Regulation (EC) No 854/2004 (29 April 2004): Laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption.

Regulation No 852/2004 lays down general requirements on the hygiene of any food, but nothing specific to visual contamination of meat. The other two regulations are more useful for the current context.

Regulation 853/2004 specifies (Annex III, Chapter IV, §10): "*The carcases must not contain visible faecal contamination. Any visible contamination must be removed without delay by trimming or alternative means having an equivalent effect.*" The implication seems to be that any contamination needs to be removed but that no recording of the number of occurrences is required.

Regulation 853/2004 documents the requirements for fresh meat in Annex I. As part of the auditing tasks, the "*official veterinarian is to check that the operators' procedures guarantee, to the extent possible, that meat … does not bear faecal or other contamination*" (§2b). However, no specific requirements or laid down with respect to the frequency with which such audits are to take place.

EVOLUTION OF THE CURRENT SYSTEM OF VISUAL INSPECTION

The beginnings

As stated by Butler *et al*. (2003), before the 1990s, the traditional meat inspection system in Australia was similar to that in other countries. The Quality Assurance (QA) approach had not yet permeated the industry and the primary focus was on removing macroscopic defects at the end of the slaughter chain, or in the chillers. The focus was on enforcement and prosecution, and not on a co-regulatory approach by the inspection service and the business.

The inability of a traditional inspection system to influence the microbiological status of carcases prompted New Zealand scientists to challenge the role of meat inspection in: *A new approach to meat inspection* (Blackmore 1983) and *Postmortem Meat Inspection Programs; Separating Science and Tradition* (Hathaway & McKenzie 1991).

In Australia, the process of uncoupling the nexus between veterinary meat inspection and food safety began in 1990 when then-Treasurer, the Hon. Paul Keating, instituted a user-pays policy for meat inspection. For the first time, establishments were required to meet full cost recovery of veterinary meat inspection provided by State, Territory and Federal governments.

The costs were onerous and the Meat Research Corporation trialled the successful replacement of government inspectors, with company meat inspectors at three domestic establishments in Victoria, Tasmania and New South Wales. The experimental work: pathology and microbiological quality of carcases inspected under both systems is presented in Sumner (1994).

By the mid-1990s, it was commonplace for domestic establishments to have company-employed meat inspectors as part of a QA team operating a HACCP-based system, with the concept presented at several international gatherings (Sumner, 1996; Fabiansson & Sumner, 1997; Sumner & Herd, 1999).

Concurrently with these significant changes in the domestic industry, a large outbreak occurred in the United States where more than 400 became ill and four children died of Hemolytic uremic syndrome following consumption of undercooked hamburgers from a chain of restaurants (Bell *et al.* 1994). In 1996, the United States Department of Agriculture (USDA) published the so-called MegaReg, a final rule on reducing pathogens that made the progressive introduction of HACCP systems and Standard Operating Procedures mandatory (USDA, 1996).

In 1997, Australian establishments entitled to export meat to the USA began microbiological testing of carcase surfaces for generic *E. coli* and *Salmonella* (the ESAM program).

According to Butler *et al.* (2003), meat hygiene assessment (MHA) was first developed by AQIS in 1993 with the first edition of Meat Hygiene Assessment published in 1996. The second edition: Meat Hygiene Assessment, Objective Methods for the Monitoring of Processes and Product was published in 2002, citing the work of Evan Singleton in conjunction with a representative of the US Food Safety and Inspection service (FSIS). Singleton states: *The U.S.A. drivers on our current system were based on: HACCP-based Inspection Models Project "In Plant Slaughter" conducted by the United States Dept. of Agriculture Food Safety Inspection Service Office of Policy, Program Development, Evaluation Inspection Systems Development Division, May 12 1998.*

The current system

John Langbridge states: *"The current system is essentially reverse engineered from the US import inspection and was a product of various US market access pressures. NZ went through a similar reverse*

engineering process and came up with something that is different but provides a similar outcome, but as I understand it they monitor their CCPs differently.

The current defrost re-inspection caused by a failure in CMA is the same as the old US Point of Entry inspection process.

CMA is a cusum process designed to be slightly more sensitive than the defrost inspection process over an entire day's production.

MHA is designed to pick up defects on carcases at a 90% confidence level if that defect is on 11% or more of carcases (hardly "0" tolerance) but appropriate for acceptance by the market - again reverse engineered from US import inspection.

A lot of the industry uses MHA sampling criteria as a verification of compliance with HACCP; the assumption is where there is visual faeces, ingesta or milk there is the possibility that an STEC is present, effectively making it a surrogate for STEC.

USDA accepts the sampling plan under MHA as being reasonable for the monitoring of CCP compliance, and have accepted within DAWR that 11 beef sides or 11 sheep carcases is a reasonable verification sampling rate.

USDA also accepts that you don't need a CCP in your offal room if you are applying MHA. I don't think anyone has actually applied this equivalence agreement in the offal room and don't have a CCP.

Recent history

US have changed their import inspection criteria e.g. unless things like bone are big enough to seriously compromise product use, they are not scored. This is because defect eliminators at grinding plants deal with the defect.

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APPENDIX 2: MEAT HYGIENE ASSESSMENT: PRODUCT MONITORING (3RD EDITION)

APPENDIX 3: MEAT HYGIENE ASSESSMENT (3RD EDITION): PRINCIPLES AND GUIDANCE