NSW Food Authority

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NSW domestic red meat abattoir evaluation

Final report

Catherine Bass, Paul Crick and David Cusack

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1. Background

It has been more than a decade since the introduction of HACCP requirements for red meat abattoirs. The introduction of HACCP into NSW red meat abattoirs took place in January 1997. One year later, abattoirs were then required to carry out microbial testing on carcases. At that time, the Food Authority (the then Meat Industry Authority) did not collect baseline data. Figure 1 shows the national and NSW regulatory milestones applicable to the red meat industry.

Red meat abattoirs were an ideal sector to evaluate. A decade after the introduction of major regulatory change, the NSW Food Authority (the Authority) has undertaken an evaluation of domestic red meat abattoirs.

Abattoirs and the Authority jointly manage food safety risk via the NSW Meat Food Safety Scheme. From March to June 2006, the Authority undertook a study evaluating the effectiveness of NSW Meat Food Safety Scheme. Additional microbiological sampling was conducted from December 2006 to January 2007 and in December 2007.

Figure 1. Regulatory milestones for red meat abattoirs
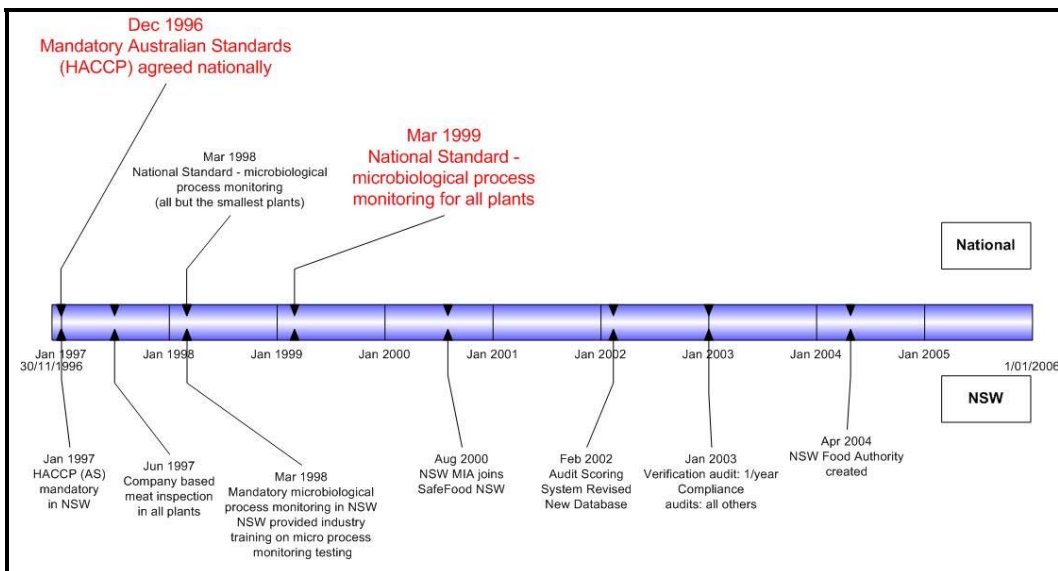
The evaluation had four (4) main objectives.

They were to:
1. assess company based meat inspection systems,

2. check compliance with mandatory HACCP,

3. benchmark industry food safety practices and establish a NSW domestic red meat carcase hygiene baseline so that the impact of any future food safety management initiatives can be assessed, and

4. review the regulatory framework and industry guidelines to identify any areas needing work.

2. Method

2.1 All abattoirs were assessed in ten (10) key categories

From March to June 2006, the evaluation team visited each domestic red meat abattoir in NSW and an assessment tool was completed for fifteen (15) of the sixteen (16) sites. The development of the assessment tool included field trials in both a large and small abattoir.

In order to assess the adequacy and effectiveness of the food safety management systems operating in each abattoir, the assessment tool required the evaluation team to:

a) review written programs (eg HACCP, support programs and work instructions),

b) review six (6) months of monitoring documentation,

c) verify food safety management practices and check compliance with the Standard (AS4696:2002) during production, load out, clean down,

d) observe microbiological carcase sampling techniques,

e) collect meat temperature data (where required), and

f) collect samples for the carcase hygiene survey.

The assessment tool looked at ten (10) key areas. The tool required information to be collected in the following categories:

Part A: Industry profile – production volumes

Part B: Processing characteristics – types of dressing operations, carcase decontamination interventions

Part C: Food safety commitment and regulatory awareness survey

Part D: Hazard management, HACCP (8 questions, 40 points)

Part E: Process control:

- ante and post mortem inspection practices (4 questions, 4 points)

- beef processing (10 questions, 10 points)

- sheep processing (9 questions, 9 points)

- pig meat processing (9 questions, 9 points)

Part F: Factory and operation (18 questions, 18 points)

Part G: Clean down and monitoring (11 questions, 11 points)

Part H: Cold chain management (11 questions, 11 points)

Part I: System review and verification (6 questions, 17 points)

Part J: Training (7 questions, 7 points)

Parts D to J included questions that were identified as vital to food safety management in red meat abattoirs. They were based on elements of the following audit tools from *South Australian: Gold Standard process control in poultry processing and Gold Standard for the control of L. monocytogenes in smallgoods manufacturers* (G. Raven, Manager Food Plant Standards, PIRSA, personal communication). Questions that assessed compliance with the Australian Standard (AS4696:2002) were also included.

2.2 Surveying meat temperatures at load-out

The survey checked the temperature of a statistically valid number[1] of carcases, meat portions and offal (n=250) from fifteen (15) abattoirs at load-out (before transportation and distribution). As per the requirements of AS4696:2002, whole carcases must be chilled to surface temperature of 7^oC or colder within twenty-four (24) hours of stunning and carcase parts and offal must be chilled to 5^oC or less within twenty-four (24) hours.

2.3 Testing beef, sheep and pig carcases for microbiological indicators of hygiene

All abattoirs were included (n=16) and the team collected samples during three (3) time-periods:

- March to June 2006,

- December 2006 to January 2007, and in

- December 2007.

One hundred (100) beef, 323 sheep and 76 pig carcases samples taken.
A statistical model[2] determined the number of beef, sheep and pig carcases required for this study. However, in reality, sample numbers were slightly higher for beef and pig carcases. Total Viable Count and for *E.coli* were the two hygiene indicators used.

Sampling methods were consistent with those outlined in AS4696:2002. Microbiological enumeration was performed according to AOAC method 990.12 for Total Viable Count (TVC), and the AOAC method 9910.14 for *E.coli*. The incubation conditions for TVC samples were 25°C for 96 hours.

Carcase ratings; excellent, good, acceptable or marginal

In accordance with procedures described *in Meat Standards Committee – microbiological testing for process control in the meat industry* (October 2002), results of the survey were expressed as excellent, good, acceptable and marginal.

For TVC, excellent was (< 1000 cfu/cm^2), good ($1,000 - 10,000$ cfu/cm^2), acceptable ($10,000 – 100,000$ cfu/cm^2) and marginal ($100,000 - 1,000,000$ cfu/cm^2).

For *E.coli*, excellent was (not detected), good (>0 -10 cfu/cm^2), acceptable (10- 100 cfu/cm^2) and marginal (100 - 1,000 cfu/cm^2).

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[1]Sample size calculations were based on the normal approximation to the binomial distribution. It was determined that a sample size of 250 would provide at least 95% confidence of the survey estimate being within 5% of the true prevalence, assuming the true prevalence of carcases compliant with AS4696:2002 is 20% or less.

[2] Sample size calculations were based on the normal approximation of the binomial distribution. It was determined that a sample of 73 (beef), 323 (sheep) and 73 (pork) carcases would provide at least 95% confidence of the survey estimate being within 5% of the true prevalence, assuming the true prevalence of *E.coli* is $\leq$33% (sheep) and $\leq$5.5% (beef and pig) carcases.

3. Results and discussion

3.1 Abattoirs process ten (10) times more sheep than beef

Table 1 lists the production volumes of the abattoirs surveyed (n=16). The evaluation further identified that the Authority licenses four (4) Very Small Plants (VSPs)[3].

Table 1. NSW domestic red meat production volumes

Animal species	Total slaughter numbers/week February to June 2006*
Sheep/lambs	52,620
Pig	3,931
Beef	4,408
Goat	750
Deer	20

*Based on average head kill/week per abattoir

Red meat abattoirs employ almost 900 staff. At the time of the evaluation, the domestic red meat industry employed a total of 762 full time, 106 casual workers and fifteen (15) agency staff.

Bed dressing and no automated chain is the norm for beef. Table 2 describes selected beef, goat and sheepmeat processing practices in abattoirs surveyed in this project. The evaluation established that almost half of the abattoirs (46%) processed beef carcases by bed dressing.

Most abattoirs use conventional dressing for sheep carcases. Almost one-third (27%) of abattoirs used inverted dressing to process goat and sheepmeat carcases.

Carcases are rarely decontaminated using acid washes, hot water and steam vacuum. The study found that only one (1) abattoir applied a hot water wash as a decontamination intervention step instead of cold-water wash prior to chilling. For sheep and goat meat processing, two (2) abattoirs (13%) used steam vacuuming as a carcase decontamination intervention step in addition to a cold-water wash.

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[3] An abattoir is designated a VSP where the number of animals killed per week is less than 150 cattle equivalents (8 sheep = 1 cattle equivalent, and 1 pig = 1 cattle).

Table 2. NSW domestic beef and sheepmeat processing details

Beef (n=13)	% abattoirs	Ovine/Goats (n=15)	% abattoirs
Bed dressing	46	Inverted dressing	27
Automated chain	0	Automated chain	47
Dead rail	62	Dead rail	33
Gravity rail	38	Gravity rail	20
Hide removal			
Backing down	54	Automated pelt removal	33
Upward	46		
Downward	0		
Carcase wash – automated	0	Carcase wash – automated	20
Carcase decontamination intervention (hot water/acid wash/steam vacuum)	8	Carcase decontamination intervention (hot water/ acid wash/steam vacuum)	13

3.2 Abattoirs are committed to food safety and know about food safety requirements

Abattoirs are strongly committed to food safety. The evaluation established the fact that NSW domestic red meat industry is strongly committed to food safety and aware of national legislation for producing safe meat. On a scale of one (1) to ten (10) (where 10 indicates food safety is extremely important to the business), the average industry rating score was 9.8.

Abattoirs know about national rather than NSW food safety requirements. All abattoirs were aware that compliance with the Australian Standard 4696:2002 (*Australian Standard for hygienic production and transportation of meat and meat products for human consumption*) was required and most had a current version on hand (88%). However, only two (2) abattoirs were able to refer to relevant state based legislation such as the *NSW Food Act 2003* and NSW Food Regulation 2004.

The company based meat inspection system is working. In January 1997, company based meat inspection was first introduced into NSW red meat abattoirs. Each abattoir is required to employ a Meat Safety Officer (MSO) who must be present during processing. MSO must hold a Certificate IV Meat Processing (Meat Safety) qualification and roles include veterinary health inspection of all carcases. The evaluation offered a unique opportunity to obtain information as to the status of the MSO workforce and to assess relevant Food Authority programs. Table 3 presents the MSO results.

Most MSOs adequately perform their MSO duties. The results also showed that 85% of abattoirs operated with MSOs that were able to demonstrate they adequately understood their regulatory role and responsibilities as an approved MSO. As a measure of proficiency, the survey asked MSOs whether they were required to fulfill other in-processing tasks in conjunction with their MSO duties. Almost two thirds of MSOs (67%) responded 'yes'.

At this time staff MSO numbers are adequate. At the time of the evaluation, the red meat abattoir sector employed forty eight (48) MSOs. Just under half of the abattoirs stated that more staff were enrolled in the MSO training program. Almost 90% of abattoirs were confident in their abilities to assist with on the job training for the MSOs.

Abattoirs are managing the MSO system. The data shows that abattoirs are managing the MSO system. Almost all have MSO policies and procedures in place and half routinely operate with more than one (1) MSO per shift.

Table 3. Profiling the Meat Safety Officer system

	% of abattoirs
How well are MSO duties performed?	
MSO understands regulatory role and responsibilities	85 %
MSO has additional in-processing duties to inspection work	67 %
What is the status of the MSO workforce?	
48 Meat Safety Officers employed in NSW	**% of abattoirs**
Abattoirs confident in their ability to trains MSOs	87 %
Abattoirs with staff undertaking MSO training	47 %
How well do abattoirs manage the MSO system?	
Abattoirs have MSO staffing policy and procedures	93 %
Abattoirs with more than one MSO on duty per shift	47 %

Three quarters of abattoirs have used the Food Authority's website. The survey looked at industry awareness of the Authority's routine modes of communication. Upon questioning, 75% of abattoirs stated that they had used the Food Authority's website. At the time of the study, only two (2) abattoirs were aware of, or had read Foodwise (the Authority's industry publication).

Food Authority auditors routinely provide technical assistance. During the course of the study, the evaluation team noted that the Authority Food Safety Officers (FSOs) appeared to provide industry with much technical assistance in addition to their duties as auditors. Whilst this observation is unsupported by the data, future evaluations will try to quantify the amount of technical support provided by the FSOs under the current system. This information is most relevant in light of the proposed introduction of a third party auditing system in NSW.

3.3 Industry performance across seven (7) food safety management categories

Overall industry scores for food safety management practices during March to June 2006 are presented in Figure 2.

Industry scored the highest in the process control category. Average industry scores were greater than 55% for six (6) of the seven (7) categories examined, with industry scoring 65% or greater for three (3) of the seven (7) categories (hazard management - HACCP, process control and factory operations).

Industry scored the lowest for the clean-down (48%) and system review and verification (56%) categories. While overall cleanliness was generally satisfactory, areas requiring improvement included the appropriate use of cleaning chemicals, cleaner training and the provision of feedback to cleaners.

Similarly, industry scored 56% for the system review and verification category. All abattoirs were taking and analysing carcases for microbiology and thermometer calibration was scored at 79%. However, areas requiring improvement included reviewing and trending food safety data, in particular carcase microbiology data.

The amount of variation calculated for each category is also considered an important measure of industry performance. For example, from Figure 2, it can be seen that a large variability in scores were obtained for the training category. These results assist the Authority prioritise programs that will lead to all abattoirs operating at the same high standard. However, it should be noted that the number of questions varies for each category and therefore we can expect there to be greater variance for those categories with fewer questions.

Figure 2. NSW domestic red meat abattoirs industry score card
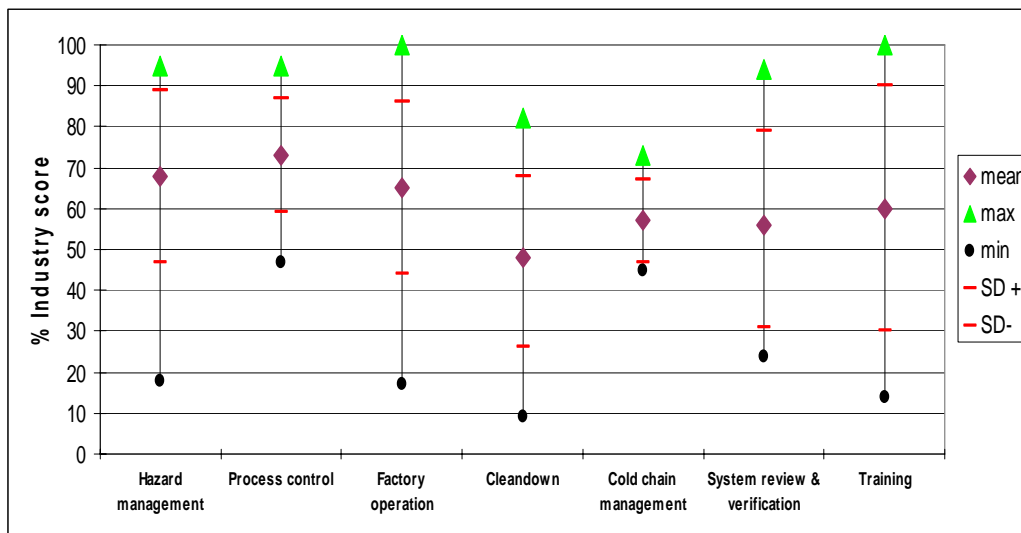
3.4 Industry scored, on average, 71% for carcase processing

The process control category included an assessment of dressing practices and verification systems for each species processed. Figure 3 presents the scores for beef, sheep and pig species. The average results for each species are consistent; 72% (beef) or 71% (sheep and pigs).

Figure 3. NSW domestic red meat abattoirs industry process control score card
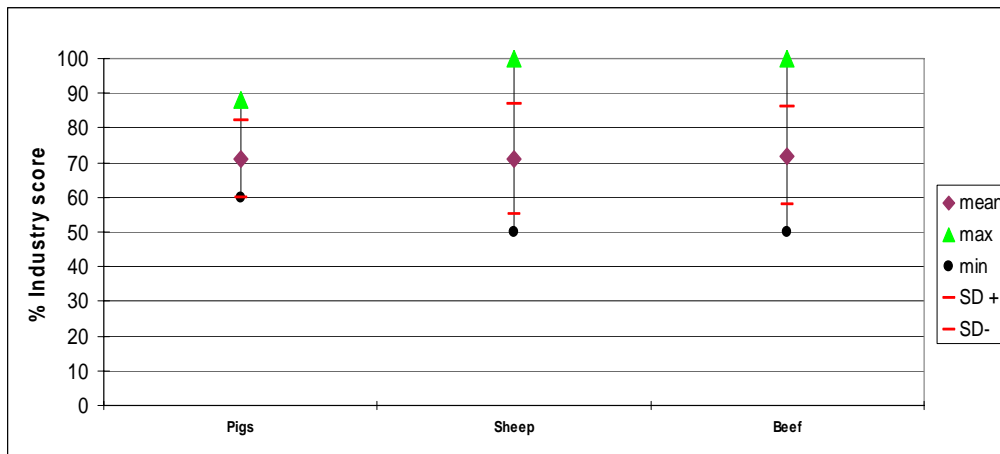
3.5 Carcase and portion meat, not offal, more likely to comply with temperature requirements at load-out

Nine (9) out of ten (10) carcases complied with the Australian Standard. The findings indicated that 96% of carcases and meat portions (n=253) complied with AS4696:2002.

Abattoirs chilled only four (4) in ten (10) offal pieces to the correct temperature before load-out. The survey results found only 38% of offal samples (n=29 from ten (10) abattoirs) complied with the AS4696:2002. The Authority has been focusing on this area of non-compliance in respect of offal chilling practices during audits. It is important that abattoirs validate their meat and offal chilling processes.

3.6 Generally, low levels of bacteria found on beef, sheep and pig carcases

All beef carcases received excellent or good ratings. The study results rated one hundred percent (100%) of beef carcases as excellent or good for TVC and *E.coli*.

Table 4 presents results from the Authority's study on beef carcases for TVC and *E.coli*.

Beef TVC scores ranged from 0.48 log (3.0) cfu/cm^2 to 3.95 log (8,912.0) cfu/cm^2. One quarter (25%) of the beef carcases sampled tested positive for *E.coli*. Scores ranged from -0.89 log (0.12) cfu/cm^2 to 0.69 log (4.89) cfu/cm^2.

Table 4. Beef carcase hygiene results

Category	TVC CFU/cm^2	*E.coli* CFU/cm^2
Excellent	75%	80%
Good	25%	20%
Acceptable	-	-
Marginal	-	-

Low levels of *E.coli* and TVC found on sheep carcases. Almost all (98% and 97%) of sheep carcases (lamb/hogget/mutton) were rated as excellent or good for TVC and *E.coli* respectively. Table 5 lists the results for the sheep carcases.

The sheep TVC scores ranged from 0.30 log (1.99) cfu/cm^2 to 5.47 log (295,120) cfu/cm^2. Just over half (53%) the carcases tested positive for *E.coli*. The *E.coli* scores ranged from -0.48 log (0.33) cfu/cm^2 to 2.24 log (173.33) cfu/cm^2.

Table 5. Sheep carcase hygiene results

Category	TVC CFU/cm^2	*E.coli* CFU/cm^2
Excellent	82%	52%
Good	16%	45%
Acceptable	2%	2%
Marginal	0%[3]	1%

Counts on pig carcases were higher than beef or sheep

Table 6 presents the results from the Authority's study on pig carcases for TVC and *E.coli*. The results indicate that 80% of pig carcases tested, rated excellent or good for TVC, and 91% rated as excellent or good for *E.coli*.

The pig TVC scores ranged from 0.85 log (7.0) cfu/cm^2 to 5.03 log (106,667.0) cfu/cm^2. The percentage of carcases testing positive for *E.coli* was 63%. The pig *E.coli* scores ranged from -1.10 log (0.08) to 1.30 log (19.95) cfu/cm^2.

Table 6. Pig carcase hygiene results

Category	TVC CFU/cm^2	*E.coli* CFU/cm^2
Excellent	43%	39%
Good	37%	52%
Acceptable	17%	8%
Marginal	3%	1%

The establishment of the NSW carcase hygiene baseline is one measure against which the impact of any future food safety initiatives can be assessed. Over time, these results will provide insight into hygienic processing of red meat in NSW. However, the industry

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[3] Due to rounding to the nearest whole number, rather than an actual score of 0%

baseline score and the individual rankings cannot provide individual abattoirs with a highly accurate assessment of their own processing outcomes over time. Individual abattoirs will best be able to improve processing outcomes by using TVC data to inform feedback systems. TVC data always provides information (compared with *E.coli* data) so that trends can be established over time and most importantly processes can be adjusted accordingly.

4. Future directions

Based on the findings from the study, the Authority developed an action plan. Key areas for further activity include:

- conducting verification audits in red meat abattoirs at least every five (5) years using the on-site assessment tool,

- developing a meat safety manual that will include technical bulletins and information on food safety laws including information outlining MSO responsibilities, and approval criteria,

- increasing the scrutiny of cleaning programs used by the red meat industry,

- placing a stronger focus on the validation of chilling programs especially for offal,

- focussing on sampling equipment and incubators used for microbiological testing during audit, and

- emphasising the importance of review systems where abattoirs trend information in order to improve processing outcomes (eg the application of carcase hygiene data).

In the future, this work will form a baseline against which to measure the success of any new food safety initiatives in red meat abattoirs.

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