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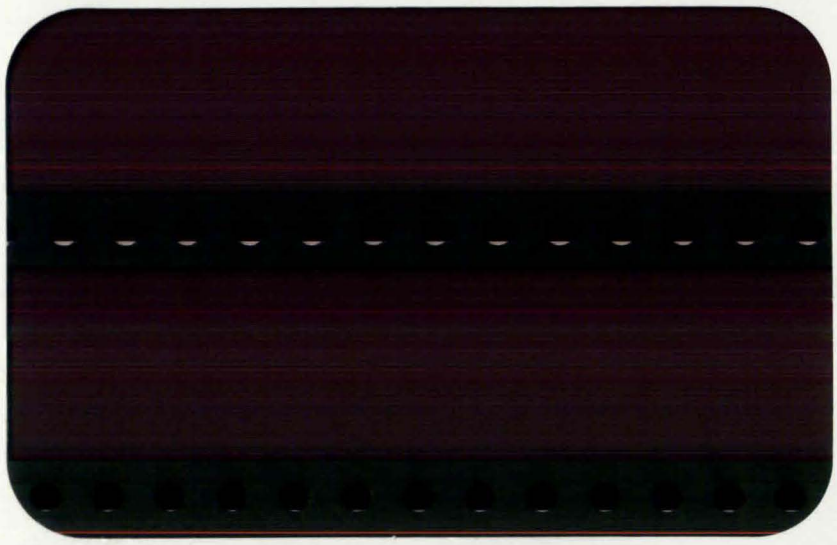
AUSTRALIAN MEAT TECHNOLOGY



Investigation of vacuuming equipment for removal of wool and fleece dust contamination from sheep carcases

Prepared for

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by

G. Brauns & I.J. Eustace

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Executive summary

In early 1997, AQIS approved the use of vacuuming treatments involving steam or hot water to remove faecal and ingesta contamination from carcases with the provision that areas of contamination of 25 mm or greater in the greatest dimension must continue to be removed by trimming.

In August 1997, AQIS advised its technical staff that the equipment was not yet approved in Australian export establishments for use on sheep or lamb carcases to remove wool fibres and fleece dust by sweeping. At the request of the Meat Research Corporation, investigations were undertaken to facilitate consideration of an approval of the equipment for this purpose for treating sheep and lambs. The investigation assessed two issues. These were: the ability of the vacuuming unit to remove individual fibres and clusters of wool and wool dust; and whether the method of sweeping the unit head across the surface of the carcases is acceptable.

The vacuuming unit was evaluated at an export establishment. The evaluation involved both visual and microbiological assessments of mutton carcases. Visual assessments of carcases were undertaken to determine the initial level of visual wool and dust contamination and then to determine if the unit was able to remove visible contamination. Microbiological analysis of the carcases was undertaken to determine if the unit was able to reduce the bacterial load on contaminated surfaces.

The unit was found to be capable removing wool and wool dust from the surface of sheep carcases. Microbiological counts on carcases after treatment were less than before treatment and there was no evidence to suggest that the sweeping motion relocates contamination.

Recommendations

Based on the test findings presented in the attached report, MRC should recommend to AQIS that it accept vacuuming systems using hot water and/or steam for use on sheep carcases subject to the following conditions:

1. If the vacuuming unit is used on the chain before final inspection, procedures should be in place to prevent the use of equipment to remove faecal material greater than 25 mm in any dimension and to prevent sweeping the vacuum head over any visible pathological defects.

2. The method of application of the equipment should depend on the type of contamination present. For faecal material, the unit should be used for localised 'spot' treatment over and in the immediate vicinity of the contamination. A sweeping motion should not be used to remove visible faecal material.

   For the removal of incidental visible contamination such as single wool fibres, wool clusters and wool dust, a sweeping motion is very effective and is recommended for the removal of loose wool and fleece dust.

3. In collaboration with suppliers, establishments should develop guidelines for the operation of the equipment. Operators should be fully conversant with its operation. A program should be implemented where the operator of the unit ensures that the vacuum head is kept clean of wool and fat build-up.

4. The temperature of water and steam delivered to the vacuum head, the degree of vacuum and the steam pressure developed by the equipment should be displayed and be visible to the operator. Minimum values for these parameters should be specified and the equipment should not be used if the parameters do not meet the specified values.

The parameters used in the trials and which are judged to be appropriate were:

- Water temperature at generator unit: 90°C
- Steam temperature: 120°C
- Vacuum: 8 in Hg (200 mm)
- Steam pressure: 10 psi (69 kPa)

Notwithstanding these recommendations, it should be recognised that use of the equipment cannot replace adherence to good manufacturing practice.

Background

In early 1997, AQIS approved the use of vacuuming treatments with hot water or steam to remove visible faecal and ingesta contamination less than 25 mm in its greatest dimension from carcases. The approval followed extensive in-plant trials which demonstrated the physical and microbiological effectiveness of the steam vacuuming units for use instead of knife trimming (Kochevar et al, 1996; Dorsa et al, 1996). At the present time AQIS has not approved the use of these units in Australian export establishments for removal, via sweeping motions, of hair, wool fibres and fleece dust.

This report describes the work undertaken at an export establishment in NSW processing sheep and lambs. The investigation was undertaken to determine whether the method of sweeping the head of the unit across the carcase is capable of removing visible contamination from the surface of carcases and reducing the bacterial load on the area the contamination, without causing any cross-contamination.

Methodology

The investigation was carried out over a two day period. Over this time, a total of 1502 carcases were assessed visually for the presence of wool dust, individual wool fibres, clusters of wool and faecal contamination before and after vacuuming at two locations on the slaughter floor. Samples for microbiological testing were collected from 120 of the visibly contaminated carcases.

Use of the vacuuming equipment

The vacuuming device used for the investigation was a Kentmaster Vac San unit which employs hot water rather than steam to remove loose wool, fleece dust (fall-out) and faecal material from the surface of carcases by loosening the material and drawing it away from the surface by vacuum. If the head is held at a particular location for a period of a few seconds, the hot water also sterilises the treated area. When it is placed on the carcase, hot water is aspirated onto the surface. The unit draws the water and any contaminating material away from the surface by vacuum. Steam is emitted from orifices on the head to sterilise it. The vacuum at the carcase surface is sufficient to remove the contamination and condensed water from the surface of the carcase to prevent dripping.

The unit was temporarily installed at the plant for the trial. It was assessed at two locations on the slaughter floor. The first was immediately after the pelt had been opened and cleared from the foreleg, brisket and neck. At this location, the shank, foreleg and brisket point were assessed. The second location was immediately after pelt removal, with the mid-line of the flank and belly being assessed from the end of the brisket to the pubic section.

A specific vacuuming pattern was used. When an area on the surface of the carcase was observed to be contaminated, the head of the unit was applied over the contamination and was moved in a continuous sweeping movement across the surface

rather than being held in the contaminated area as in the spotting method for faecal material. Hereafter in this report this action is referred to as sweeping.

Visual Assessment

For each carcase, the presence of wool strands and clumps, wool fall-out (dust etc) and faecal material was assessed using a rating system developed specifically for this trial, and recorded. The scoring system is shown in Appendix 1. Assessments were made on carcases before and again immediately after vacuuming.

Microbiological Assessment

Samples for microbiological testing were collected at both locations. At each, 30 samples were collected before treatment and 30 after treatment. The samples were collected after visual assessment and generally collected alternately before and after vacuuming was applied. It was not practicable to collect before and after samples from the same sites. Samples were collected using the sponge sampling technique recommended by FSIS, (See Appendix 2). Enumerations for total viable count, coliforms and *E. coli* were performed on all of the samples as described in Appendix 2.

Results and Discussion

Visual Assessment

During the trial, 802 carcases were assessed visually at the foreleg and brisket position and a further 700 after pelt pulling. Overall, clusters of wool fibres and loose wool and /or wool dust were observed on the foreleg and brisket on 75% of the carcases after the pelts had been opened and on the flanks and bellies of 72 % of the carcases after pelting. Table 1 summarises the visual assessments before vacuuming at the two locations.

Table 1: Percentage incidence of contamination at foreleg and post-pelting positions

Location	Proportion of carcases contaminated (%)			
	Overall	Wool Dust	Wool	Faecal material
Foreleg	74.6	9.6	63	2
Pelting	72.1	33.4	37	1.7
Total	73.8	20.7	51.1	1.9

One hundred and twenty carcases were assessed visually and then sampled for microbiological testing. There was no significant difference between the pre-treatment assessment scores of the carcases selected for microbiological sampling before treatment and those selected after treatment. Reductions in microbiological counts can therefore be attributed to the effect of the vacuuming treatment and are not due to sampling carcases after treatment that had low levels of initial contamination.

After application of the vacuum treatment almost all visible contamination was removed. Of the 1502 carcases assessed before and after vacuuming with the sweeping motion, there was minor visible contamination on only fifteen carcases.

Microbiological Results

The total viable count (TVC) on carcase surfaces treated by vacuuming are significantly lower than counts on surfaces sampled before treatment. Table 2 shows the mean TVC on carcases before and after treatment at the two locations.

Table 2: Mean TVC before and after vacuum treatment

Location	Mean TVC (cfu/cm^2)		Reduction (%)
	Before vacuuming	After vacuuming	
Foreleg	1,862	645	65
After pelting	2,428	401	83
Combined locations	2,221	497	78

Overall, *E. coli* was detected in 33 (55%) of the 60 samples before treatment. However the numbers of *E. coli* on the carcases before treatment were very low. The average *E.coli* count for positive samples was 2.8 cfu/cm^2. The incidence of detection of *E. coli* decreased to 35% for samples collected after treatment.

The reductions in mean TVC and incidence of *E. coli* are due to physical removal of bacteria along with the visible contamination, and to an extent, the sanitising effect of the hot water and steam delivered by the vacuum nozzle. Samples were deliberately collected from carcase surfaces at the end of travel of the sweeping motion. There was no evidence to suggest that contamination was spread to the end of the sweeping stroke. If the vacuum nozzle spread contamination it might be expected that clusters of *E. coli* would be spread more uniformly over the swept area and the incidence of *E.coli* could increase after vacuuming. In fact the incidence of *E. coli* decreased after vacuuming .

Other observations

During the trials, the typical operational characteristics of the Vac San unit were:

- water temperature: 90°C
- steam temperature: 120°C
- vacuum: 8 in Hg (200 mm Hg)
- steam pressure: 10 psi (69 kPa)

It was noted that there was a tendency for wool strands to be caught on the water delivery jet inside the vacuum nozzle. Other fat and debris built up on some parts of the outside of the nozzle. The buildup of material inside and outside the vacuum nozzle did not appear to affect the performance but both the inside and outside of the nozzle should be cleaned and sanitised if there is any sign of accumulation of material.

Conclusions

The work undertaken at the export sheep processing plant supports the previous work carried by Australian Meat Technology in a plant processing cattle and also by Dorsa

et al. in the United States. We have demonstrated that the vacuuming unit is capable of efficiently removing visual contamination from the surfaces of sheep carcases. When used in accordance with the manufacturer's recommendations, the units are effective in removing visible contamination and decreasing the total bacterial load on the surfaces of carcases.

It is recommended that the method of application of the vacuuming equipment be dependent on the type of contamination present. A sweeping motion across the surface of the carcases is very effective for the removal of loose wool fibres and wool clusters and wool dust.

It is possible to monitor certain operating parameters of the equipment to ensure its reliability. The vacuum and steam temperature should be checked regularly and compared with the settings recommended by the manufacturer, as part of the plant's QA/HACCP program.

Acknowledgments

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References

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Dorsa, W.J., Cutter, C.N., Siragusa, G.R., Koohmaraie, M. 1996. "Microbial decontamination of beef and sheep carcasses by steam, hot water spray washes and a steam-vacuum sanitizer.' Journal of Food Protection Vol 59: pp. 127-135.

Appendix 1

Criteria for visual assessment

0	No ingesta, faecal or other material
1	No ingesta or faecal material, but fleece dust present
2	No ingesta or faecal material, but wool present (<10 strands or 1 wool
3	No faecal material, but wool present (>10 strands or >1 cluster of wool) Fleece dust present if indicated
4	Smear of faecal or other material smaller than 6 mm x 6 mm (0.4 cm2)
5	Smear of faecal or other material larger than 6 mm x 6 mm and (0.4 cm2)
6	Mass of faecal material smaller than 6 mm x 6 mm (0.4 cm2)
7	Mass of faecal material larger than 6 mm x 6 mm (0.4 cm2)

Appendix 2

Collection of Microbiological Samples

Microbiological samples were collected by the following method.

1. A special collection sponge in a whirl-pak bag was pre-moistened with 25 mL of sterile Butterfield diluent.

2. While wearing a pair of sterile gloves, the sponge was removed from the bag.

3. The sample was collected by wiping the sponge over the sampling area. The sponge was placed back into the bag, air expelled and the top was folded down.

4. Samples were placed in an esky with a Gel-Pak at 0 -2 °C. Samples were taken to the plant laboratory for testing.

5. Total viable count, coliform and *E. coli* analyses were performed on each of the samples, using 3M Petrifilm. After massaging the sponge swabs to release microbes into the diluent, 1mL samples were plated in duplicate onto Petrifilm *E. coli*/coliform films. Two dilutions of the sponge eluate were plated. Plates for TVC were incubated for up to 72 h, while those for *E. coli*/coliforms were incubated at 37°C for up to 48 h.