EFFECTIVE CLEANSING OF LIVESTOCK VEHICLES AT UK PIG ABATTOIRS

- WASH PROCESS REPORT -

PART 2 (i) October 2013
&
PART 2 (ii) December 2013

PART 2 (i) October 2013

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1. BACKGROUND & BRIEF

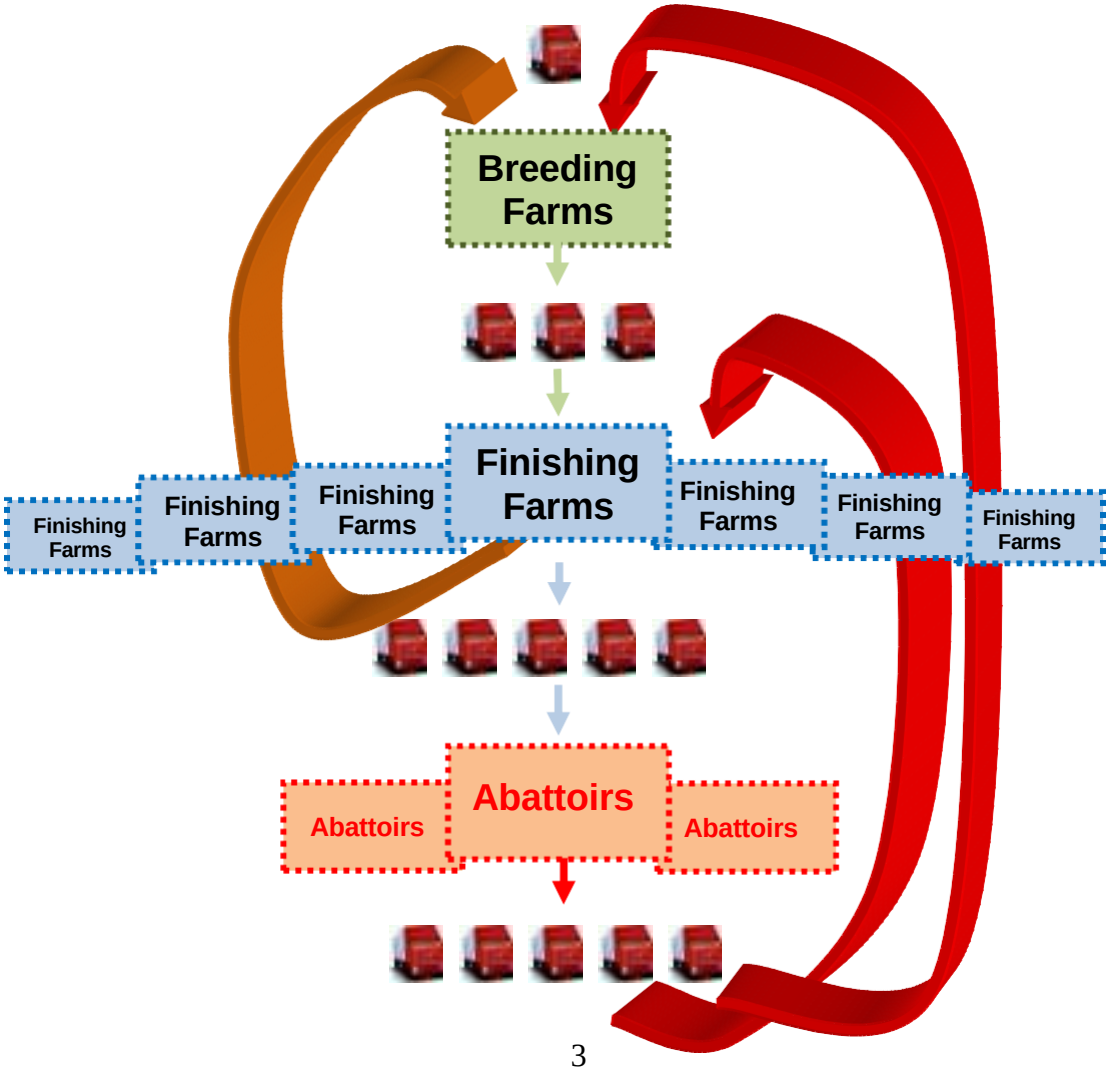
Background

This report builds on the interim report published in March 2012.

The UK pig industry is a 'just in time' supply chain. Insemination, farrowing, weaning, growing, slaughter and processing, distribution and delivery to outlet (and thereby to final customer) are highly organised and very inter-dependent. Any major disease outbreak that slows or reduces the supply of slaughter pigs quickly impacts on all links in the chain. A crucial part in maximising bio-security is the effective cleansing of livestock vehicles at abattoirs, ready built focal points for potential cross-contamination.

Whilst the pig supply chain may be considered as links a straight chain .

The bio-security of pig transportation vehicles most certainly is not .



UK abattoirs are a natural confluence of hundreds of pig livestock vehicle journeys each week. A conservative estimate is that BQAP abattoirs alone receive some 800 deliveries every week. The potential for disease transmission via ineffectively cleansed vehicles and/or the cross contamination of vehicles is self evident.

From 1st January 2012, the BQAP standard included a clause in the general requirements section as a new sub-clause 2.5, which reads: 'Adequate facilities for the cleaning and disinfection of livestock vehicles shall be available at all times commensurate with the size and number supplying the abattoir.'

From 1st April 2012, this became a fully auditable requirement.

From 1st January 2013, it became a BQAP compliance requirement that all vehicles must be effectively cleaned (using detergent) and disinfected before leaving the site. It follows that BQAP abattoirs need to provide adequate, fully functioning facilities to make this possible.

BPEX is seeking to develop an effective cleansing protocol for livestock vehicles that could be adopted by UK pig abattoirs.

The Brief

1. To measure/establish the component times to remove solids, apply a detergent soak, clean water wash to visibly clean, drain and apply an appropriate disinfectant mix for livestock vehicles at the abattoir.
2. The vehicle types to include:
    a. Artic. (triple deck).
    b. Drawbar combination.
    c. Rigid (triple deck).
    d. Small 'Ifor Williams' type.
3. A 'clean vehicle' is defined as visibly clean and disinfected.
4. 'Vehicle' is defined as "the internal livestock compartment, tailboard, belly box and cab foot well and with no obvious significant organic contamination on the vehicles wheels etc. which may be transferred onto another farm".
5. To quantify the water, detergent and disinfectant requirements involved for each vehicle type.

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2. EXECUTIVE SUMMARY

Please note: cleaning times indicated are a guide and the actual time required will depend on type of vehicle, equipment and individual completing the task.

1. It was found that the time and materials required for the effective cleaning of the trials vehicles, using straw as the vehicle bedding substrate was as follows:

a) Artic. (triple deck) - 2¼ hours and approximately 3,000 litres of detergent mix, clean water and disinfectant mix.

b) Drawbar combination (double deck) - 2 hours and approximately 2,600 litres of detergent mix, clean water and disinfectant mix.

c) Rigid (triple deck) – 1¾ hours and approximately 2,300 litres of detergent mix, clean water and disinfectant mix.

All livestock containers were of Houghton Parkhouse design.

2. There are many different vehicle surfaces, angles and profiles on which and in which soiling can occur. These require the use of lances and multi-span water hose gun from differing angles, augmented with the use of brush and broom to properly clean them.

3. Detergent mix applied through a 'foaming lance' improves adherence to surfaces and provides a highly visible coverage, crucial in helping the operator to assess the quality of coverage. Detergent needs at least 10 minutes contact time to be effective at releasing grease and penetrating stubborn dirt.

4. In order to ensure complete coverage of 'flat' surfaces when applying detergent or disinfectant, it is important that the operator uses methodical, and overlapping, horizontal sweeps of the lance. Vertical sweeps are needed on vertical edges and corners.

5. The wash process was carried out with pressurised clean water (16-20 bar as told) using a 'gun' having a variable flow and spray span. The use of a hand brush and broom during this stage of the process can assist in the removal of stubborn deposits.

6. It is possible that disinfectant may be effective on 'lightly soiled' sites but it is most unlikely to penetrate 'moderate' or 'heavy soiling'. For this reason it is crucial that every effort is made to physically remove all soiling during the clean water wash phase, ie before disinfectant is applied.

7. The disinfectant mix, which did not have a foaming agent, was applied through a foaming lance and proved only marginally more visible than clean water. In poor light or when applying to wet surfaces however, it is virtually impossible for the operator to see, and therefore to judge, coverage. Disinfectant provides the final level of security in the wash process and it is a real necessity to find a way of making the disinfectant application as visible as detergent.

To maximise effectiveness and to avoid further dilution, surfaces should, ideally, be dry but certainly have stopped running with wash water before disinfectant is applied.

8. The inaccessibility of areas below the livestock container of the lorry, noticeably the inside tyre walls, tyre tread and wheel arches, make it unrealistic to expect a driver to manually clean these effectively. A combination of detergent, mechanical brushing/high pressure water jetting and disinfecting may be the only effective solution. Out of sight, so out of mind, cannot result in a clean vehicle.

9. Perhaps the greatest industry challenge is to develop and implement a sound auditing procedure which will assess the vehicle areas posing the greatest risk to bio-security. These locations should be targeted, either routinely or randomly, immediately after wash down - rather than as vehicles leave the abattoir. If any soiling issues remain, the vehicle is still in an area where the problem can be rectified.

In the absence of robust auditing it is possible that the time taken, materials used and wash effectiveness may be proportionate to drivers' perceived time pressures!

10. Finally and importantly - Sawdust is used as the vehicle bedding substrate by the vast majority of UK pig hauliers. It has a real advantage in that it is easier to wash straight out of the vehicle using a hose, being less bulky and less prone to trappage than straw. Anecdotally, it is a common belief amongst drivers that it is significantly quicker to clean a vehicle which has a sawdust substrate. It has not been able to verify this.

It has been suggested that sawdust is safer bedding on which to transport pigs in that it tends to stay where it is sprinkled and offers better grip to standing pigs. Straw, on the other hand, is less absorbent and tends to be dispersed along the sides of the decks within a short time of pigs being loaded. Again, it has not been possible able to verify this.

NEXT STEPS:

(i) Further trials should be undertaken to compare the use of sawdust versus straw as vehicle bedding substrate, with regards to the times and materials required for effectively cleansing livestock vehicles.

(ii) It is recommended that further and ongoing training be given to drivers to explain the importance of vehicle cleanliness in the overall context of vehicle bio-security.

(iii) It is recommended that a standardised approach to the wash process be developed and introduced both operationally and for all training.

Recommendations (ii) & (iii) are unlikely to succeed without:

(i) The provision of appropriate facilities (inc. capacity and properly maintained equipment)

- and -

(ii) The full recognition that drivers need adequate time in which to carry out an effective wash process.

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3. METHODOLOGY

The Current Situation: The industry in general does not have a defined standard of 'clean', nor an objective and quantifiable method of measuring the quality of wash. The vehicle's driver undertakes the vehicle washing, and it is he/she who decides, on an ad-hoc visual basis, the final 'clean' status of the vehicle before it leaves the abattoir. Little or no third party monitoring or auditing occurs. The Interim Study (March 2012) included 122 vehicle recordings and showed huge variations in wash process times and water volumes used on vehicles deemed 'clean' by their drivers.

Standardising work is the 'Lean Thinking' way of removing variations in a process such that the product or outcome is less variable and more predictable. A process is 'standardised' when it produces a uniform outcome every time. This must be the goal for an abattoir vehicle cleaning process which, currently, is inherently variable and subjective.

In 2012 Dalehead Foods opened a new 4 bay lorry wash facility at its Spalding plant and, following trials conducted there before the new installation, kindly offered BPEX continued access to undertake more quantifiable trials.

A metering system has recently been retro-fitted to one of its 4 wash bays. This has made possible the individual metering of water, detergent mix and disinfectant mix.

The 3 predominant industry vehicle types were used in the trials, namely:

- Triple deck artic'.
- Triple deck rigid.
- Double deck drawbar and trailer combination.

The above were included in the trials. To date, however, it has not been possible to trial the small 'Ifor Williams' type trailer at an abattoir with suitable wash facilities.

Volunteer drivers were identified as regular users of the 3 specific vehicle types targeted. Drivers were briefed before the trials and aware that an audit process would be carried out after the wash phase of the process and before disinfection; this being the point at which the vehicles should be visually clean.

All vehicles in the Spalding trials used straw as the bedding substrate for transporting the pigs and the trials data is therefore based on this. It is recognised however, that the overwhelming majority of UK pig hauliers use wood 'shavings' (sawdust) as bedding substrate. Sawdust has a real advantage in that it is easier to wash straight out of the vehicle using a hose, being less bulky and less prone to trappage than straw. Anecdotally, it is a common belief that it is significantly quicker (20-30 mins.) to clean a vehicle which has a sawdust substrate. It has not been possible to verify this.

It has also been suggested that it is safer bedding on which to transport pigs in that it tends to stay where it is sprinkled and offers better grip to standing pigs. Straw, on the other hand, is less absorbent and tends to be dispersed along the sides of the decks within a short time of pigs being loaded. Again, it has not been possible to verify this.

The Wash Process

The effective cleansing of a livestock vehicle is already recognised as involving 4 distinct process stages and this process was adopted for the trials:

i. The removal of all solid manure including straw or shavings to ensure that the subsequent detergent application can directly reach all surfaces.
ii. A detergent soaking stage to penetrate and loosen surface grease and muck/dirt, with a minimum of 10 minutes soaking time before washing.
iii. A wash stage using pressurised clean water (with hand brushes and brooms as necessary), to physically remove all visible remaining muck/dirt loosened by the detergent application.
iv. The application of disinfectant to all cleaned, drained surfaces.

It is also recognised that a combination of detergent and hot water would be more effective at removing grease and dirt than using detergent and cold water. However, the absence of hot water at UK abattoir vehicle washes has meant that it has not been possible to trial this approach.

Why is the initial removal of 'Solids' necessary?
Detergent can only act on surfaces to which it is exposed. For detergent to act effectively on underlying grease and stubborn muck/dirt, all substrate needs to be removed before a detergent mix is applied. To save wash-bay time, whether straw or sawdust is used, this should be pushed to the rear of the vehicle, deck by deck, as pigs are unloaded. It can then be simply pushed onto the ramp before each deck is soaked with detergent. In some situations, a brief pre-soak with water will assist final pushing-out before the detergent soak.

Detergent needs a contact time of at least 10 minutes in order to loosen grease and dirt from surfaces. A foaming lance ensures thorough, highly visible coverage to the driver and, when applied as foam, clings to surfaces enhancing potential contact time.

Detergent applied through a 'foaming lance' improves adherence to surfaces and provides a highly visible coverage.

Once detergent has had sufficient contact time, it must be washed off all surfaces and those surfaces allowed to drain and, ideally, to dry before applying disinfectant. Applying disinfectant to wet surfaces dilutes it, reducing its effectiveness and, if still draining, wash water will carry the disinfectant away from the intended contact areas.

It is possible that disinfectant may be effective on ‘lightly soiled’ sites but it is most unlikely to penetrate ‘moderate’ or ‘heavy soiling’. For this reason it is crucial that every effort is made to physically remove all soiling during the clean water wash phase, ie before disinfectant is applied, so that when it is applied it has the best possible contact opportunity with all surfaces. During the wash phase, the use of hand brushes or brooms can help to remove more stubborn deposits.

Operator removes all visible soiling with a clean pressurised water wash.

Operator disinfects the washed and drained vehicle using a ‘foaming lance’.

The disinfectant application needs at least the same degree of visibility as the foaming lance provides for detergent. In poor or fading light, (e.g. reduced daylight hours), it is not easy for an operator to see whether any areas have been missed.

- It is strongly recommended that a colour or foaming agent is sought which can be added to the disinfectant mix.

- To ensure complete coverage of 'flat' surfaces when applying detergent or disinfectant, it is recommended that the operator uses methodical, overlapping, horizontal sweeps. Vertical sweeps are needed on vertical edges and corners.

Auditing the Wash Process

The primary objective of the project was to establish the time needed to effectively clean vehicles. A method of measuring the effectiveness (quality) of the wash process was therefore needed. It was recognised that it would not be feasible to take swabs from vehicles to assess their pathological status as this would be too expensive, time consuming and unlikely to form part of any commercial approach. It was also important that the drivers collaborating in the trials would fully understand the objective and engage positively with the project.

A simplified procedure was adopted using white cotton gloves to check for cleanliness at a series of random points inside and outside the vehicle and within the driver's cab. After the driver had cleaned the vehicle, but before any disinfectant was applied, white gloved finger tips were wiped across 8 of 24 possible pre-identified points (unknown to the driver), to assess the level of any soiling remaining on the vehicle.

A simple scoring system was used thus:

Clean glove – score 0
Light soiling – score 10
Moderate soiling – score 20
Heavy soiling – score 30

A 'bench mark' glove (see below) was established by pre-loading a glove with the appropriate levels of soiling. A laminated photograph of this was used against which to assess vehicle audit samples. The white glove method, whilst not perfect, gave an immediate and objective assessment of the visual cleanliness of the audited points. This approach worked very well in practice and gave an immediate indication of the level of cleanliness whilst not delaying the wash down procedure. However, on very dry surfaces, especially areas that had been cleaned and had time to dry, or areas that had not been wetted at all (i.e. not cleaned!), a good sample was more difficult to obtain.

'White Glove' samples offer a simple, quick and visual outcome.

A selection of 8 sample points per vehicle was made randomly ahead of the trials but every audit included audit points 1, 2, 3 and 4; these being perceived as high risk locations.

Example:

<u>Audit Point 3</u>: Middle deck, compartmental gate locking mechanism (2nd gate from rear).

A list of the specific locations of all 24 audit points, together with photographs of each, is included in Appendices (i) and (ii).

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4. FINDINGS

Vehicle Wash Auditing Results

Preliminary Abattoir - Audit Scores for 11 Vehicles Sampled 12 & 13.11.12																								
Trial Ref.	<< Sample Location No. >>																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
T1	0	30	10	0					10				10				10					30		
T2	0	10	0	10	10						10			0									10	
T3	0	20	0	0		0									10				10		30			
T4	0	10	10	0			0			0						10								10
T5	10	10	10	0				0				0						10		30				
T6	10	20	10	0					0				10				30					20		
T7	10	10	20	0	10						20			20									10	
T8	0	0	0	0		0									0				10		30			
T9	0	n/a	10	0			0			20						10								30
T10	10	n/a	0	0				0				20						20		30				
T11	0	0	0	0					0				20				20					10		

Dalehead Foods (Spalding) - Audit Scores for the 11 Vehicles Sampled 31.07 to 20.09.13																								
Trial Ref.	<< Sample Location No. >>																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SP1	0	10	0	0					10				0				0					30		
SP2	10	10	10	0	0						0			0									0	
SP3	0	30	10	0		0									0				0		0			
SP4	0	20	0	0			0			0						0								0
SP5	0	30	0	0				0				0						0		0				
SP6	0	10	0	0					10				0				10					10		
SP7	0	10	0	0	0						0			0									0	
SP8	10	30	0	0		0									10				10		30			
SP9	10	30	0	0			0			0						20								30
SP10	0	10	0	0				0				0						0		20				
SP11	10	10	0	0					0				0				0					30		

Summary of Audit Results		No Soiling	Light Soiling	Moderate Soiling	Heavy Soiling
Preliminary Abattoir	Vehicles washed with clean water (only) prior to audit sampling. Drivers aware that auditing would be conducted.	41.9%	36.0%	12.8%	9.3%
Dalehead Foods (Spalding)	Vehicles subjected to a detergent soaking phase prior to clean water washing and audit sampling. Drivers aware that auditing would be conducted.	73.2%	19.6%	1.8%	5.4%

The ‘Preliminary Abattoir’ was selected on the grounds that the wash facility is considered typical of many UK abattoirs. The cleaning part of the wash process at this abattoir involves the use of clean water only i.e. no detergent. Average load size and, allowing for sawdust substrate being used, wash times are similar to those of Dalehead Foods Spalding in Dec. 2011 - Jan. 2012, before the new wash facility was installed.

- On vehicles having had a detergent soak applied before the washing phase, **73%** of the points sampled showed ‘no visible’ soiling, whereas on vehicles having had no detergent soak only **42%** of the points sampled showed ‘no visible’ soiling.

- On vehicles having had a detergent soak applied before the washing phase, **7%** of the points sampled showed ‘moderate’ or ‘heavy’ soiling, whereas on vehicles having had no detergent soak, some **22%** of the points sampled showed ‘moderate’ or ‘heavy soiling.

The two most contaminated locations were inside the belly box and the mudguards of the livestock container.

The high level of soiling recorded for the belly box is associated with the ‘normal’ operating procedure of most of the drivers. Personal protective equipment (PPE), such as boots and overalls, is often stored in a dedicated plastic box or crate kept within the belly box when not in use. During the cleaning procedure drivers remove the plastic box from the belly box, then clean and disinfect it while it is on the ground outside the vehicle. The belly box itself, which is what is sampled, was never seen to be cleaned so the high audit scores reflect the accumulated level of dirt over, probably, many weeks or months. With some thought it should be possible to reduce most belly box scores to zero and, thereby, change the overall audit picture dramatically. For example, if one water-tight lidded plastic box were to be used for PPE and another for personal clothing, they could be removed at each wash for the belly box to be cleaned. This same PPE may well be used when loading/un-loading at the next farm and, if stored loose in an unclean belly box, will be a potential high risk source of cross-contamination to those pigs.

The other area where high audit scores were recorded regularly during auditing, and consistently observed on other vehicles, were the spray suppression systems (e.g. ‘*cats’ whiskers’*) on the vehicle mud flaps. Clearly these are designed to catch water from the wheels, rather than dispersing it straight onto the road, thus making driving safer for other road users. However, these designs also tend to trap dirt which is then very difficult to remove as unimpeded access to the flaps across their full width is not feasible. This is, presumably, not seen a big problem in general haulage but for the livestock industry, interested in maximising bio-security, it most certainly is. The problem was observed to be worse after a rainy day where the soiling had penetrated deeper into the spray suppression material.

- It may be that an alternative design e.g. a series of vertical blade ridges across the inside of the mud flap might still reduce lateral spray and would be far easier to clean; something for the EEC livestock industry to challenge?

One further area of concern on vehicles, not originally identified and therefore not included in the auditing list, was that of nipple drinkers. It was observed on a number of occasions after cleaning that, although the outer surface of the drinker was clean, there was still a high level of contamination within the body of the drinker itself.

- It is recommended, in any future planned auditing, that this location is included.

The design of modern livestock vehicles does not lend them to easy cleaning as they feature many 'trappage points' where both gross contamination (e.g. straw wrapped around hinge points) and general soiling can occur within the vehicle. In addition, there are many other areas on the outside of the vehicle where there is further potential for the accumulation of dirt and muck.

The nature of the transport operation means that vehicles operate in 'hostile' environments where contamination must be expected. However, it is of paramount importance that all vehicles are thoroughly cleaned to reduce the potential risk of disease transmission between farms. This becomes even more critical where a vehicle is to be used to transport weaner pigs following a movement of pigs for slaughter.

- It is recommended that hauliers enter into dialogue with lorry/livestock container builders to encourage them to focus more of their design attention towards making effective cleaning easier.

- It is recommended that further and ongoing training be given to drivers to explain the importance of vehicle cleanliness in the overall context of vehicle bio-security.

- It is recommended that a standardised approach to the wash process be developed and used operationally and for all training.

  These last two recommendations need to go hand in hand with:

  (iii) Providing the correct facilities (inc. capacity and fully maintained equipment)

  and

  (iv) Providing the time in which to carry out an effective wash process.

If commercially feasible there would also be benefit if, periodically, each vehicle could be given a thorough clean using steam cleaning to remove any accumulated dirt. This approach may make the routine wash process easier and more effective. There may be a cumulative benefit of the detergent soaking phase for successive washes.

- Perhaps the greatest industry challenge is to develop and implement a sound auditing procedure which will assess the vehicle areas posing the greatest risk to bio-security. These locations should be targeted, either routinely or randomly, immediately after wash down, rather than as vehicles leave the abattoir. If any soiling issues remain, the vehicle is still in an area where the problem can be rectified.

In the absence of robust auditing it is possible that the time taken, materials used and wash effectiveness may be proportionate to drivers' perceived time pressures!

Time and Materials Usages

Please note: cleaning times indicated are a guide and the actual time required will depend on type of vehicle, equipment and individual completing the task.

Trials to establish cleaning times and materials usages were conducted at Dalehead Foods (Spalding). As described earlier, to assess the quality of the wash process a degree of objectivity was introduced using the white glove auditing technique. However, the time taken by the driver, and the materials used to arrive at 'visibly clean', was left to the drivers' discretion, in the knowledge that an audit would follow.

It is the 'Lean Thinking' way to determine the time requirement to carryout a task as that necessary for a trained operator working at a normal pace ie at a pace which could be maintained throughout the working day.

Inevitably, with a relatively low number of trial washes recorded, variations in time taken and materials used were to be expected and this proved to be the case. Nevertheless, the reasons behind the variations in the data were largely understood and there can be confidence that the general findings and recommendations are appropriate for most conditions. To arrive at these, a combination of trials data (inc. video), proportionate vehicle sizes, number of deck movements, together with observations of speed of work and thoroughness has been used.

The following recommendations assume:

a) Straw substrate is used and that this it is not permitted to direct this into the drainage system.
b) A full load situation requiring the vehicle to have used all decks and sections.
c) 'Pushing-out' of solids to the rear of containers is conducted at the lairage, the time for which is excluded. 'Pushing-out' time includes clearing muck from the ramp into a container.

Vehicle Type:	Artic. x3 Decks		Drawbar Combination x2 Decks		Rigid x3 Decks	
Time Required:	2¼	Hrs	2	Hrs	1¾	Hrs
Materials Required:	3020	Lts	2560	Lts	2320	Lts
Detergent mix (2%)	300	Lts	270	Lts	250	Lts
Water (clean)	2400	Lts	2000	Lts	1800	Lts
Disinfectant mix (1%)	320	Lts	290	Lts	270	Lts

Using the BMPA load density limits for 100kg live weight pigs for the respective vehicles above the materials utilisations are as follows:

Artic. = 1330 lts /100 pigs.
Drawbar Combination = 1530 lts /100 pigs.
Rigid = 1560 lts /100 pigs.

Within the above table the following time approximations can be apportioned:

- 9% to preparation, pushing-out and put-away of equipment.
- 19% to applying detergent.
- 54% to clean water washing.
- 18% to applying disinfectant.

Clearly, the time taken to effectively clean a vehicle will be affected by several factors. For example, pig numbers, pig health and journey times have a bearing on the degree of dirtiness of vehicles arriving at the abattoir, as will the state of the roads and farm tracks. In hot weather muck can get 'baked' onto vehicle surfaces making it more difficult to remove.

One other caveat worthy of mention is that these processes, times and materials recommendations cannot guarantee that the wheels, mud flaps and even more inaccessible areas will be clean. In the conclusions contained within the Interim Report it was noted that:

- *"The inaccessibility of areas below the livestock container of the lorry, noticeably the inside tyre walls, tyre tread and wheel arches, make it unrealistic to expect a driver to manually clean these effectively. We believe that a combination of detergent, mechanical brushing/high pressure water jetting and disinfecting may be the only effective solution. Out of sight, so out of mind, cannot result in a clean vehicle."*

The risk associated with this fact needs to be assessed by qualified professionals.

Recommended Wash Process

The following recommended process order is specifically for a triple deck artic. with an 'over-step' swan-neck front section. This process order can be applied to all vehicles and adapted to the differing configurations by removing any steps that are not applicable.

Note: For the purposes of cleaning the inside of drawbar combinations, the lorry and trailer should be treated as if they were 2 separate rigid vehicles. However, in order to improve detergent contact time during cleaning, it is recommended that the outsides are treated as if the two containers were one and cleaned at the same process stage. Thus, the outsides of the lorry and trailer should receive a detergent application, be clean water washed and disinfected after the insides of both containers have been completed.

- It is recommended in making progress towards standardising the wash process, that the uppermost deck, container roof and inside walls are treated at the same stage of the process. Similarly, the ramp and ramp gates should be treated at the same process stage as the bottom deck.

	AT LAIRAGE:		
1	Push-out 'solids' to rear of each deck as pigs are unloaded. Note: Restrictive ceiling heights on some vehicles may make it impracticable to push-out the bottom deck at the lairage.		
	AT WASH BAY:		
2	**Preparation:** Locate vehicle in wash bay, exit cab, remove foot-well mat, walk to belly box, remove PPE container(s), put on PPE and open up container.		
	NB - In the interests of brevity in the table below, where a particular deck is referred to, it includes associated ceilings, side walls and internal gates.		
	ACTION	**AREA OR VEHICLE**	**DECK POSITIONS**
	(i) Container interior:		
3	**Push-out**	Top main deck onto ramp	All down
4	**Detergent**	Top front deck	
5	**Detergent**	Middle front deck	
6	**Detergent**	Top main deck	
7	Raise top and lower middle deck		
8	**Push-out**	Middle deck onto ramp	
9	**Detergent**	Middle deck and ceiling	
10	Raise middle deck		All up
11	**Push-out**	Bottom main deck onto ramp	
12	**Push-out**	Ramp into container	
13	**Detergent**	Bottom front deck	
14	**Detergent**	Bottom main deck, ramp and ramp gates	
15	Lower all decks		All down
16	**Wash**	Top front deck	
17	**Wash**	Middle front deck	
18	**Wash**	Top man deck,	
19	Raise top and lower middle deck		
20	**Wash**	Middle main deck	
21	Raise middle deck		All up
22	**Wash**	Bottom front deck	
23	**Wash**	Bottom main deck, ramp and ramp gates	
24	**Wash**	Concrete (prevents treading muck back into vehicle)	
25	**Disinfect**	Bottom front deck	
26	**Disinfect**	Bottom main deck	
27	Lower middle deck		
28	**Disinfect**	Middle main deck	
29	Raise middle and lower top deck		All down
30	**Disinfect**	Top front deck	
31	**Disinfect**	Middle front deck	

32	**Disinfect**	Top main deck	
33	**Disinfect**	Ramp and ramp gates	
34	Close up container		
	(ii) Vehicle Exterior:		
35	**Detergent**	External surfaces	
36	**Wash**	External surfaces	
37	**Disinfect**	External surfaces	
	Clean & Put-away:		
38	Final rinse concrete, stow fork/broom/squeegy/shovel etc.		
39	Wash and disinfect PPE, stow hose and lance(s), re-stow PPE in lidded box in belly box, return foot-well mat to cab		
40	Exit lorry wash		

The above process clearly shows the inside of the container being washed first. However, there may be an argument for reversing this based upon the perceived risk to the next load of pigs. By washing the outside last it is possible that some contaminated material will be forced into the container through the vents. This is of less significance if the next load to be carried is slaughter pigs. However, if the next load is a transfer of weaners to a finishing farm, it might be worth considering cleaning the outside first so that the process order improves the chances of leaving the inside clean.

A sobering thought

Porcine Epidemic Diarrhea virus (PDEv) is spread by ingesting contaminated faeces. It has been reported in America, in a study into transmission of PDEv by vehicle transportation, that more vehicles left abattoirs contaminated with PDEv than came into those abattoirs contaminated with PDEv!

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5. Appendices

Appendix (i) List of Audit Point Locations.

The 24 audit points below (with accompanying photographs) were chosen to reflect the areas of perceived greatest risk and to take in a range of points throughout vehicles.

Audit Points and Descriptions	
1	Outer tailgate ground contact point (midpoint of edge of offside hoop if present)
2	Belly box containing PPE (midpoint of junction of front most wall and floor)
3	Middle deck compartment gate (2nd gate in from rear, gate lock mechanism)
4	Middle deck floor (front section, 1m back from front wall and 1m from offside wall)
5	Outer tailgate external surface (1m up from lower edge and 1m from nearside)
6	Outer tailgate internal surface (1m up from lower edge and 1m from nearside)
7	Inner tailgate external surface (1m up from lower edge and 1m from nearside)
8	Inner tailgate internal surface (1m up from lower edge and 1m from nearside)
9	Inner tailgate lower edge (1m from nearside)
10	Inner tailgate hinge to vehicle body (uppermost hinge)
11	Lowest deck floor (beneath 2nd gate in and 1m from nearside)
12	Cab foot well or mat if present (midpoint)
13	Top deck ceiling (midpoint between 1st and 2nd gate)
14	Deck wall external surface (top of lowest guard rail above centre point of rear nearside mudguard)
15	Middle deck wall internal surface (midpoint between tailgate and compartmental gate, 0.5m from floor)
16	Cab pedals (centre of brake pedal)
17	Cab wheels (front nearside wheel immediately above highest wheel nut)
18	Livestock container wheels (rear offside wheel immediately above highest wheel nut)
19	Cab tyres (front offside tyre at “3 o’clock” and centre of tread)
20	Livestock container tyres (rear nearside inner tyre at ‘9 o’clock’ and centre of tread)
21	Cab mud flap (lowest inside midpoint of rear of rear offside mud/spray guard)
22	Livestock container mudguard (lowest midpoint inside front of front nearside mud/spray guard)
23	Cab front surface (midpoint of front number plate)
24	Surface below Livestock container (surface beneath of container edge 1m forward from nearside rear of container)

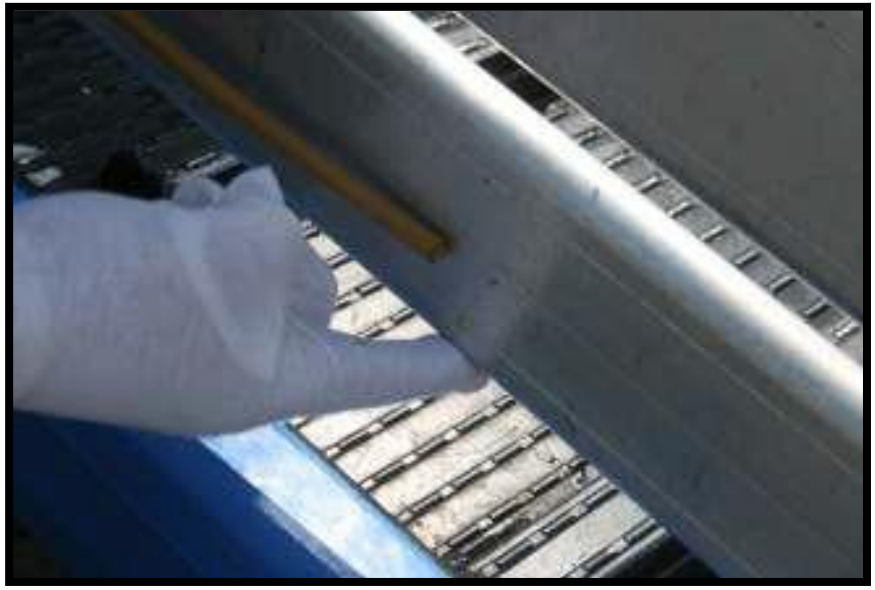
Appendix (ii) Photographs of Vehicle Audit Locations.

Location of audit point 1 (above) and audit point 2 (below).

Location of audit point 3 (above) and audit point 4 (below).

Location of audit point 5 (above) and audit point 6 (below).

Location of audit point 7 (above) and audit point 8 (below).



Location of audit point 9 (above) and audit point 10 (below).

Location of audit point 11 (above) and audit point 12 (below).

Location of audit point 13 (above) and audit point 14 (below).

Location of audit point 15 (above) and audit point 16 (below).

Location of audit point 17 (above) and audit point 18 (below).

Location of audit point 19 (above) and audit point 20 (below).

Location of audit point 21 (above) and audit point 22 (below).

Location of audit point 23 (above) and audit point 24 (below).

Appendix (iii) Dalehead Foods (Spalding) Times & Materials Usages.

1) Swan-neck Artic x3 Decks

Approx. total surface area of vehicle container(s) (inside and outside) to be cleaned (ex. cab, wheels & chassis) 485 sq. mts (6 axles)

		Prep & P/A	PUSH	DET. (2%)		WASH (water)		DIS. (1%)		TOTALS	
Trial	Decks used:	Mins.	Mins.	Mins.	Lts.	Mins.	Lts.	Mins.	Lts.	Mins.	Lts.
SP3	3 main + bottom front	4	9.5	20.5	188	51	1936	18	234	103	2358
SP5	2 main + bottom front	0	7	17	181	47	1778	16	203	87	2162
SP7	All 6 sections	4	4	17	246	72	2266	15	309	112	2821
SP10	3 main + 2 lowest front	2	7	24.5	506	68.5	2500	26	360	128	3366

2) Drawbar Combination x2 Decks

Approx. total surface area of vehicle container(s) (inside and outside) to be cleaned (ex. cab, wheels & chassis) 465 sq. mts (5 axles)

		Prep & P/A	PUSH	DET. (2%)		WASH (water)		DIS. (1%)		TOTALS	
Trial	Decks used:	Mins.	Mins.	Mins.	Lts.	Mins.	Lts.	Mins.	Lts.	Mins.	Lts.
SP2	All decks.	5.5	19.5	15.5	214	48	1758	20.5	340	109	2312
SP4	All decks.	7	5	16	127	44	1490	15	195	87	1812
SP8	All decks.	10	5	23	243	47.5	n/a	14	189	99.5	n/a
SP11	All decks.	10	5	15	199	54.5	2005	16	225	100	2429

3) Rigid x3 Decks

Approx. total surface area of vehicle container(s) (inside and outside) to be cleaned (ex. cab, wheels & chassis). 330 sq. mts (3 axles)

		Prep & P/A	PUSH	DET. (2%)		WASH (water)		DIS. (1%)		TOTALS	
Trial	Decks used:	Mins.	Mins.	Mins.	Lts.	Mins.	Lts.	Mins.	Lts.	Mins.	Lts.
SP1	All decks.	1	16	22.5	240	55	1897	24.5	252	119	2389
SP6	All decks.	0	13	29	282	62	2052	21	255	125	2589
SP9	All decks.	8	12	24	301	67	n/a	21	389	131	n/a

Appendix (iv) Multi-span Water Hose Gun & Foaming Lance.

Multi-span water hose gun, operating at a pressure of 16-20 bar and having a variable flow and spray span, used to wash and rinse after the detergent application.

Foaming Lance used for applying a detergent mix (prior to the clean water wash/rinse), and the disinfectant application after the wash/rinse phase.

- WASH PROCESS REPORT -
PART 2 (ii)

STRAW - v - SAWDUST SUBSTRATE COMPARISON

December 2013

PART 2 (ii) December 2013

TABLE OF CONTENTS:

1. BACKGROUND & BRIEF

Background

Following provisional delivery of the first section of this report in October 2013, additional trials work was commissioned.

Recommendation 10 of the October 2013 reports reads:
"Finally and importantly - Sawdust is used as the vehicle bedding substrate by the vast majority of UK pig hauliers. It has a real advantage in that it is easier to wash straight out of the vehicle using a hose, being less bulky and less prone to trappage than straw. Anecdotally, it is a common belief amongst drivers that it is significantly quicker to clean a vehicle which has a sawdust substrate. It has not been able to verify this.

It has been suggested that sawdust is safer bedding on which to transport pigs in that it tends to stay where it is sprinkled and offers better grip to standing pigs. Straw, on the other hand, is less absorbent and tends to be dispersed along the sides of the decks within a short time of pigs being loaded. Again, it has not been possible to verify this."

The Brief

To measure/establish the component times to remove solids, apply a detergent soak, clean water wash to visibly clean, drain and apply an appropriate disinfectant mix for: a) Straw and b) Sawdust bedding substrates.

- -

2. EXECUTIVE SUMMARY

Summary of Findings for Sawdust versus Straw Substrate:

1. Pushing-out times were 6 minutes (33%) quicker for sawdust, by 2 minutes at the lairage and 4 minutes at the wash bay and the process was easier for the operator.

2. The wash process was quicker by an average of 12½ minutes (12%) for sawdust.

3. Water usage was lower for sawdust by some 230 litres per wash (11%).

4. Detergent use was 10% less for sawdust.

5. Total fluid volumes used were 250 litres less for sawdust.

It is a reasonable assumption that savings would be proportional for other types of vehicle.

To put the results into context:

For an abattoir slaughtering 15,000 pigs per week -

- The abattoir could expand its slaughter numbers by approx. 1800 pigs per week with the same wash bay capacity and fluid usage.

Or -

- The abattoir could reduce usage of clean water by some 19,000 litres per week and save the equivalent in effluent treatment.
- The abattoir could reduce the time needed at the wash bay by over 15 hours per week.

Other observations:

Fluid usage could be reduced by ensuring that hoses and lances are switched off when not being intentionally directed to the wash process. Particularly in the case of straw substrate, fluid usage, and possibly time, could be further reduced by the judicious use of brooms or squeegies, rather than the hose, on stubborn or clumped material.

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3. METHODOLOGY

The vehicle type used was a triple deck artic. and the livestock container was a Houghton Parkhouse design. For each trial pigs were transported using the 3 main decks and only the bottom 2 front ‘swan-neck’ decks. These trials are not, therefore, directly comparable with those in the earlier section of this report.

The same driver and vehicle were used for each trial, with similar pig numbers and journey distances. In all other respects the cleaning methodology and auditing were the same as in the main section of this report.

Two trials were conducted each day with the substrate being alternated over the first and second loads for each of 3 days trials. For the trials using sawdust as bedding substrate, two bags of sawdust (approx. 36kgs in total) were used for each load, evenly distributed across the decks in use. In the sawdust trials, straw was used on the ramp to encourage the pigs to load. It was considered impracticable to weigh the straw in the straw substrate trials. However, photographs of both substrates at various stages of the process are included later in this report.

It can be seen, in the earlier section of the report, that ‘solids’ (excrement and substrate combined) should be removed (pushed-out) from the deck surfaces before the detergent application is applied. At UK pig abattoirs the wash bay is often a bottleneck for hauliers. In order to minimise time at the wash bay, much of the pushing-out (to the rear of each main deck) can be carried out, deck by deck, as the pigs are unloaded. It should be noted that this can be achieved such that pigs being moved from the front to rear of the lorry always walk over a deck surface with substrate in place. It was felt important to quantify the work content (time needed) for this operation in order to understand any potential adverse effects on unloading throughputs at the lairage.

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4. FINDINGS

Vehicle Wash Auditing Results

Following the clean water wash phase of the process, the vehicle was audited using the 'white glove' method to measure visual cleanliness.

SAWDUST Substrate - (Audit Scores 21.11.13 to 03.12.13)																							
Trial Ref.	<< Sample Location No. >>																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SP12	10	30	0	0	0						0			10									10	
SP15	0	30	0	0				0				0						20		10				
SP16	0	30	0	0					0				0				0					30		

Key: 0 = No Visible Soiling 10 = Light Soiling 20 = Moderate Soiling 30 = Heavy Soiling.

STRAW Substrate - (Audit Scores 21.11.13 to 03.12.13)																								
Trial Ref.	<< Sample Location No. >>																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SP13	0	30	10	0		0									0				10		10			
SP14	10	30	0	0			0			10						20								30
SP17	0	30	0	0	0						0			10									20	

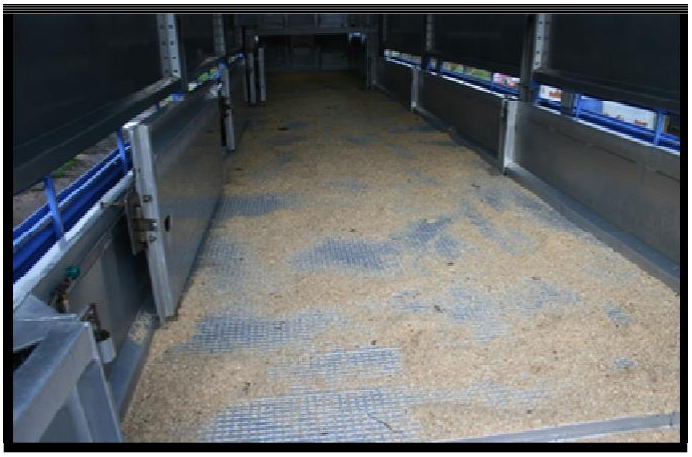
There was no noticeable difference in the visible standard of cleaning achieved between the substrates. In common with earlier results, the areas of highest contamination were inside the belly box and other areas below the livestock container itself.

Substrate & Pushing-out Comparisons

The photos below show a visual comparison of the two substrates in place on the decks at loading. If sawdust substrate is used on the decks, some straw may be needed on the tail ramp to encourage pigs to walk onto the vehicle although, anecdotally, this is not always necessary.

Bottom front deck: **Sawdust**

Bottom front deck: **Straw**



Top main deck through to bottom front: **Sawdust**

Pigs loading over top main deck towards front bottom deck: **Straw**

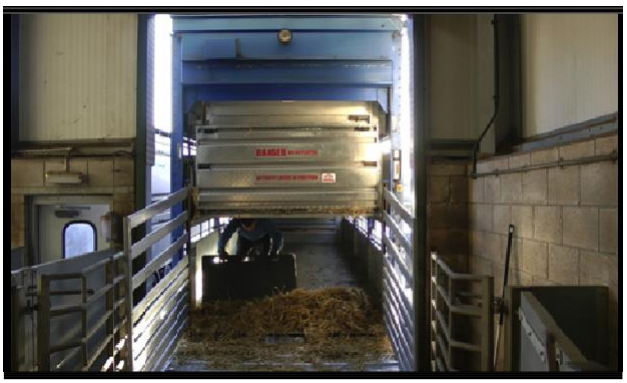
The Pushing-out Process

(i) Lairage Push-out

At the lairage, the operator used a combination of wide broom and pig board to push the solids to the rear of each main deck, as pigs were unloaded; the solids remained on the vehicle.

The photographs below show comparisons, on a deck by deck basis, of volumes of sawdust and straw pushed out at the lairage.

Bottom main deck: **Sawdust**



Bottom main deck: **Straw**

Middle main deck: **Sawdust**

Middle main deck: **Straw**

Top main decks plus two lower front decks: **Sawdust**

Top main decks plus two lower front decks: **Straw**

(ii) Wash Bay Push-Out

The accumulated substrate at the rear of the decks was forked and/or shovelled into plastic pallet containers at the wash bay.

Pushing- out Times

Trial Ref.	Journey (kms)	No. Pigs	Deck Substrate	PUSH-OUT at LAIRAGE Mins.	PUSH-OUT at WASHBAY Mins.
SP12	110	193	SAWDUST	8.0	4.0
SP15	102	201	SAWDUST	7.0	4.5
SP16	119	202	SAWDUST	7.5	4.0
	110	199	< Average >	7.5	4.2
SP13	92	200	STRAW	10.0	8.5
SP14	119	203	STRAW	9	8.0
SP17	85	213	STRAW	9	8.5
	99	205	< Average >	9.3	8.3

Despite it only being possible to carryout 3 iterations of each substrate, the push-out data was remarkably consistent for each.

The push-out process for sawdust was one third quicker than for straw.

It can be seen from the photographs above that there is considerably more bulk of straw substrate needed to provide adequate deck coverage as opposed to sawdust. Additionally, there is a tendency for straw to become trapped around almost any obstacle it comes into contact with. Both of these factors result in longer push-out times: for straw averaging 6 minutes per load, of which approx. 2 minutes is at the lairage and 4 minutes at the wash bay. At lairage and wash bay, pushing out sawdust appeared to be noticeably easier for the driver.

Sawdust is more absorbent than straw and, arguably, provides better grip under foot.

It should be noted that push-out times at the lairage are not additional to the actual unloading times. It is estimated that some 75%+ of pushing-out can be carried out whilst pigs are being marshalled in the lairage, particularly with sawdust. This may add, therefore, possibly 2 minutes to the unloading process but will save approximately 6 minutes at the wash bay.

Wash Process Times & Fluid Usages.

As mentioned earlier, the wash process followed the same format as detailed in the earlier part of this report.

	KMS	PIGS		Prep & P/A	P/Out Wash bay	DET. (2%)		WASH (water)		DIS. (1%)		TOTALS	
				Mins.	Mins.	Mins.	Lts.	Mins.	Lts.	Mins.	Lts.	Mins.	Lts.
SP12	110	193	**SAWDUST**	2.5	4.0	15.0	185	49.0	1693	17.0	270	87.5	2148
SP15	102	201	**SAWDUST**	2.5	4.5	14.5	207	49.0	1362	16.0	270	86.5	1839
SP16	119	202	**SAWDUST**	2.5	4.0	18.5	218	59.5	1588	16.5	270	101.0	2076
	110	**199**	**< Average >**	2.5	4.2	16	203	53	1548	17	270	92	2021
SP13	92	200	**STRAW**	2.5	8.5	16.0	222	62.0	1984	16.5	270	105.5	2476
SP14	119	203	**STRAW**	2.5	8.0	16.0	206	60.0	1708	17.5	270	104.0	2184
SP17	85	213	**STRAW**	2.5	8.5	19.0	242	58	1649	15.5	270	103.5	2161
	99	**205**	**< Average >**	2.5	8.3	17	223	60	1780	17	270	105	2274

Notes:

(i) The disinfectant line meter was unserviceable for trials SP14 to SP17 inclusive. However, neither disinfecting times nor volumes should be affected by vehicle substrate. A notional volume of 270 litres has therefore been used for all the trials. Accordingly, although actual disinfecting times have been shown for interest, for the purposes of comparing substrates, a common time of 17 minutes has been used for both.

(ii) With the small sample size possible, it was to be expected that some relatively wide variations would occur. It will be seen in the table above that litres/minute are not constant for any particular phase of the wash. Recorded times were to the nearest ½ minute and deck movement times were not necessarily recorded on a like for like part of the process and raising and lowering may have been separated or combined. Additionally, the water gun used for the wash phase has a variable flow rate which is controlled at the discretion of the operator. Times taken to wash the concrete also varied. These factors, not withstanding, it is the opinion of the authors that the summary times and fluid usages used are realistic of those needed.

Results:

(i) A time saving of around 12 minutes in the wash process was recorded using sawdust as opposed to straw substrate.

(ii) Detergent mix usage was approximately 20 litres more when using straw.

At first thought, it would seem that there should be no difference in the time taken for the detergent phase, or in detergent volumes used, for either substrate. However, it can be seen in the table below that some 10% more detergent was used for straw substrate. It is thought that this could be due to the fact that straw push-out at the lairage is a less complete process than for sawdust which may result in the temptation for the operator to remove any trapped straw at the first opportunity i.e. with the detergent spray. This may, therefore, point to an unexpected saving of detergent if using sawdust.

(iii) A saving of around 250 litres of clean water was recorded for the wash process where sawdust had been used.

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Acknowledgements

The authors are grateful to Dalehead Foods (Spalding) for taking part in and facilitating the lorry wash project. Thank you, also, to BQP management and logistics for their help in making the wash bay facilities available to us and in scheduling the vehicles.

Particular mention should be made of the Nelson's livestock drivers whose enthusiastic inputs, patience and good humour contributed greatly towards the conduct and success of the wash trials.

David Salvage

LEANING forward
process improvement

Peter Kettlewell