

# **The development of a tool to measure how well pathogens are controlled in a pork slaughterhouse**

**Mary Howell**

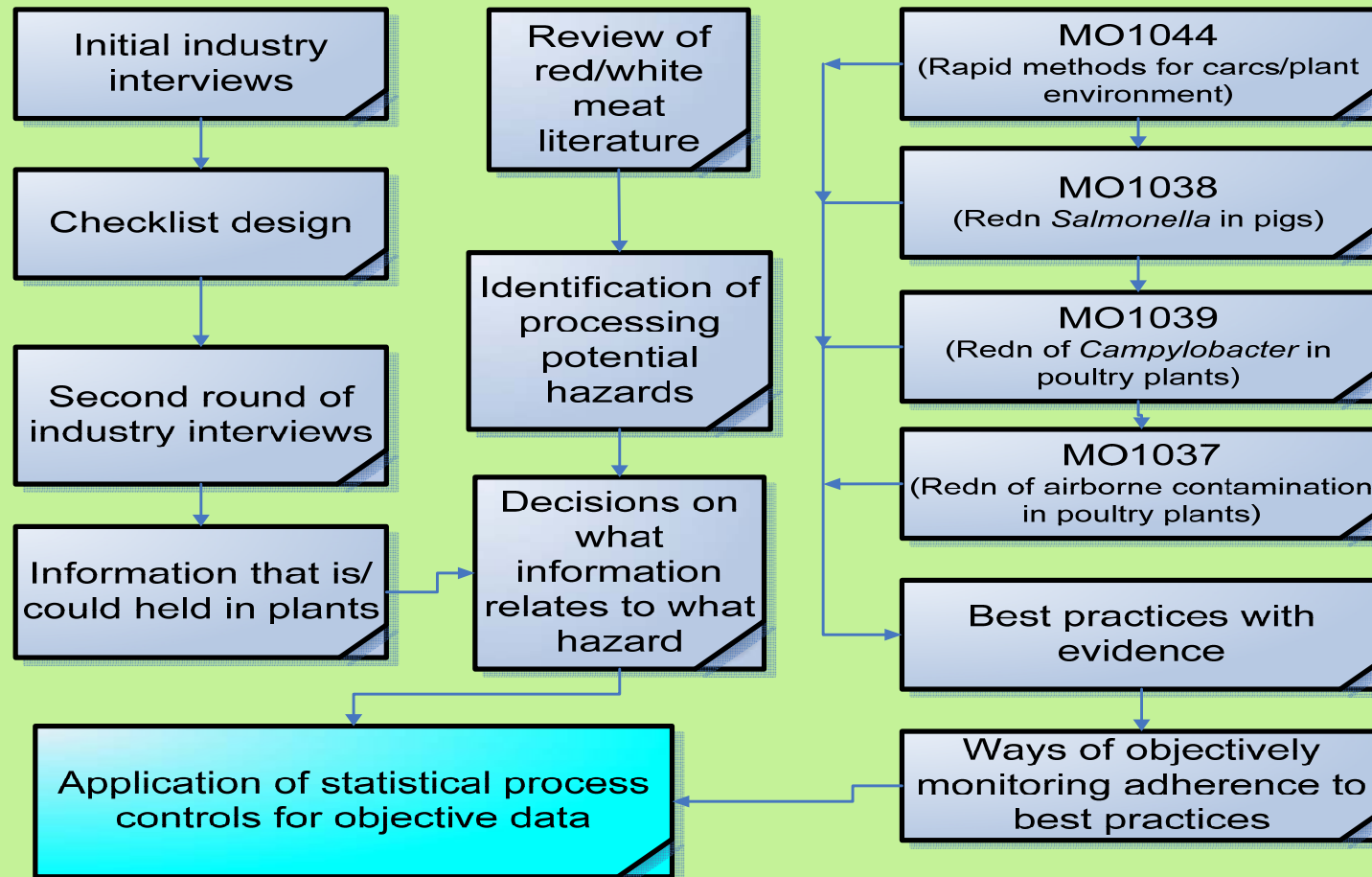
**Food Standards Agency UK**

**Workshop on salmonella control in pigs**

**February 26th 2009**



# Can process data in slaughterhouses be linked to food safety and used as a measure of control?



# Basic approach for each species

- Split the production processes into distinct stages
- Review scientific literature and our current research project outputs relating to each stage
- Draw up best practices/proven hazards based on science (Campylobacter, Salmonella, E.coli )
- Using the opinion of experts
  - Relatively rank each process stage
  - Weight each stage based on the rankings



# Practices within stages

- Within a stage the range of practices or measurable performance are allocated a score from a response to a question
- Questions phrased in a manner that requires record keeping and thus it is an objective assessment that can identify areas for improvement
- The additive score from a stage is multiplied by the stage weighting



# Status of the project

- *Prototype tools have been developed for pigs and broilers linked to UK strategic targets to reduce **salmonella in pigs** and campylobacter in chickens.*
- *Partnership trials with processors are in progress*





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- Processed Meats
- Corrective Actions
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Site constructed and maintained by Hutchison Scientific Ltd



## Process monitoring (Lairage) (stage multiplier = 4)

(click to see the scientific background and explanatory text for each question in this section)

Q23 How long are stock typically held in lairage?  (1, 2, 4, 8, 10, 12, 15)

Q24 Are pigs held on a clean (i.e. wet removal of gross detritus) and sanitised (i.e. treated with a chemical decontaminant) at an appropriate stocking density to prevent welfare issues (e.g. overheating or stress) transporter instead of in the plant lairage?  (1, 2, 3, 4, 5, 6)

Q25 What is the lairage floor surface composed of?  (1, 10, 10)

Q26 Is the lairage generally cleaned (i.e. wet removal of gross detritus) in between batches of animals?  (1, 5, 10, 15, 20, 25)

Q27 Is the lairage cleaned and sanitised (i.e. treated with a chemical decontaminant) in between batches of animals? (a batch is defined as a transporter load of animals)  (1, 20, 40, 60, 80, 100)

Q28 Is any sanitation a 'validated as effective' procedure?  (3, 10, 1)

Q29 Are the waters changed and the water troughs cleaned between batches of animals or, alternatively, does the plant use clean water drinkers that have been proven to prevent cross contamination between different animals?  (1, 2, 4, 6, 8, 10)

Q30 Are the animals power-washed on exit from the lairage? (we are currently awaiting additional data that may show a advantage for low pressure washing by, for example, sprinklers)  (1, 2, 4, 6, 8, 10)

Module Summary	Maximum available value
Module total:	186
Module mean:	23.25
Module overall score:	93



### Process monitoring (Stunning) (stage multiplier = 1)

(click to see the scientific background and explanatory text for each question in this section)

Q31: How is backup stunning undertaken?

Using a bolt all of the time

(1, 2, 4, 6, 8, 10, 15)

Q32: Is the roll out surface cleaned (i.e. wet removal of gross detritus) in between carcasses?

Not cleaned during a day`s kill

(1, 2, 4, 6, 8, 10, 15)

Q33: Is the roll out surface cleaned and sanitised (i.e. treated with a chemical decontaminant) in between carcasses?

Not sanitised during a day`s kill

(1, 20, 40, 60, 80, 100, 150)

Q34: Is any sanitation a 'validated as effective' procedure?

No

(3, 10, 1)

Q35: Is the roll out surface solid floor or a grate?

A solid floor

(1, 40)

Module Summary	Maximum available value
Module total:	230
Module mean:	46
Module overall score:	46

Part save this assessment for later

### Process monitoring (Exsanguinations) (stage multiplier = 1)

(click to see the scientific background and explanatory text for each question in this section)



## Process monitoring (Singe and polish) (stage multiplier = 6)

(click to see the scientific background and explanatory text for each question in this section)

- Q57:** Is polishing undertaken?  (1, 2, 4, 6, 8, 12)
- Q58:** If so are polishing equipment cleaned (i.e. wet removal of gross detritus) during each processing day?  (1, 2, 2, 4, 6, 8, 10, 12)
- Q59:** If so are polishing equipment cleaned and sanitised (i.e. treated with a chemical decontaminant) during each processing day?  (1, 1, 8, 12, 16, 20, 24, 30)
- Q60:** Is any sanitation a 'validated as effective' procedure?  (3, 16, 1)
- Q61:** Is the automatic singeing stage duplicated (i.e. repeated) after initial polishing?  (1, 1, 100)
- Q62:** Is an additional hand singeing stage undertaken?  (1, 2, 4, 6, 8, 12)
- Q63:** Are there areas of the carcass that are stay below 50°C during singeing?  (3, 1, 5, 20, 50, 75, 120)

Module Summary	Maximum available value
Module total:	291
Module mean:	41.57
Module overall score:	249.43

## Singeing and polishing

Information that relates to specific question(s) is highlighted with the appropriate question number in pink.

17: Is polisin Effective singeing can result in almost complete removal of skin-surface contamination (Berends *et al.*, 1997). However, not all singeing is completely effective and consequently, the polishing stage that routinely occurs after singeing has been estimated to be directly responsible for between 5% and 15% of all carcass cross-contamination on pork lines (Berends *et al.*, 1997). Polishing can redistribute those few bacteria that survive the flame treatment across the surface of the carcass (Berends *et al.*, 1997). After a typical singe, under routine processing conditions, carcass APC were reported to decrease by 3 log units cm<sup>-2</sup> (Bolton *et al.*, 2002). The finding was confirmed when similar reductions were reported by Pearce *et al.*, (2004). In addition to APC, Pearce and colleagues expanded the bacteriology to observe significant reductions in numbers of total coliforms. *Salmonella* were not detected after singeing by Bolton *et al.* (2002). The high level of decontamination reported was attributed to the use of a hand-held singeing unit which can be more comprehensively and consistently applied to all areas of the carcass compared to automated singeing machines used in larger plants (Q62). However, although Bolton and colleagues accept that it is difficult to extrapolate their findings when scaling up to routine processing in full throughput plants, no *Salmonella* were detected also after singeing in full throughput plants operating under commercial processing conditions by Pearce *et al.* (2004).

18: If so aross detritu

19: If so aeated withy?

20: Is any s

21: Is theter initial p

22: Is an ac

23: Are thearing singe

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Within a high throughput plant Warriner *et al.* (2002) found that the levels of total viable bacteria after both singeing and polishing were not significantly different. It is unclear if the difference was due to imperfect singeing or the inclusion of the polishing step that was not included within the small plant studied by Bolton *et al.* (2002). The levels of *E. coli*, as an indicator of enteric contamination, had reduced by one log unit when compared to the numbers after scalding and de-hairing. However, substantial numbers of *Enterobacteriaceae* and *E. coli* were found on both the dry and wet polisher. In the case of the wet-polisher no contamination was found at the start of operations but after 4 hours numbers significant increased to more than 5 logs *Enterobacteriaceae* and 4 logs for *E. coli*.

The polishing stage of processing was the focus of a study by Pearce and co-workers (2004). They report that residual hair removal by polishing led to a one-log increase in APC, coliforms and resuscitated coliforms. The stage however

**Process monitoring (Single and polish) (stage multiplier = 6)**  
 (click to see the scientific background and explanatory text for each question in this section)

- Q57** Is polishing undertaken?  (1, 2, 4, 6, 8, 12)
- Q58** If so are polishing equipment cleaned (i.e. wet removal of gross detritus) during each processing day?  (1, 2, 2, 4, 6, 8, 10, 12)
- Q59** If so are polishing equipment cleaned and sanitised (i.e. treated with a chemical decontaminant) during each processing day?  (1, 1, 8, 12, 16, 20, 24, 30)
- Q60** Is any sanitation a 'validated as effective' procedure?  (3, 16, 1)
- Q61** Is the automatic singeing stage duplicated (i.e. repeated) after initial polishing?  (1, 1, 100)
- Q62** Is an additional hand singeing stage undertaken?  (1, 2, 4, 6, 8, 12)
- Q63** Are there areas of the carcass that are stay below 50°C during singeing?  (1, 2, 4, 6, 8, 12)

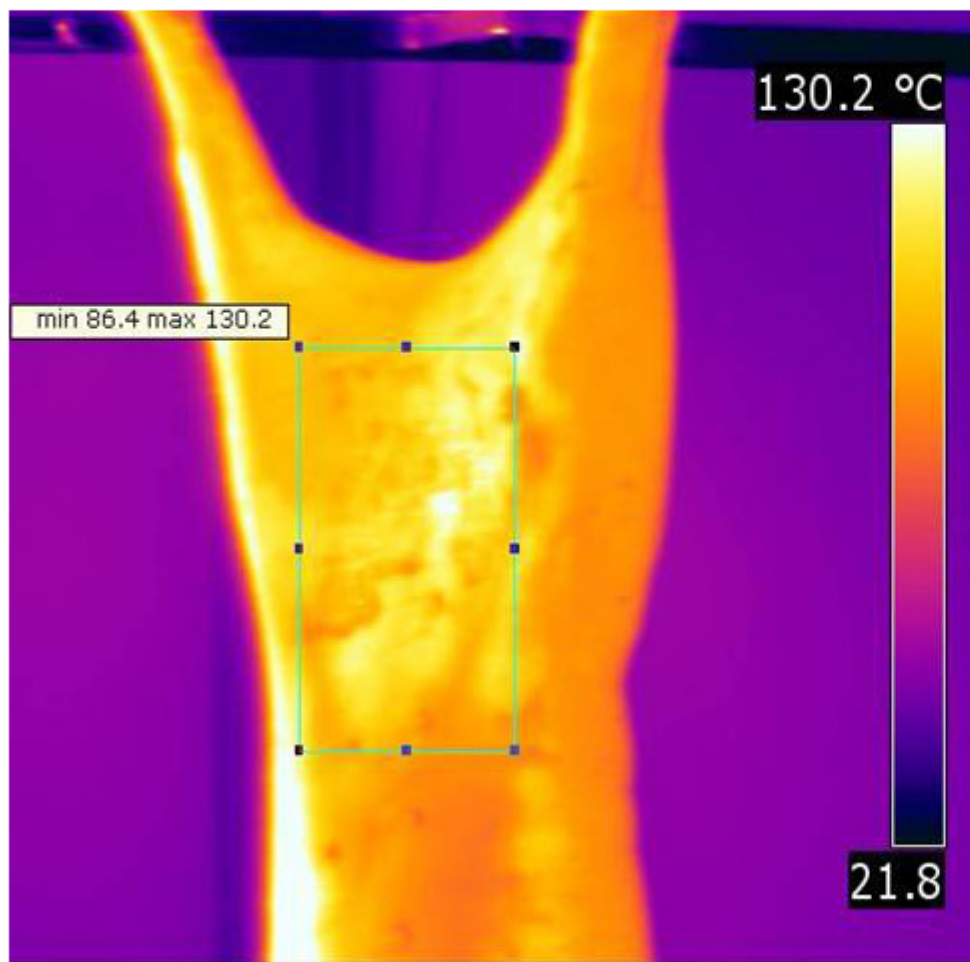
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Module mean:	41.57
Module overall score:	249.43

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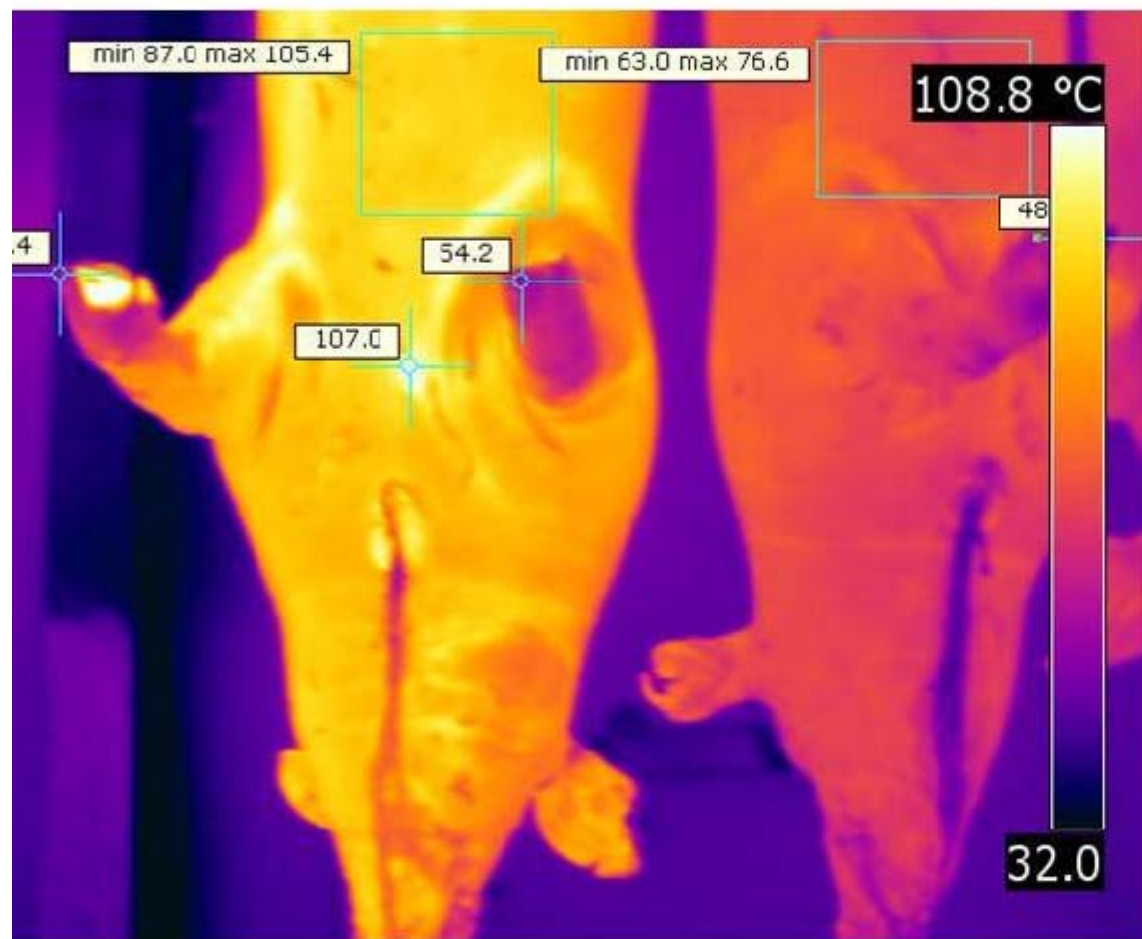
**Process monitoring (Eviscerate) (stage multiplier = 5)**



profile of a carcass. An example of a good and a poorly-singed carcass are shown below.



An example of a uniformly-singed carcass as evidenced by the even distribution of colour.



example of a poorly-singed carcass from a UK plant. The bluish distribution of colour on the trotters reveals an area that has not been heated enough to cause bacteria known to be ineffectively heated in some singers include the rectum and scrotum of carcasses.

pages, and unpublished information relating to the microbiological consequences of ineffective singeing, were provided by [Prof Chris Dodd, Dr Phil Richards](#) and [Dr David](#). A list of contractors that can undertake carcass temperature profiling is available by clicking [here](#). The Food Standards Agency does not endorse any of the contractors listed. Other methods (e.g. infra red probes) can also be used to profile the temperatures across pig carcasses.

## Infra red-based temperature profiling of singed pig carcasses

Below is a list of contractors that can undertake infra red (IR)-based temperature profiling of pig carcasses by a photography-based method. Please contact [dawn.harrison@bristol.ac.uk](mailto:dawn.harrison@bristol.ac.uk) with your details if you would like to be added to the list.

Please note that these contractors are in no way endorsed by the Food Standards Agency. The information provided here is only to help simplify the sourcing for the UK pig industry. There are alternative methods for the profiling of carcass temperatures that can also be used.

Company: Hutchison Scientific Ltd  
Contact person: Mike Hutchison  
Email: [mh@hutchisonscientific.com](mailto:mh@hutchisonscientific.com)  
Phone: 01902 399970  
Website: [www.hutchisonscientific.com](http://www.hutchisonscientific.com)

Summary of service: Each plant visit will result in the generation of around 50 carcass pictures taken across the entire processing day and, wherever possible, over a range of carcass sizes. The camera used takes high-resolution simultaneous IR and visible-light pictures all of which are provided on CD to the plant as part of the reporting process. A short report on the effectiveness of singeing, which includes prints of the best case, worst case, and typically-singed carcasses is provided within a few days of the plant visit.

Company: Dave Tinker and Associates Ltd  
Contact person: Dave Tinker  
Email: [d.tinker@ntlworld.com](mailto:d.tinker@ntlworld.com)  
Phone: 01525 750337

Q95: Are there any carcasses touching other carcasses in the chiller? Yes (1, 10)

Q96: Are staff permitted to enter chillers after they are filled and running? All of the time (1, 2, 5, 10)

Q97: Are the temperature profiles as expected and predicted to prevent the growth of *E. coli*? (RI-based assessment) None of the time (1, 20, 50, 100)

Module Summary	Maximum available value
Module total:	269.5
Module mean:	38.5
Module overall score:	192.5

Part save this assessment for later

### Plant-related information (General) (stage multiplier = 2)

Q98: Is the slaughterhouse subject to unannounced third party audit (e.g. from retailers)? No (1, 40)

Q99: Does the plant have a mechanism to feed back down the line problems such as increased visible contamination that become apparent at the end of processing? No (1, 50)

Module Summary	Maximum available value
Module total:	90
Module mean:	45
Module overall score:	90

Part save this assessment for later

# A measure of hazard control

- General theme of reward the “good” don’t punish the “bad”
- Risk-based approach; similar to HACCP but has a strict science base for hazards and scorings and is not just reliant on the opinions of people
- Inherent flexibility – if plants can prove new good practices; they can have additional questions and appropriate scorings





# Trialling the new method

- To help refine the tool plant trials are underway
  - A working group has been established with the British Meat Processors Association /Zoonosis National Control Programme for interested pig processors
  - Following training sessions plants have completed the questionnaire and provided feedback to help refine the prototype
  - Assistance and support is available
  - A second trial currently in progress



# Improvement projects

- Following assessment with the tool small projects can be supported
- to help plants measure key data
  - Singeing temperatures
- to try interventions
  - bunging
- to measure the effect of interventions
  - microbiology
  - temperature



# Ongoing development of the assessment tools

- Scientific information for pigs being updated
  - needs to be periodically undertaken
- Output from a complimentary study looking at barriers to implementation incorporated
  - once proven system could be used to decide audit frequency



# Refined tool to be available

March 09.

- Plants will be able to identify areas for improvement based on evidence
- How can we prove that the tool works?
  - implementing change and improving scores over the next few years will result in a reduction in SALMONELLA levels on pig carcasses.
- Use EFSA baseline survey and FBO ongoing monitoring
- Repeat in 2010



THANKYOU FOR YOUR  
ATTENTION

