Working Document
Version: 12.11.2008

Steam, Steam Vacuum and Hot Water Decontamination System for Red Meat Carcasses

Purpose of the use of heat decontamination

Canada raised the possibility of using heat decontamination on red meat carcasses in the framework of equivalence discussions during the EU-Canada Joint Management Committee (JMC) Meeting in October 2006. Heat decontamination is commonly used in the USA and Canada as an intervention method to reduce contamination with E. coli O157 by applying pressurized steam to the carcass surface for a short time. To date, this USDA approved treatment is not in use in Europe.

The overall scope of this study is to verify the compatibility of this technique with existing Community legislation and to study the potential benefits of the use of the technique in the EU.
After having presented the results of the mission to Canada on heat decontamination, it was decided in the MSs' Technical Working group on hygiene on 6 March 2008 to carry out visit(s) to Member States that have experiences in such techniques. The European meat association UECBV provided assistance in the organisation of a visit to 2 slaughterhouses in Denmark where also the Danish competent authorities participated.

- The steam vacuum technique is commonly used in cattle slaughterhouses in Denmark on more or less large surfaces of the carcass, the application area being determined on basis of a risk assessment in the slaughterhouses. This system is apparently also used in Sweden.

The hot water technique is used for carcasses originating from pig fattening farms with higher Salmonella risk. This process uses recycled water, monitored by a light intensity measurement system.

1. Chronology of actions about Heat Decontamination

Date	Occasion	Concern – Implemented action
October 2006	JMC EU – Canada	Canada raised the possibility of using heat decontamination on red meat carcasses.
29 March 2007	SANCO D4	The Commission provided Canada a list of concerns about heat decontamination and Canada replied on 21 June 2007.
30 August 2007	France, rapporteur in the Canada Potsdam group	France requested the views of Member States on heat decontamination.
10 September 2007	Canada Potsdam Group	Discussion on the possibility to accept heat decontaminated carcasses. Some Member States raised concerns.
16 October 2007	SCOFCAH, Biological Safety of the Food Chain	The Commission presented a summary of the views of Member States (MS) on heat decontamination.
9 November 2007	Working Group on hygiene	The Commission presented further elaborated data on heat decontamination also addressing the concerns of some MSs. The possibility for a fact-finding on-the-spot mission to Canada/North America was further discussed.
16 November 2007	SANCO D4	Canada was provided with the elaborated data and requested for further scientific clarification on heat decontamination. Also, the intention for the fact-finding

		mission was raised.
3 December 2007	EU – Canada co-chair conference call	A conference call between the co-chairs of Canada Agreement took place in order to further clarify the open questions concerning heat decontamination and the scheduled time for the intended mission.
13 December 2007	Canadian Authority (CFIA), SANCO D4	Canada confirmed the date for the intended mission that will take place in the week of 18-22 February 2008. The MSs interested in participating in this mission were informed about the date of the mission.
18-22 February 2008	Information gathering mission in Canada	Planned mission to Canada/North America in order to receive information on the experiences in the use of heat decontamination in practice and to discuss open questions on scientific data. Participants: Commission and MSs.
6 March 2008	Working Group on hygiene	Presentation of the results of the Information gathering mission in Canada. It was decided to do further missions to Member States.
15 to 16 April 2008	Information gathering mission in Denmark	Planned mission to Denmark in order to receive information on the experiences in the use of heat decontamination in practice and to discuss open questions on scientific data. Participants: Commission and MSs
24 November 2008	Working Group on hygiene	Presentation of the results of the Information gathering mission in Denmark. Evaluation of the Community legislation. Commission proposal.

2. Description of the techniques

Canada

The Steam Decontamination System of Frigoscandia is a patented commercial procedure following the slaughtering process in order to reduce bacterial counts by applying pressurized steam to the surface of carcasses for a short time (95 °C/15 s). This moving clamshell system has been developed and redesigned as a static chamber later in a consortium together with Kansas State University (Scientific work done by Phebus R.K. and Nutsch A.L.), Frigoscandia Equipment Group, Bellevue and Cargill Int. and has been approved by the USDA in 1995. Besides Frigoscandia, the US / Canadian Chad Company also offers similar decontamination systems.

Denmark

The steam vacuum system is a flexible tube large like a vacuum cleaner. The exchangeable metallic head piece has an aspirating hole in the centre surrounded by a set of small holes from where the steam comes out when the head piece is in close contact with the carcass' surface. The steam is only produced from potable water (15 litres per hour) without recycling. The pressure of the steam entering the handle is 1,2 bar. The temperature of the exchangeable metallic piece, which has contact with the surface of the carcasses, has a temperature of >= 75 °C.

The hot water system uses a large amount of hot water that is applied in a cabinet by some few nozzles (80 litres per carcass, 15 seconds, 80 °C (78° is the minimum) and spread by moulded sheet metals, resulting in a full coverage of the carcass. The temperature is considered as a CCP. No cold water shower is applied before and after the hot water treatment.

The hot water is prepared from potable water. During the process a separation takes place: 80 % was recycled whereas the water dripping off the carcasses in the middle of the chamber is being removed. Re-filling of water is done with potable water. The recycled water is removed after the end of the slaughter operations. The recycled water is screen filtered for removing bigger particles and skimmed for surface foams of proteins. The recycled water is continuously monitored by a light intensity measurement system and in case of passing a threshold level (defined by the Danish CA) potable water was added. An alarm system is activated when the minimum temperature is not fulfilled.

3. Issues for consideration and available scientific knowledge

Issue	**Available Information**	**References / *Remarks***
General remarks		
Has the Heat Decontamination – system been taken up in Europe?	In Denmark the steam vacuum technique is used for beef carcasses surfaces and the hot water decontamination is used for pigs meat carcasses originating from farm holdings with a higher Salmonella infection level. The steam vacuum technique is also used for beef carcasses surfaces in Sweden.	
Where is this system actually used?	United States, Canada	Indirect information from cited references. Information may not be complete.

What are the overall benefits of this system?	To reduce the risk of exposure of the consumer to foodborne pathogens, particularly *E. coli* O 157.	Phebus RK. *et al.*, J Food Prot (1997) 60: 476-84 Corantin H. *et al.*, Can J Vet Res (2005) 69: 200-07
What are the overall uncertainties regarding this system?	The lack of inherent scientific data on the reversibility of colour change and the organoleptic characteristics of this meat.	Science-based information is required from Frigoscandia.
Scientific data		
Does heat decontamination result in complete decontamination of bacteria?	No.	Factsheet Frigoscandia SPS® SC Heat Decontamination System. Minihan D. *et al.*, J Vet Med (2003) 50: 352-56 Corantin H. *et al.*, Can J Vet Res (2005) 69: 200-07 Retzlaff D. *et al.*, Foodborne Pathog Dis (2005) 2 (2): 146-51
What is the average of bacterial reduction?	Reduction of at least 1 $\log_{10}$ cfu/cm^2 *(studies based on naturally contaminated carcasses)*	Gill C.O.and Bryant J., Meat Sci (1997) 47: 267-76 Minihan D. *et al.*, J Vet Med (2003) 50: 352-56 Corantin H. *et al.*, Can J Vet Res (2005) 69: 200-07 *(studies based on naturally contaminated carcasses)*
	Reduction of 1.4 to 1.9 $\log_{10}$ cfu/cm^2	Retzlaff D. *et al.*, Foodborne Pathog Dis (2005) 2 (2): 146-51
	Results on Frigoscandia Factsheet reveal a reduction of 3 $\log_{10}$ for TVC (total viable counts) and of 1 $\log_{10}$ for Enterbacteriaceae	Assumed sources: Nutsch A.L. *et al.*, J Food Prot (1998) 61: 571-77 *(based on naturally contaminated carcasses)* Castillo A. *et al.*, J Food Prot (1998) 61 (1): 19-25 *(based partially on artificially contaminated carcasses)*
Are there corresponding decreases for all species of bacteria (faecal indicator organisms and foodborne pathogens)?	Heat decontamination results in a decrease of faecal indicator organisms (Enterobacteriaceae / *E. coli*).	Gill C.O.and Bryant J., Meat Sci (1997) 47: 267-76 Nutsch A.L. *et al.*, J Food Prot (1998) 61: 571-77 Minihan D. *et al.*, J Vet Med (2003) 50: 352-56
	Also, foodborne pathogens like *E. coli* O 157 and *Salmonella spp.* are reduced by this technique in a comparative way.	Corantin H. *et al.*, Can J Vet Res (2005) 69: 200-07 *(the only study known so far that examined either faecal indicator organisms or foodborne pathogens*

Field Code Changed

		in parallel using naturally contaminated carcasses)
Is this bacterial reduction the same on all locations of the carcass?	Microbial contamination does not affect carcass surfaces uniformly.	Sofos J.N. et al., J Food Prot (1992) 62: 140-45 Bacon R.T. *et al.*, J Food Prot (2000) 63: 1080-86
	The effect of heat decontamination is more effective on more contaminated sites.	Minihan D. *et al.*, J Vet Med (2003) 50: 352-56
	Furthermore, smaller reductions of pathogens were observed on the inside round region.	Castillo A. *et al.*, J Food Prot (1998) 61 (1): 19-25 *(hot water decontamination)*
Does this heat decontamination enhance the growth of some bacteria after treatment?	This decontamination may indirectly contribute to the growth of some pathogenic microorganisms like *L. monocytogenes* (partial destruction of competing flora).	Corantin H. *et al.*, Can J Vet Res (2005) 69: 200-07
	Analogously, the treatment of carcasses with hot water (75° C / 30 s) led to slightly higher growth rates of surviving *L. monocyto-genes* during a storage of 25 days than on untreated carcasses. Decontamination with hot water did not shift the predominant microflora in the direction of yeasts and gram-positive bacteria (lactic acid bacte-ria) as did treatments with acids.	Koutsoumanis K.P. *et al.*, J Food Prot (2004) 67(12): 2703-11 Van Netten P. *et al.*, J Food Safety (1994) 14(3): 243-57
	During 21 days of storage at 4° C, the growth of pathogenic bacteria inoculated on beef carcasses after hot water treatment was less sup-pressed than that of carcasses threatened with alkaline or organic acid washes.	Dorsa W. J. *et al.*, J Food Prot (1998) 61(12): 1615-22
	The storage condition after sub atmospheric steam treatment (75° C) for sliced beef is crucial. Best results to ensure no re-growth were achieved packaging and storing them under vacuum at 0 degrees.	Logue C.M. *et al.*, J Appl Microbiol (2005) 98(3):741-51
Is scientific data available on the outlined reversibility of colour change?	Small colour change (darker colour) after treatment observed measuring samples with a spectrophotometer.	Cygnarowicz-Provost M. *et a*l., J Food Sci (1994) 59(1): 1-5
Will the maturation of meat be affected by this treatment?	No scientific data available.	Science-based information is required from Frigoscandia CA.
Is there any evidence available that organoleptic characteristics are the same after treatment?	No scientific data available.	Science-based information is required from Frigoscandia CA.

Field Code Changed

Does this treatment affect meat processing?	No scientific data available.	Science-based information is required from Frigoscandia CA.

4. Questions addressed to Canada on 16 November 2007 about heat decontamination

Further scientific data is requested on the following issues:

- It is still not clear if heat decontamination has a similar effect on all relevant pathogenic bacteria (like Salmonella, Campylobacter, Listeria etc.) because most studies are based on the elimination of *E. coli* O157:H7. Are there further studies available responding to this question?
- Considering the work done by Corantin *et al.* (2005), the question arose, if heat decontamination enhances the growth of specific pathogenic bacteria after treatment, possibly because of a partial destruction of commensal bacteria. Therefore, we are interested in studies on the impact of interactions of microorganisms on the meat surface after heat decontamination.
- Further clarification is requested on whether the effect of heat decontamination is uniform regarding the whole carcass. Available scientific data does not address this question sufficiently.
- Is scientific data available on the outlined reversibility of colour change?
- Will meat maturation be influenced by heat decontamination?
- Does this treatment affect meat processing?
- Have these issues been studied?
- Is there any evidence that organoleptic characteristics are the same after treatment? Is scientific data available on this?

Technical questions concerning:

- the moment of the application of heat decontamination (e.g. immediately after slaughter and final carcass inspection or later, after a cooling step)
- the water quality in use and the possibility of reusing it after suitable preparation
- the installation of sufficient ventilation in plants in order to prevent condensation
- the implementation of periodical microbiological analyses on the efficiency of heat decontamination elaborated by the plant
- the frequency of failures of heat decontamination and the main causes thereof

Additional questions to be referred to CFIA:

- the different heat decontamination systems in use in Canada (possibly in combination with any other intervention for food safety like treatments with organic acids etc.)
- the integration of functionality checks concerning heat decontamination during a supervision visit of plants using this technology and the appropriate parameters to clarify this

5. Compatibility of this technique with the European Legislation / Codex alimentarius

	European Legislation	***Codex alimentarius***
Can steam be used directly in contact with food?	Steam can be used directly in contact with food. It may not contain any substance that presents a hazard to health or is likely to contaminate food (Reg 852/2004 Chapter VII (5).	Steam used in direct contact with food or food contact surfaces should not constitute a threat to the safety and suitability of food (CAC/RCP 1-1969, Chapter 5.5.3.)
Can steam be used in direct contact with meat?	Following the remarks above and considering Art. 3 Chapter II in Regulation 853/2004 food business operators who handle food of animal origin shall not use any substance other than potable water, unless the use of clean water is permitted by Regulation (EC) No 852/2004 or Regulation (EC) No 853/2004.	Washing of the animal bodies at multiple steps in the dressing process, and as soon as possible after each contaminating step, reduces the adherence of bacteria to the skin which can minimise overall carcass contamination. (Washing after evisceration and post-mortem is also necessary for technological reasons, as this is the only method available to routinely clean carcasses before entry to the chilling process). Washing may be carried out by several methods e.g., spraying, immersion washing (CAC/RCP 58-2005, Chapter 9.4, no. 123). The use of steam is therefore not precluded in principle.
Can steam be considered as potable water?	The requirements for potable water (i.e. water intended for human consumption) are laid down in Council Directive 98/83/EC of 3 November 1998. To this category belongs also water used in any food-production in direct contact with food (Art. 2). Water intended for human consumption shall be free from any micro-organisms and parasites and from any substances which, in numbers or concentrations, constitute a potential danger to human health and meets the minimum requirements set out in Annex L of this Directive (Art. 4). As mentioned in Reg 852/2004 Chapter VII (5), steam in direct contact with food may not present a hazard to health or contaminate food. The requirements for steam used for direct contact to food and water intended for human consumption are considered to achieve the same food safety objective.	Potable water should be as specified in the latest edition of WHO Guidelines for Drinking Water Quality or water of a higher standard (CAC/RCP 1-1969, Chapter 4.4.1) As mentioned in CAC/RCP 1-1969, Chapter 5.5.3 steam in direct contact with food should not constitute a threat to the safety and suitability of food. The requirements for steam used for direct contact to food and water intended for human consumption are considered to achieve the same food safety objective.

Does heat decontamination after slaughter lead to an interruption of the cold chain?	The cold chain as mentioned in Regulation 852/2004 Chapter IX, (5) is intended for food that cannot be stored safely at ambient temperature. Fresh meat belongs to this category. When using this heat decontamination directly after slaughter, the cold chain has not yet started. Therefore, no interruption of the cold chain occurs.	Maintaining the cold chain is important for freshly slaughtered and dressed carcasses as remarked in Chapter 9.7 of CAC/RCP 58-2005. When using heat decontamination directly after slaughter, the cold chain has not yet started. Therefore, no interruption of the cold chain occurs.
Can meat that has been treated with this method still be considered as fresh meat?	Considering Annex I Chapter 1.10 of Regulation 853/2004 'Fresh meat' means meat that has not undergone any preserving process other than chilling, freezing or quick-freezing, including meat that is vacuum-wrapped or wrapped in a controlled atmosphere. Heat decontamination is not to be considered as a preservation method but as a method to reduce bacterial surface contamination (what is intended for food of animal origin, Reg. 853/2004, Chapter II, Art. 3) and therefore heat decontaminated meat can still be considered in principle as fresh meat (if no changes to the characteristics of the meat appear). See also the Evaluation of Antimicrobial Treatments for Poultry Carcasses – Opinion of the Scientific Committee on Veterinary Measures relating to Public Health, adopted on 14-15 April 2003. Substances used for the removal of surface contamination will not affect the status of fresh meat.	Codex alimentarius (CAC/RCP 58-2005) defines 'Fresh meat' as meat that apart from refrigeration has not been treated for the purpose of preservation other than through protective packaging and which retains its natural characteristics. Definition of fresh meat does not preclude interventions for the purpose of pathogen reduction (Code of Hygienic Practice for Meat, CAC/RCP 58-2005).
Can recycled water be considered as potable water? Under what condition can be used?	Considering Art. 2, Reg. 853/2004 food business operators shall not use any substance other than potable water. According to Regulation EC 852/2004, Annex II, Chapter IX, Paragraph 3 "at all stages of production, processing and distribution, food is to be protected against any contamination likely to render the food unfit for human consumption, injurious to health or contaminated in such a way that it would be unreasonable to expect it to be consumed in that state." Reg. 852/2004 states that "recycled water used in processing or as an ingredient is not to present a risk of	Codex Alimentarius CAC/GL 61 - 2007 specifies that "recycled process water used in direct contact with finished product should be discarded or decontaminated (e.g. chlorination for recycled water, heat treatment, or some other effective treatment) with sufficient frequency to ensure control of L. monocytogenes"

	contamination. It is to be of the same standard as potable water, unless the competent authority is satisfied that the quality of the water cannot affect the wholesomeness of the foodstuff in its finished form".	

6. Results achieved:

Canada

- The effectiveness of the treatment in reducing the microbe level by x logs has to be demonstrated over an initial period of 4 months under in-plant operational conditions.
- It must be demonstrated under in-plant operational conditions that the intervention results in a product that is below detectable level for E-coli O157:H7 (sampling and analysis).
- The carcases seen in the pig slaughter facility at the research centre were only slightly discoloured, some parts of the bovine carcasses seen in the bovine slaughterhouses were more substantially discoloured, even after 24 hours of chilling.
- Meat discolouration is only recognised as a qualitative parameter and not a food safety issue. This is therefore not regulated by CFIA.
- Whereas for steam decontamination technique only potable was used, in hot water decontamination techniques the water was in most cases (if not all commercial applications) recycled. Re-filling of water was always done with potable water. The recycled water was always removed and the installation cleaned on daily basis. It was considered that there was no growth of microbes due to the operating temperature of 85 °C. The recycled water was screen filtered in order to remove bigger particles and skimmed for surface foams of proteins

Denmark

- The Danish CA provided figures demonstrate that the use of the steam vacuum technique achieved better microbiological decontamination results than manual trimming.
- For the hot water technique a reduction of the E. Coli with >2 log was achieved and the prevalence of Salmonella on contaminated carcasses was reduced to a level below detection in more than 90 of cases.
- The amount of water used is immense and it would be difficult to accept both from an environmental and economical point of view.

7. Pro and contra of heat decontamination

Pro

- Heat decontamination aims to make a safe product safer.
- As heat decontamination significantly reduces counts of enteric bacteria, it can contribute to decreasing the bacterial load of cattle infected with pathogens causing human illnesses like *E. coli* O 157 and *Salmonella spp*.
- The application of heat decontamination can lead to a reduced exposure of consumers to the above-mentioned foodborne pathogens, an advantage from which persons with a suppressed immune status may especially benefit.
- Meat of higher risk origin (i.e. farms with Salmonella problems) might be a further target for the use of heat decontamination.
- As heat decontamination significantly reduces the contamination, it can contribute to increasing the speed of the production line.

Contra

- The adoption of heat decontamination is associated with considerable investment costs and operating expenses.
- Operators might view this technology as a way of rendering product with an initially high microbial loading "clean" and therefore pay less attention to the strict hygiene procedures necessary.

8. Conditions on which heat decontamination might be acceptable

- Heat decontamination has to be integrated into good hygienic practices and HACCP-based systems. The method must be regarded as an additional measure providing acceptable hygienic production of meat and in no way as a substitution for good hygienic slaughtering practices and operating procedures. The vertically integrated approach to food safety (farm-to-table) must still be fulfilled.
- Sufficient ventilation must be ensured to avoid condensation in the operation room.
- Steam used in direct contact with the carcass has to fulfil the legal requirements (Reg. 852/2004 Chapter VII (5) defines that steam used directly in contact with food is not to contain any substance that presents a hazard to health or is likely to contaminate the food).
- After treatment, the meat must still meet the definition of fresh meat (Reg. 853/2004 Annex I, Chapter 1.10) and in particular the organoleptic characteristics.

9. Control and authorisation by the CA

Observations:

- Canada:
    - CFIA controls: supervision acceptable, however some remarks validation of the technique
    - 4 months verification period
    - Daily, weekly, monthly checks, 3 monthly audits
    - Re-validation of the techniques

- Denmark: Both systems were developed and monitored with the scientific assistance of the Danish Meat Research Institute.

10. Information gathering mission to Canada from 18-22 February 2008 (Annex I)

The visit helped to clarify technical questions, to receive information on the experiences in the use of the technique in practice and to further inquire on open scientific questions e.g. by visiting a research centre involved in the development of the technique.

11. Information gathering mission to Denmark from 15-16 April 2008 (Annex II)

12. Scientific Data on Heat Decontamination Systems (Annex III)

Annex I: Short report on a fact-finding mission to Canada on Heat Decontamination from 18 to 22 February 2008

1. Background:

Canada wishes to export beef carcasses that have undergone heat decontamination to the EU. This technique, which has been developed in the United States, is performed to improve microbiological quality of beef carcasses by applying pressurized steam to their surface for a short time (15 s/ 95 °C). A list of concerns about this technology has already been sent to Canada and was answered by them. Nevertheless, there are still open questions about this technology (e.g. the reversibility of colour change, the influence on meat maturation and the impact on the interactions of microorganisms on the meat surface) which may not have been clarified in the scientific data.

2. Scope and purpose of the mission:

- To conduct an on-the-spot fact-finding mission to Canadian order to clarify these technical questions and to receive additional information on the experiences when using this technique in practice.
- To learn about the heat decontamination techniques by visiting slaughterhouses and gathering scientific information during a visit to a research centre involved in the development of these techniques.
- To inform MSs and the Commission of the findings of the mission.
- To provide answers to the questions raised by the working group with MSs on hygiene.

3. Mission programme

3 large size bovine slaughterhouses, two of those using Steam Decontamination and the third one using hot water decontamination, were visited as well as a research centre with a small pig slaughter facility using hot water decontamination. None of the visited establishments are EU listed. Local, regional and federal CFIA officials were always present during the visits.

4. Main findings:

- In all establishments visited, except the small pig slaughter facility, several decontamination techniques including washing of on-hide carcases, chemical decontamination, steam vacuum cleaning and warm water rinse were used (a so called multi hurdle approach).
- As an alternative to steam decontamination, hot water decontamination technique can be used. Both techniques were operated with different parameters (temperature, pressure, exposure time or steam injection time), with or without air drying before and cold water rinse after steam application, and applied at different places along the slaughter line. The parameters are regularly modified. The temperature applied was between 75 and 85 °C and the exposure time was between 6 and 12 seconds.
- The legal basis for raw beef meat is in the Canadian Manual of Procedures Chapter IV from 2004 (Annex O), which prescribes the use of one or more validated interventions (such as steam pasteurizer, organic acid sprays, etc.) at the time of slaughter to reduce contamination with E. coli O157:H7 to below detectable level. No such requirement exists for pigs or other species. The requirement is only applicable for federal establishments controlled by CFIA and not for establishments under the control of the provincial veterinary services.
- Steam, steam vacuum and hot water decontamination techniques are only used in the federally approved establishments. As the federal production counts for about 95 % of the total national production, it can be assumed that at least 90 % of all beef meat undergoes steam or hot water decontamination, and in most cases in combination with one or more of the other decontamination techniques. CFIA stated that the percentage of pig carcases undergoing steam or hot water decontamination is much lower and that the techniques are not applied in other species.

- Steam, steam vacuum or hot water decontamination are only used in slaughterhouses before carcase chilling and not in cutting or processing plants although there is no legislation prohibiting the latter.
- Whereas the carcases seen in the pig slaughter facility at the research centre were only slightly discoloured, some parts of the bovine carcasses seen in the bovine slaughterhouses were more substantially discoloured, even after 24 hours of chilling.
- Meat discolouration is only recognised as a qualitative parameter and not a food safety issue. This is therefore not regulated by CFIA.
- Discoloured meat surfaces do not alter the eligibility of raw meat and there is no obligation for trimming the discoloured parts. Whereas such trimming was carried out in one establishment it was not done in the other establishments visited.
- The trimmings of discoloured meat were in most cases used in the production of minced meat or meat products. In one establishment it was stated that such trimmings were not used in products for human consumption for quality and commercial reasons (discoloured fat was melted for tallow production and meat/bone sent for rendering).
- Whereas for steam and steam vacuum decontamination technique only potable was used, in hot water decontamination techniques the water was in most cases (if not all commercial applications) recycled. Re-filling of water was always done with potable water. The recycled water was always removed and the installation cleaned on daily basis. It was considered that there was no growth of microbes due to the operating temperature of 85 °C. The recycled water was screen filtered in order to remove bigger particles and skimmed for surface foams of proteins. However, liquid or emulsified fats or proteins could not be removed during the working day.
- The hides of beef animals (feed lot) had heavy dung-tags.
- The hides of the cows in Lacombe were in an acceptable state of cleanliness.
- There is no requirement of labelling of meat that has undergone a steam or hot water treatment
- Concluding from information received by CFIA, the unavailability of a consumer organisation for a discussion with the mission team and a visit of a member of the mission team in a food store there seems to be little concern and even awareness about such treatments among the Canadian consumers.

5. Role of CFIA in the validation and authorisation of heat decontamination techniques for bovine slaughterhouses

The validation and authorisation of the installations are done in 3 steps:

- The operator has to provide scientific information/data demonstrating the capability of the reduction of the microbial contamination and supplying the relevant critical factors (time, temperature, pressure). The performance criteria are not clearly laid down but are expected to achieve a 2 log reduction.
- The effectiveness of the treatment in reducing the microbe level by x logs has to be demonstrated over an initial period of 4 months under in-plant operational conditions.
- It must be demonstrated under in-plant operational conditions that the intervention results in a product that is below detectable level for E-coli O157:H7 (sampling and analysis).

The following observations were made:

- The validation of the heat decontamination system was carried out in isolation and not taking the additional decontamination techniques into consideration. In none of the cases was there any evidence of validation for the other techniques used prior to steam, steam vacuum or hot water decontamination.
- There is no control on the efficacy of the treatment on all parts of the carcass (e.g. blind spots). The overall effect is based on E. coli O157:H7 controls carried out on final products such as carcases and / or ground beef (zero tolerance).
- Although the Manual of Procedures prescribes that validation has to be conducted again when the operations have changed and/or pathogen interventions have been modified/added, no criteria had in practise been laid down for when such changes/modification required the food business operator to conduct a new validation.
- Organoleptic changes are not controlled by the CFIA.

- The cleanliness of animals at arrival in the slaughterhouse is not controlled by CFIA.

Report to the MSs:

The mission findings will be presented in the MSs' working group on hygiene on 6 March 2006.

Mission team:

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Annex II: Short report on a fact-finding mission to Denmark on Heat Decontamination of red meat surfaces from 16 to 16 April 2008

1. Background:

After having presented the results of the mission to Canada on heat decontamination, it was decided in the MSs' Technical Working group on hygiene on 6 March 2008 to carry out visit(s) to Member States that have experiences in such techniques. The European meat association UECBV provided assistance in the organisation of a visit to 2 slaughterhouses in Denmark where also the Danish competent authorities participated.

2. Scope and purpose of the mission:

- To conduct an on-the-spot fact-finding mission to Denmark in order to learn about the state of play of the experiences and the use of steam vacuum/hot water decontamination techniques in slaughterhouses in Denmark
- To inform MSs and the Commission of the findings of the mission.
- To provide answers to the questions raised by the working group with MSs on hygiene.

3. Mission programme:

1 large bovine and 1 large pig slaughterhouse were visited. In the bovine slaughterhouse a steam vacuum technique was used whereas in the pig slaughterhouse a hot water treatment was used. Both of the visited establishments were EU approved. Officials of the different levels of the CA were always present during the visits.

4. Main findings:

- The steam vacuum/hot water decontamination techniques are used to further reduce the contamination level of meat surfaces and to improve food safety. For the pigs it is applied for meat carcasses originating from farm holdings with a higher Salmonella infection level.

- In the bovine slaughterhouse visited the steam vacuum technique was mainly used on some parts of the carcass, in particular the tarsal and carpal parts, the belly and chest including areas around the anus and the inguinal parts. It was reported that this technique is commonly used in other cattle slaughterhouses in Denmark where in it may be used on larger surfaces or even all over the carcase, the application area being determined on basis of a risk assessment in the slaughterhouses. Steam vacuum is not considered as a CCP.

- Description of the steam vacuum system: It is a flexible tube large like a vacuum cleaner. The exchangeable metallic head piece has an aspirating hole in the centre surrounded by a set of small holes from where the steam comes out when the head piece is in close contact with the carcass' surface. The steam is only produced from potable water (15 litres per hour) without recycling. The pressure of the steam entering the handle is 1,2 bar. The temperature of the exchangeable metallic piece, which has contact with the surface of the carcasses, has a temperature of >= 75 °C.

- In the pig slaughterhouse visited a hot water treatment technique was installed and used only for carcasses originating from pig fattening farms with higher Salmonella risk (level III). DK has developed a national monitoring programme on salmonella on farms where farms are categorised in three groups, level III being the highest risk accounting for 1,5 % of the Danish pig population. Level II accounts for 8,5 % and level I for 90 %. The hot water system was in use only during one day in the week at which level III pigs were slaughtered originating from the whole of Denmark. Level III pigs are also being slaughtered in other slaughterhouses without hot water treatment while a special slaughter procedure is thereby applied aiming at reducing the risk of cross contamination, i.e. reduced speed of the slaughter line. At the slaughterhouse with the hot water treatment however the standard slaughter line speed and procedure was applied also for level III pigs.

- Description of the hot water system: A large amount of hot water is applied in a cabinet by some few nozzles (80 litres per carcass, 15 seconds, 80 °C (78° is the minimum) and spread by moulded sheet metals, resulting in a full coverage of the carcass. The temperature is considered as a CCP. No cold water shower is applied before and after the hot water treatment.

- The hot water is prepared from potable water. During the process a separation takes place: 80 % was recycled whereas the water dripping off the carcasses in the middle of the chamber is being removed. Re-filling of water is done with potable water. The recycled water is removed after the end of the slaughter operations. The recycled water is screen filtered for removing bigger particles and skimmed for surface foams of proteins.

- The recycled water is continuously monitored by a light intensity measurement system and in case of passing a threshold level (defined by the Danish CA) potable water was added.

- An alarm system is activated when the minimum temperature is not fulfilled.

5. Results:

- The Danish CA provided figures demonstrating that the use of the steam vacuum technique achieved better microbiological decontamination results than manual trimming (see Annex). No cross contamination was observed by the use of the steam vacuum due to the high temperature of the steam.

- For the hot water technique a reduction of the E. Coli contamination with >= 2 log was achieved.

- The hot water technique has shown to reduce the prevalence of Salmonella on contaminated carcasses to a level below detection in more than 90% of cases.

- The use of the steam vacuum technique did not lead in practice to a visible meat surface discoloration of the beef carcasses. However a meat discoloration occurs if the technique is applied for several seconds at one surface location.

  The use of the hot water technique leads to a slight discoloration which was mostly disappearing during chilling. Staff is being trained to ensure that no discolorations occur.

- The steam/hot water techniques are used within the framework of a HACCP system while applying a good/acceptable hygiene practice at all stages of the slaughter process. The animals were in general in a good/acceptable state of cleanliness.

- The Danish CA stated that there is no prolongation of the shelflife due to the steam/hot water decontamination treatments.

6. Role of the Danish CA in the validation, authorisation and control of the steam/hot water decontamination techniques

- Both systems were developed and monitored with scientific assistance of the Danish Meat Research Institute.

- For the hot water decontamination technique, the Danish CA set a threshold for the light intensity for the recycled water as a food safety parameter. The setting of the light intensity threshold has been based on experience from an Australian equipment used for decontamination of cattle carcasses. It has been verified, that the recycling does not present a risk of contamination.

- The installations are controlled in the framework of the routine veterinary supervision by the CA. Microbiological testing on basis of Regulation 2073/2005 is carried out. Only one Salmonella positive case was detected on the pig slaughter carcass in the last years. This carcass was used as a meat product.

Report to the MSs:

The mission findings will be presented in the MSs' working group on hygiene in the autumn 2008.

Mission team:
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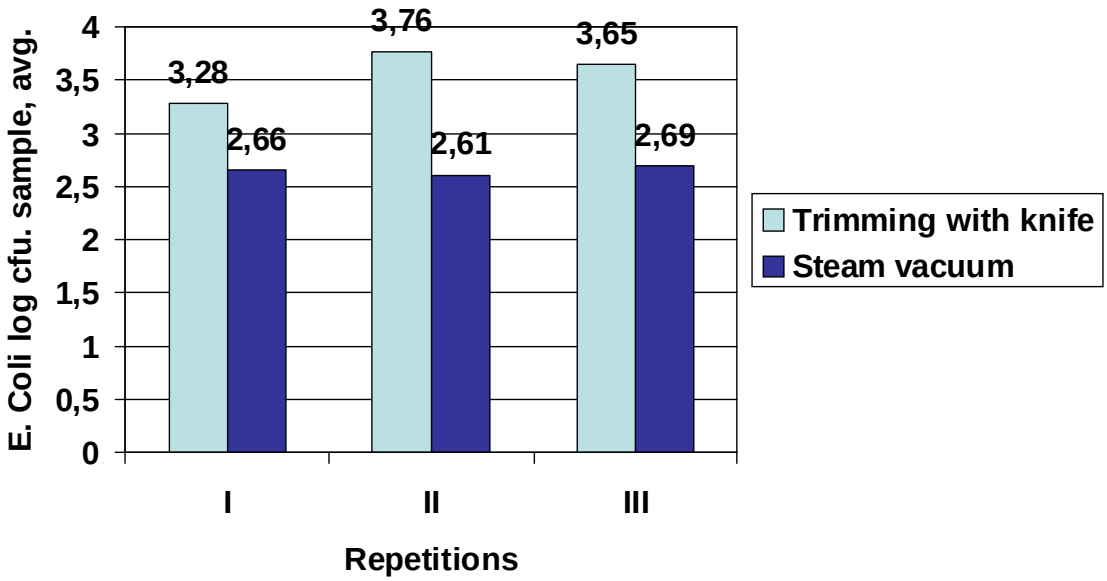
Numbers of E. coli in the pelvic duct and on adjoining meat and rind surfaces after removal of visible feacal contamination with knife or with the steam vacuum tecknique



n=30 pr. bar

Annex III: Scientific Data on Steam Decontamination Systems

Reference	System used	Study in a commercial plant	Number of animals	Artificial contamination	No. of carcass locations	Method used for analyses	Examined terms	Detected germ reduction	Remarks
Minihan, 1998 (Ireland)	Frigoscandia (Chamber unit)	Yes	30 (before/ after treatment)	No	3	Sterile sponge	APC, Enterobacteriaceae, E. coli	1 log (10)	Higher reduction on more con-taminated sites
Nutsch, 1998 (Kansas, U.S.)	Frigoscandia (Clamshell Unit)	Yes	40 before / 40 after treatment	No	5	Sterile sponge	APC, Enterobacteriaceae, E. coli	5 log (10)	Neck area is less treated
Corantin, 2005 (Canada)	Steam decontamination chamber prototype from Riopel, Québec	Yes	1003 (before/after treatment /after 24 h chilling)	No	3	Sterile gauze	APC, Coliforms, E. coli, Salmonella spp., E. coli O157:H7, L. monocytogenes	1 log (10)	Increase in the incidence of L. monocytogenes after treatment /chilling
Retzlaff, 2005 (Kansas, U.S.)	SPS 400-SC, Frigoscandia	Yes	20 (before/ after treatment)	No		Tissue excision	APC, Enterobacteriaceae Coliforms, E. coli	1.4-1.5 log(10)	
James, 2007 (UK, Poultry)	Pilot steam cabinet (80 °C)	No	27 (before /after steam)	Yes	2	Tissue excision	E. coli, C. jejuni	1.7-3.3 log(10)	Same survival for E. coli and C. jejuni

APC: Aerobical Plate Count