SHARING GOOD PRACTICES IN SLAUGHTER HYGIENE

General Guidelines

Pork

Bovine Animals (adults)

Ovine Animals

UECBV

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General Guidelines

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Preface

The European slaughterhouse industry, represented by UECBV, has decided to **share good practices in slaughter hygiene**.

The legal framework is the **EU Hygiene rules** (Regulation (EU) 852/2004, 853/2004 and 854/2004) **and the EU General food law Regulation** (EC) 178/2002**.** This guidance document focuses on **preventing and minimising contamination of fresh meat with faecal or ingesta material during slaughter** by effective means.

The intention is to provide tools to be used by the slaughterhouse for evaluation and system-based handling of contamination and procedures to handle different operations at the production line in order to prevent and minimise contamination. These are guidelines containing good practices (advice) that can be used on a voluntary basis, if found necessary; thus, it is not to be considered a legal text or a document of standard procedures to be followed. Furthermore, other procedures not mentioned here could turn out to be of benefit and should not be neglected.

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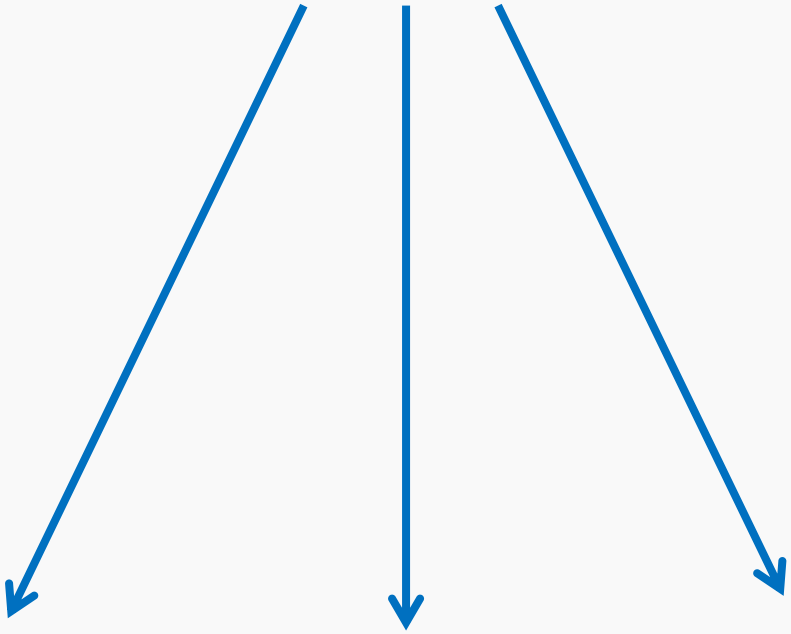
OVERVIEW

GENERAL PRESENTATION AND RECOMMENDATIONS



SPECIFIC TO PORK

SPECIFIC TO BOVINE ANIMALS (adults)

SPECIFIC TO OVINE ANIMALS

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SHARING GOOD PRACTICES IN SLAUGHTER HYGIENE - CONTAMINATION PREVENTION

General approach

prevention rather than cure, minimise contamination

In slaughter establishments, faecal/ingesta contamination of carcasses is the primary avenue for contamination with pathogens. Pathogens may reside in faecal/ingesta material, both in the gastrointestinal tract and on the exterior surfaces of the animal going to slaughter. Without care being taken in handling and dressing procedures during slaughter and processing, the edible portions of the carcass can become contaminated with bacteria capable of causing illness in humans. Once introduced into the establishment environment, the organisms may be spread directly or indirectly from carcass to carcass.

Therefore, it is important to prevent and minimise visible faecal or ingesta contamination on carcasses including head, tail and toes, and, if contamination occurs, to remove such contamination when found.

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1. Clean animals

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1.1. Bovine and ovine/caprine

According to Annex I, Part A, point II. 4(c) of Regulation (EC) No 852/2004, farmers must take adequate measures, as far as possible, to ensure the cleanliness of the animals going to slaughter. Cleanliness of livestock at slaughter is influenced by a variety of factors including diet, housing, bedding, clipping, feeding and transport. To ensure livestock arrive clean at slaughter means giving attention to the preparation of animals for slaughter. The aim should be to prevent animals from becoming dirty in the first place, but some degree of cleaning prior to slaughter may be necessary.

Every animal should be regularly inspected during finishing and before leaving the farm, and appropriate corrective actions should be taken if necessary

The following procedures are examples of good practice during finishing or corrective actions used for cattle.

- Livestock may self-clean sufficiently if moved to a suitable area with adequate bedding. Sufficient time for animals to clean up should be allowed within this area. Cattle should be housed at the correct stocking density. Ideally, such conditions should exist in the usual finishing pens. Animals that are simply wet or slightly dirty may then be fit for slaughter within a day or so, but if animals are very dirty they could require 3 to 4 weeks to clean up.
- Consideration should be given to the finishing diet. It has been shown that cattle fed on straw and water only 1-2 days prior to transport have reduced dung contamination during transport.

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- Producers must achieve dry hides and must avoid washing finished cattle before slaughter as the hide must be completely dry before the animal leaves the farm.
- If livestock remain dirty, it may be necessary to clip them either just prior to slaughter or after slaughter according to the situation. The EU guidance on Regulation 853/2004 explains it is possible to develop procedures for the hygienic dressing of animals that must protect carcasses from unnecessary contamination. Those areas from which the risk of contamination transfer to the carcass is high should be clipped to remove excessive dirt, particularly on the brisket, flanks, belly, legs, knee and hock joints. Great care is needed during clipping to avoid injury to the animal or people.

1.2. Porcine

Regarding porcine, this guideline addresses slaughtering employing scalding, dehairing and singeing/flaming. The processes in the unclean area must effectively remove faecal contamination on the rind, it is therefore less relevant from a food safety perspective whether pigs are clean at the time of delivery to the slaughterhouse.

1.3. Transporting animals to slaughter

Vehicles should be cleansed and disinfected between transport loads. Stocking rates should follow recommendations and partitions should be used to prevent injuries as a result of under-stocking.

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2. Definition

2.1 Identification of faecal/ingesta contamination

Foreign material should be identified based on both colour and texture (visual inspection) as either faecal or ingesta

Identification of faecal or ingesta contamination should be performed as visual inspection (visible to the human eye) under conditions of normal line speed and with normal lighting.

2.2 Characteristics

Livestock Feces and Ingesta Contamination Identification Chart

	Beef		Swine	Sheep and Goat
Color	Cattle	Calves	Yellow, tan, brown, or green	Green, brown, to black
	Yellow, green, or brown	White, yellow, tan		
Texture	Fibrous or plant-like texture; may include grain particles depending on diet		May include identifiable grain particles or fibrous plant material	Fibrous or plant-like, feces or ingesta may also be tarry

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3. Examples of good practices general prerequisites and SOPs for all species

3.1. Operators' training

Appropriate training of slaughterhouse personnel is a major factor in achieving good carcass hygiene.

Initial training relating to good practice, in general, hygiene, and the necessity of its implementation to guarantee food safety are a prerequisite.

Further training prerequisite is an explanation of the job description and any practical training that should ensure that the operators have understood their duties and role in in fulfilling meat safety requirements, so that the job will be well done. As an example, job descriptions can be discussed regularly with the operators during one-on-one assessments with their management. This is an opportunity to clarify certain points or to improve the operating procedures.

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3.2. Job descriptions

The job description is essential because it is the basis for the training and the evaluation of operators.

An example of a proposed job description can be as follow, divided into three parts:

1. Detailed operating procedure

All steps should be specified in chronological order.

2. Operator hygiene

Operator hygiene should be specified, depending on operation, species etc.

3. Recommendations in the presence of contamination

This part should explain what action to take with any contamination, no matter its origin, including incidents during the operating procedure at the workstation or at a previous workstation.

All recommendations for workstations should be included in a standardised procedure for the management of contamination.

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3.3. Importance of management / supervision

Management will designate a qualified person to be responsible for supervising operations to ensure that operators are adhering to their job descriptions and Standing Operating Procedures (OPs) (for example, a line manager). This person has a crucial role for the smooth running of the slaughter hall.

During slaughter operations, the designated person must ensure the implementation of working instructions and good hygiene practices, thereby preventing and minimising any contamination. Regular evaluations of all the slaughter steps and of the hygiene of a representative sample of carcasses before entering the chill can fulfil this obligation.

Relevant documented procedures should allow the prompt detection and appropriate response to any deviation from the standard.

3.4. HACCP based system

Ownership and maintenance of the HACCP system should be developed by an internal team. This is a good way for the HACCP system to be tailored to the needs of the slaughterhouse and be understood and applied by staff.

These procedures should mean that the necessary action is taken, with a focus on actions that not only address the problem, but prevent it from reoccurring.

It is essential to point out that it is not so important whether or not process steps are called Critical Control Points (CPs); Critical Points (CPs) or similar, as long as they are appropriately controlled by the

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Food Business Operator (FBO) by applying general Hazard Analysis and Critical Control Point (HACCP) based procedures.

Recording is essential in order for the FBO to document that the procedure has been correctly followed.

3.5. Health mark application

The FBO is responsible for preventing contamination to the extent possible[1]. Any contamination must be removed without delay to prevent cross contamination[2] according to the Regulation EC/853/2004.
The choice of methods used to satisfy this obligation is up to the FBO.
The FBO must have an internal procedure of management of contamination which is relevant and which ensures the cleanliness of the carcasses. According to the configuration of the slaughter line and particularly the location of finishing operators, the removal of contaminations can occur before or after the Post-Mortem Inspection (PMI). In all cases, health mark is applied after the removal of contamination

Removal of contaminations before the PMI: this practice, if feasible and within a clear framework and with specified procedure (for example, well-defined contaminations), can, in some cases, decrease the risk of cross-contamination.

[1] Regulation no. 854/2004, Annex I, Section I, Chapter 1, point 1 & 2, litra b).
[2] Regulation 853/2004, Annex III, Section I, Chapter IV, point 10.

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Removal of contaminations after the PMI: finishing operators are often located at the very end of the slaughter line to correct everything that may have occurred upstream. This location is relevant on the sanitary level but it implies that the health mark is not applied at the PMI workstation, but further, on the line or out of the line, in the framework of a procedure agreed upon jointly by the FBO and the CA. The removal of contamination out of the line does not imply necessary a detaining of carcasses; on the contrary, an almost immediate trimming should be preferred to limit cross contaminations.

3.6. Post slaughter clipping or other post-mortem cleaning methods for bovine or ovine/caprine

Slaughterhouse operators must ensure that animals are clean. Animals sent for slaughter must be clean enough so as not to present an unacceptable risk for slaughter and dressing operations. The objective is to avoid contamination of the meat during slaughter and dressing so as to ensure that the required microbiological quality is achieved. As stated in the Commission guidance document on the implementation of certain provisions of Regulation (EC) No. 853/2004 on the hygiene of food of animal origin the food business operator is tasked with developing procedures to achieve this. There are different ways of achieving the objective, including:

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- The effective cleaning of animals, including ante or post mortem clipping[3], or
- The sorting of animals in accordance with cleanliness and developing an appropriate slaughter scheme, or
- Developing procedures for hygienic dressing of animals that must protect carcasses from unnecessary contamination, or
- Other appropriate procedures.

On arrival at the slaughterhouse, the plant operator assesses and categorises the animals (bovine, ovine), as follows:

- Animals that have been assessed as being clean enough to be slaughtered using routine standard hygienic dressing procedures;
- Animals that can only be slaughtered by using extra defined appropriate controls;
- Animals unfit for slaughter as they are too dirty, particularly if wet. These animals should not be presented for ante mortem and the slaughterhouse operator must take the required remedial action.

Post slaughter clipping, or other post-mortem cleaning methods, can be used at the abattoir providing the operator can demonstrate that the clipping or cleaning procedure effectively controls any food safety risks that may arise. Hide clipping, both ante and post mortem, have been shown to be an effective intervention.

On-line clipping facilitates the removal of adherent material, including faecal material, prior to the commencement of carcass dressing.

[3] See the peer review paper on post mortem on-line clipping HERE

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Its use, in conjunction with good hygiene practice during dressing, can contribute significantly to a reduction carcass contamination.

Taking into account on-line clipping, consideration should be given to the following points:

- The on-line clipping area should have good extraction facilities and means of disposing of clippings;
- The on-line clipping work station should be positioned between the bleeding and first legging stands;
- A rise and fall stand should be provided to allow ease of access to areas of the hide that require clipping.
- On-line clippers may incorporate suction at the clipping head for the removal of clipped and other material.
- On-line clipping is recommended particularly for the area near the incision line, e.g. the hind quarter, including the tendon region and the midline belly, 15 cm on either side of the intended incision line, down to and including the brisket if the brisket is to be opened.
- Dirtier animals particularly in a wet condition should not be allowed for slaughtering until the hide has dried, and the possibility of cross contamination is significantly reduced.

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4. Use of additional hygiene tools

The compliance with good hygienic slaughtering practices is a prerequisite to the production of safe meat. To assist in producing a clean carcass there are additional hygiene tools available to the industry.

These tools are complementary to the good hygiene practices and not a substitute to them.

The sanitary added value of these tools is proved but it is limited.

It can be supposed improved by a multi-hurdle approach: use substances authorized by the regulation 853/2004 to reduce surface contamination at several points of the line according to the risk analysis led by the FBO.

At date, the only authorized substances are potable water for all species and lactic acid for bovine animals.

4.1 Decontamination using a steam vacuum system

[*Source: Bieche, IDELE-INTERBEV, 2014*]

4.1.1 Context

Several studies on the effect of using steam vacuum systems to treat carcasses have shown significant reductions in the surface contamination of carcasses.

The steam vacuum system involves two actions:

1. The mechanical aspiration of the contamination by vacuum, which results in a visibly clean carcass and removes the major part of the microbiological contaminants.

2. The thermal destruction of microorganisms by using a hot steam jet.

It is a tool used in conjunction with good hygienic practices (GHP), with no adverse affects on hygienic practices employed at plants.

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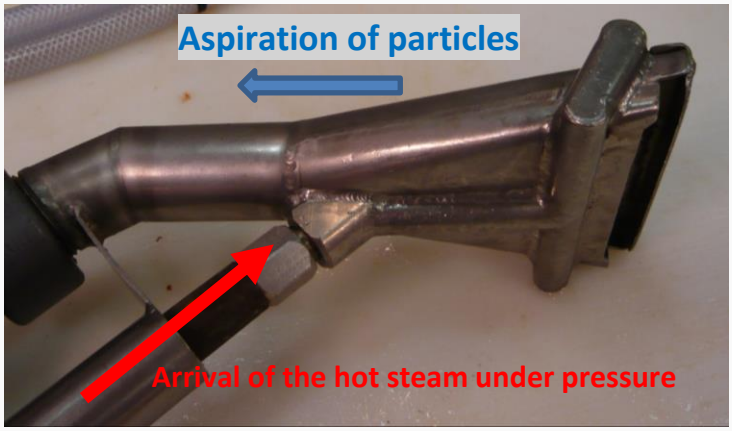
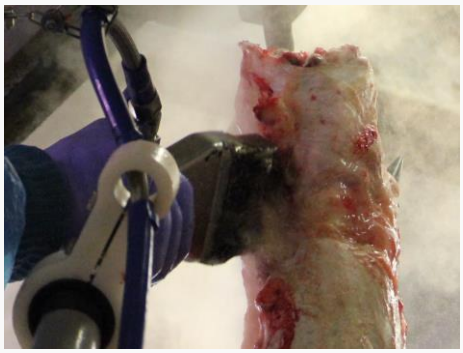
4.1.2 Possible uses

(i) on the slaughter line

(i) a. Instances of carcasses with minor and well-defined contamination.



Photos: Features of the cleaning head



YES

NO

Photo: Proper positioning of the cleaning head, properly adhering to the surface of the carcass

The steam vacuum system is used to remove the visual contamination. It is recommended to apply the cleaning head over the entire contamination, protruding at least 10 cm beyond the contamination and ensuring at least one passage at any point of the treated area.

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In the case where the contamination is trimmed before being treated with the steam vacuum system, the area to be treated must be clearly indicated.

(i) b. Case of systematic treatment of carcasses, known as "grooming" ("*toilettage" in french*), to reduce microbiological surface contamination of carcasses.

This preventive treatment is more or less extended to the carcasses, and it must treat, as a priority, the anatomical zones of the carcasses known to be the most contaminated (e.g. brisket, collar, hocks ...).

(ii) Use outside the slaughter line

For extended or multiple contaminations, real time corrective action (i.e. on the line) seems to be undesirable. The treatment of these contaminated carcasses can require different interventions: trimming, removal of peritoneum etc., alone or in combination. Steam vacuum system can be used to perfect the compliance of carcasses.

4.1.3 Cleaning the cleaning head during production

The cleaning head is heated by the means of steam and any residual particles are immediately removed; there is, therefore, no risks of cross contamination between carcasses via the steam vacuum system. It is not necessary to disinfect the steam vacuum system between two carcasses, but the operator must regularly monitor the visual cleanliness of the cleaning head during production; if necessary, any agglutinated particles are removed with a hard brush The cleaning head can be immersed in hot water to facilitate the removal of particles.

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4.1.4 Preliminary requirements

Layout of Steam vacuum systems differs between suppliers. And, as the effect depends both on the layout and the operating conditions (treatment time, type/power of vacuum pump, amount/pressure of steam), the effect under the operation conditions used should be verified by the user or the supplier.

Firstly, the company or supplier must define precise conditions for the use of the steam vacuum system, according to its objectives (treatment of visible contamination, routine grooming of certain anatomical carcass sites etc.).

This is required to:

- Quantify the effect of reducing the bacterial contamination obtained under the real conditions;
- Check that the treatment conditions (temperature and pressure of steam, action of the operator) do not alter the carcasses permanently (risk of cooking).

The operating speed of the cleaning head is important: if speed is too fast it tends to reduce the effect of decontamination; if too slow it may alter and cook mark the treated surface. A medium speed must, therefore, be found.

4.1.5 Monitoring

1. Control of physical parameters of steam

Temperature and pressure of the steam: the values set by the initial qualification must remain constant over time.

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2. Monitoring of good practices of use of the steam vacuum system.

The operator must follow the internal procedure, in particular concerning the following points:

- Compliance with the areas to be treated on the carcass, as defined by the company;
- If the initial qualifications have not shown that simply removing the visible contamination results in a satisfying reduction of the bacterial contamination, then duration of treatment per surface to be treated and the speed of passage of the cleaning head should be monitored;
- Proper positioning of the cleaning head, properly adhered to the surface of the carcass;
- The fact that the operator does not leave the cleaning head stationary on the carcass, because this could scald the surface of the carcass at this point;
- Regular cleaning of the cleaning head with a hard brush to ensure the effectiveness of the treatment

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These checks are visual.

Photo: direct the carcass and hold it to stabilize it during treatment

Photo: brushing the cleaning head with hot water

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4.2 Lactic acid

FBOs can use lactic acid to reduce microbiological surface contamination on bovine carcasses or half carcasses or quarters at the level of the slaughterhouse, in compliance with the conditions set out in the Regulation 101/2013.

Each FBO should define the best combination of parameters necessary to ensure a good efficiency, without bringing any irreversible physical modification of the meat.

These parameters are the concentration (between 2% and 5%), temperature (up to 55°C) and applying (spraying or misting).

The efficiency of the lactic acid treatment can be assessed on the decrease of hygiene indicator bacteria or on the decrease of pathogen bacteria.

4.3 Hot water washing

High temperature water (>74°C) is sprayed onto the entire carcass as the last step prior to chilling.

It is authorized to use recycled hot water (in compliance with the conditions set out in the Regulation 1474/2015), which improves the economic profitability of the treatment.

The level of reduction of surface contamination depends on the characteristics of the cabin (nozzle type, in particular) and especially on the conditions of use (spraying time, pressure and water temperature).

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This technology is routinely used in many Australian, Canadian, American and, more recently, European slaughterhouses.

4.4 Steam Pasteurisation System (SPS)

(*Source: ANSES' opinion of December 10th 2010*)

This process, located at the end of the slaughter line, is fully automated. The treatment of carcasses is carried out in three steps.

As a first step, the surface of the carcasses is dried with pressurized air. The objective of this operation is to increase the decontaminating effect of steam which will then be applied. Under the conditions of slaughter in the United States, the necessity of drying is probably amplified by the fact that, upstream the chain, the carcasses are generally showered.

The second step consists in exposing the carcass to steam at 105°C for a period of 6 to 8 seconds in a completely hermetic cabin. The surface temperature of the carcass is instantly increased to 91-94°C.

During the third step, the surface temperature of the carcass is lowered to a temperature inferior to 20°C by sprinkling chilled water ("*eau glacée*" in French). The objective of this cooling is to prevent the surface cooking of the meat from causing irreversible alterations in the appearance of the carcasses (mainly colour)

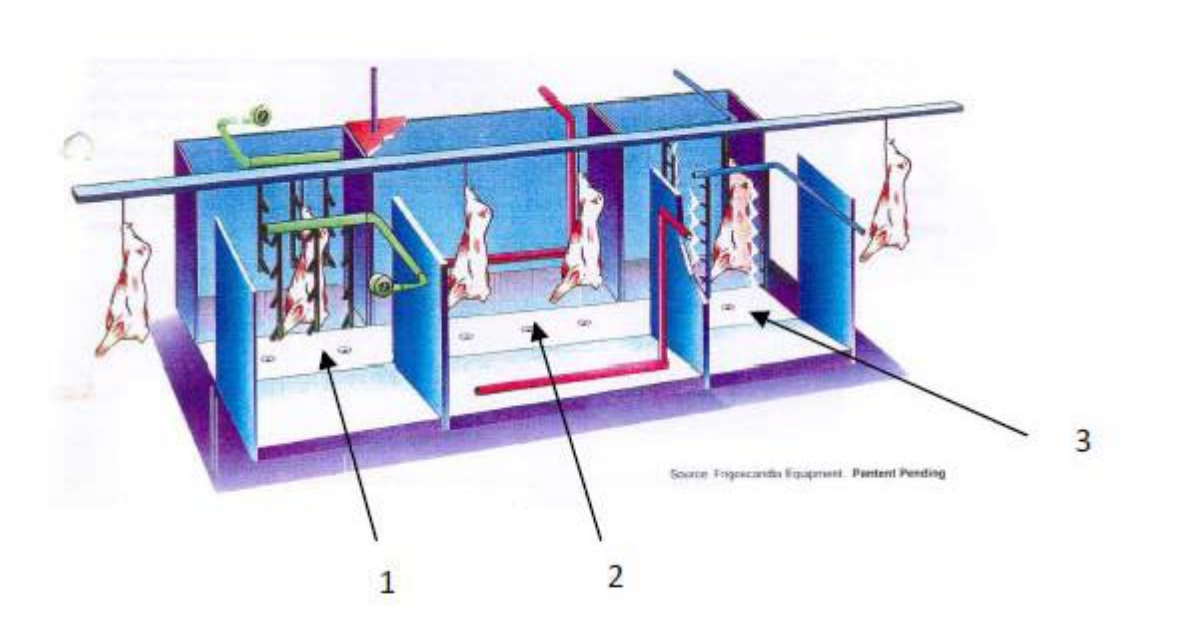

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Illustration: Principle of the SPS cabin, based on the spraying of carcasses with steam:

1: drying of the carcass (air under pressure)

2: steam treatment (6-8 seconds)

3: cold shock (sprinkling of chilled water)

The installation of SPS cabins requires space and facilities (entry and exit water etc.). It is easier to put in place when the slaughter line is designed for this equipment.

SPS designed cabins have been integrated into many US and Canadian slaughter chains. However, to our knowledge, these cabins are not marketed in Europe (although their use is allowed by European regulation).

4.5 Flaming

Flaming/singeing is a pork slaughter step. The surface temperature reaches approximately 100°C, which reduces the surface contamination of the carcasses. Normally, the occurrence of gram-negative pathogens is very low on the rind after the operations in the unclean area. This is due to the combined effect of scalding, dehairing, flaming/singeing and scraping/brushing/polishing.

If occurrence of gram-negative pathogens is a problem on the rind after the operations in the unclean area, a second flaming before evisceration can be used to reduce the number of pathogens.

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5. Specific good practices per specie

5.1. Specific part for pork:

Click here: Pork

5.2. Specific part for bovine animals:

Click here: Bovine animals

5.3. Specific part for ovine animals:

Click here: Ovine animals

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6. Track and trends

Track and trending are tools that can be used to assess whether the frequency of faecal and ingesta contamination is in control.

These tools support a system-based approach. Such tools can also be used in collaboration and regular communication between FBO and the Competent Authority and raise awareness of contamination levels over time.

6.1. Recording

Where records of contaminations are used for control purposes by the slaughterhouse, it is important that there is a standardised recording of contaminations based on the definitions in 2.2. and 2.3. (colour and texture).

Recording can be performed manually or electronically along the slaughter line, where it is most practical. Recording can be performed as a 100% recording or by collecting representative samples to calculate the prevalence of contamination.

6.2. Baseline

When using interventions to reduce and minimize the faecal/ingesta contamination, it will be useful to know the level of contaminations before the interventions are implemented or to know the level, for example, at the post mortem inspection.

This is where a baseline can be useful. A baseline can be used as a standard against which all subsequent changes are measured.

Baselines are often shown as lines in graph form to easily show changes over time. In some cases, depending on species and method of

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slaughter, it can be beneficial to have separate baselines for the origin of the contamination (for example, faecal and ingesta).

Experience has shown that, even though most contaminations are found and removed, the sensitivity of visual inspection is not 100%. Small particles, in particular, can be overlooked. Also experience from well performing pig slaughterhouses shows that faecal and ingesta can be missed even by well-trained staff.

Experience also shows that the efficiency of the staff regarding finding faecal/ingesta contamination varies a lot on a day-to-day basis and between slaughterhouses. This implies that findings from different slaughterhouses should be compared with caution.

A baseline consists of recordings of faecal/ingesta contaminations in a defined time period. A baseline is a useful tool as a reference for the development of faecal/ingesta contaminations over time.

Example

Below, an example is shown based on data from an average performing pig slaughterhouse covering one year (2014). Each dot represents % faecal/ingesta contamination for one day. Average for the entire year +/- standard deviation was 3.25 +/- 0.64%. Inspection for faecal/ingesta contamination was carried out by the competent authority. No faecal/ingesta contamination had been removed prior to inspection (and recording).

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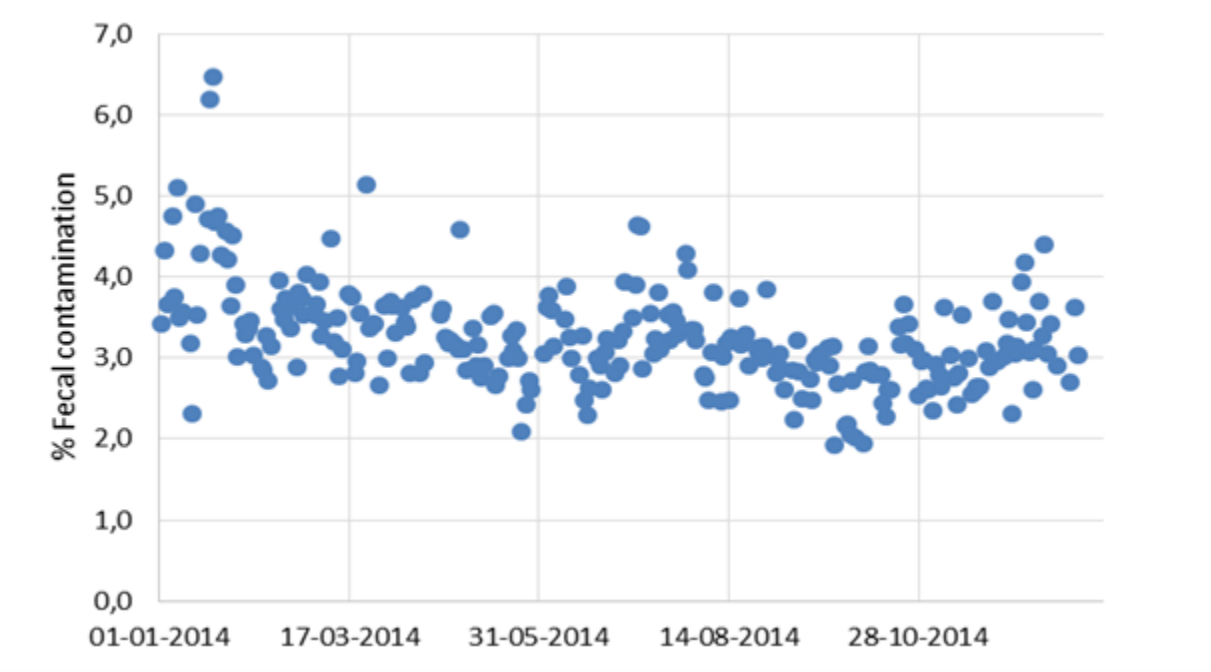

A relatively big variation between days is to be expected.

The variation arises from i.e.:

- differences between the condition of the incoming animals (e.g. adherent intestines),
- differences regarding personnel inspecting the carcasses, and
- deviations due to malfunctions on the production line that are corrected during the day.

It is not realistic to fully avoid contamination; however, experience shows that the overall prevalence of contaminations can be reduced by the use of good practices.

6.3. Trend analysis (assessing deviations and verification based on statistical approach)

As fore mentioned, trend analysis is a tool that can be used to assess whether the frequency of faecal and ingesta contamination is in control.

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Typically, a company will keep records showing the frequency of contamination from the digestive tract or hide, i.e. before measures have been taken to remove the faecal and ingesta contamination.

Example

An example of how trend analysis can be used is shown below using data from a European pig slaughterhouse. % faecal denotes the percentage of carcasses with faecal contamination per day and it is assumed that % faecal contamination is normally distributed.
The average for % faecal at the pig slaughterhouse X has been 3.25 % with a standard deviation of 0.64 % during the last year.

Slaughterhouse X has decided to evaluate the results from their daily recording on two levels, where the first level deals with the average contamination from one day and the second level deals with the average contamination over a number of days.

6.3.1 Evaluation of the daily average

On a daily basis, slaughterhouse X calculates % faecal in order to evaluate whether the parameter evaluated on a day-to-day basis is deviating from last year's average. The % faecal for a single day should be within the 99.74% interval i.e. 3.25 +/- 1.92%. If % faecal is above the upper limit, i.e. 5.17%, actions are taken to lower the percentage of faecal contamination. If % faecal is below the lower limit, i.e. 1.33%, it should be ensured that the systems for detection and registering of faecal contamination are in place and working.

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6.3.2 Evaluation of the average faecal contamination for the last 30 working days

The slaughterhouse X also calculates the average % faecal on a continuous basis covering the last 30 working days. Assuming a standard deviation of 1 the 95% confidence limit for an average (avg.) calculated on the basis of 30 observations is average +/- 0.36[1]. If the average calculated on the basis of the last 30 days is 3.0, and the contamination exceeds 3.36, then actions are taken to lower the faecal contamination. This is to ensure that the % faecal is not following an upward trend, that the % faecal is below 3% on average, and that the standard deviation is <= 1%. Using 30 working days is a choice which balances considerations regarding the precision for the estimate of the average, the period passing before an upward trend is found, and the risk of doing corrective actions due to random events.

Examples

Below are the above mentioned two examples shown graphically, where corrective actions are initiated by either the daily average exceeding the limit or the average for the last 30 working days exceeding the limit.

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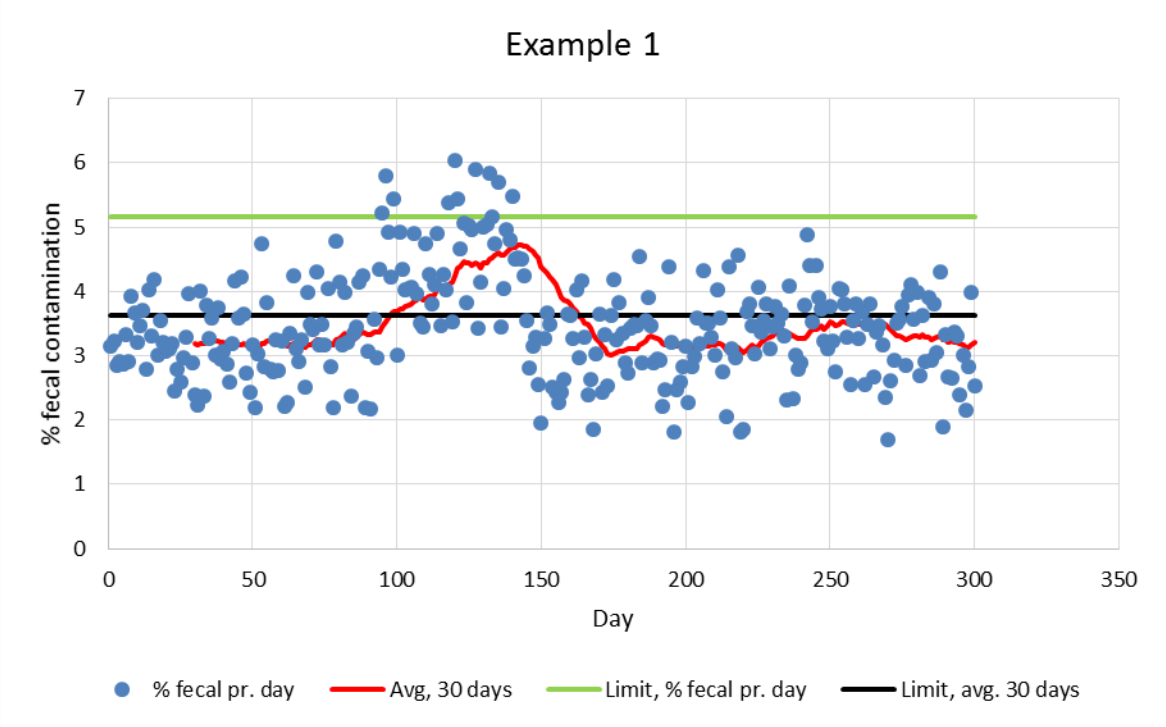

[1] (1,96*1/√30).

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