# TAFS

**INTERNATIONAL FORUM FOR TSE AND FOOD SAFETY**
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# TAFS[1] Position Paper on Slaughter Practices and the Dangers of Carcase Contamination with BSE



This note focuses specifically on methods currently, or recently, used to slaughter cattle and then to subsequently dress the carcase in preparation for human consumption. It considers the likelihood that the processing can increase risk to consumers of exposure to the BSE agent through consumption of bovine products, and changes to working practices that have been introduced to remove or reduce that risk.

The text relates primarily to practices that are in place in Europe, but can be used for consideration of the risks arising from related procedures in other parts of the world.

Although the document deals with potential risks associated with BSE, there is a need for a balanced approach to the evaluation of risks and the implementation of protective measures in any particular country. The cost of implementation can be massive, and cause severe disruption to slaughterhouses and allied industries. Therefore the extent to which measures are introduced should take into account the real risk to consumers in that country, and the degree of risk reduction offered by the solution(s) chosen.

The note does not address the ethical issues surrounding individual methods. It deals only with BSE related issues, and only with cattle.

## How are cattle slaughtered for human consumption?

- Unless prohibited by religious slaughter practice, most cattle are stunned before they are killed. The unconscious animal is then bled out, and it is the bleeding out that causes death.

[1] TAFS is an international platform created by a group of scientists, food industry experts, animal health regulators, epidemiologists, diagnosticians, food producers, and consumers. Its purpose is to establish and maintain lines of communication for the dissemination of reliable information to the public that can maintain confidence in the safety of food with regard to Transmissible Animal Diseases.

**How are cattle stunned?**

- In recent times cattle would be stunned by means of a gun, from which a bolt was driven through the skull and into the brain. This renders the animal unconscious. In some abattoirs, penetrative stunning would be followed by "pithing". This involves passing a flexible rod through the hole in the skull, and down the spinal canal. It is, or was, done primarily to protect the operators responsible for bleeding the cattle. It did so by destroying spinal reflexes controlling the front limbs, and prevented reflex kicking. In larger abattoirs with greater mechanisation of procedures, more rapid stunning and bleeding operations frequently make this an unnecessary procedure. Smaller abattoirs, with greater dependence on manual labour, and slower speeds of operation, may still find pithing to be necessary. Pithing has actually been banned in Europe.
- A variant of this method was used in some countries. In this method the flexible rod was replaced by the injection of air through the bolt and stun hole into the skull. This effectively pithed the animal. This is now illegal in the European Union.
- An alternative form of stunning, called percussion stunning, applies the stun to the outside of the skull without penetrating the skull.
- In some abattoirs electrical stunning is used. In other words the cattle may be electrocuted.

**How can stunning increase risk to consumers from BSE?**

- There is some research evidence that suggests that penetrative stunning, with or without pithing, can cause some brain tissue to enter the blood stream. Although such a risk was demonstrated many years ago by artificially contaminating the stun bolt or pithing rod with bacteria, recent studies have specifically demonstrated trace amounts of brain material in the blood of some animals immediately following stunning[2-5, 8, 9, 10, 12, 21, 24].
- The injection of air through the stun bolt has the potential to significantly increase the risk. Occasionally, samples of brain material, visible to the naked eye, have been identified lodged in tissues that receive blood after passing through the heart (usually lodged in lung or occasionally liver)[14, 15, 20, 27].
- In these circumstances, the methods of stunning have the potential if used on BSE-infected animals, to drive some infectivity into the blood stream. The extent of contamination of the rest of the carcase by this means has not been demonstrated. As mentioned above, with the exception of extremely small particles of brain, most would become lodged in organs such as the lung.
- Penetrative stunning also has the potential to expose the meat of the head (and indeed operators) to brain tissue that exudes from the hole, either on the pithing rod or subsequently after removal of the head.
- Carriage of heads to specialist plants where the meat from the head is removed (boning-out plants) can compound the likelihood of contamination if several heads are in contact. Following removal of the head, leakage of cerebro-spinal fluid, which bathes the brain and has not been shown to be infectious in BSE cases, has the theoretical potential to cause further cross-contamination.

**Is it only the stunning process that represents a risk?**

- No. In the majority of abattoirs it is normal practice to split the carcase in order make handling easier, and to supply traditional cuts of meats to the retail and manufacturing trade. This is also required to ensure that the whole carcase can be inspected to ensure that it is fit for human consumption. Splitting normally involves sawing the spinal column in half along its length. This also frequently cuts through the spinal cord. If the animal is infected with BSE, the spinal cord must be assumed to be as infectious as the brain[7, 11, 13, 16, 17, 19, 21, 22].
- It is therefore inevitable that a certain amount of spinal cord tissue is spread along the cut surface of the spinal column by the saw. In addition there will be a certain amount of spray contamination of the surface of the carcase, but research into this aspect is ongoing[6, 11, 18, 25, 28].

**What parts of the carcase are naturally infected?**

- Which tissues are infectious in a naturally infected bovine depends very much on its age, and how long before the onset of clinical disease the animal has been slaughtered. Experience in the United Kingdom suggests that most infected cattle die of BSE at ages between four and six years, with an average of 60 months, although they can be much older[29].
- So, in a young animal, under two years of age, the infectivity is almost certainly confined to the lower small intestine.
- In a four year old cow, that would otherwise have died of BSE at age four years and two months, infectivity would be detectable in the brain, spinal cord and other nervous tissues close to them, as well as the intestine.
- In a four year old cow that would otherwise have died of BSE at age eight years, infectivity may still only be detectable in the intestine. None of the current methods of detection have been shown to be able to detect positive brain tissue this far in advance of the onset of clinical disease. In fact current estimates suggest that the brain may only be infectious (detectable by rapid test) three to six, or possibly 12 months before onset of clinical signs[1, 13].
- Traces of infectivity have been found in other tissues in experimentally infected cattle. These are bone marrow around the time of clinical onset and tonsil earlier in the incubation period. Nevertheless, it is possible that trace amounts of infectivity may have been present in other tissues at levels that could not be detected by current methods.
- The distribution of infectivity in the body of naturally or experimentally infected cattle is discussed at greater length in another TAFS Position Paper, on Specified Risk Material (SRM)[26].

**Are these consumed?**

- In many countries in which BSE has been detected some tissues are removed from the human and animal food chain. Originally, in the United Kingdom, these tissues were designated by extrapolation from research on sheep. More recent research on BSE in cattle suggests that the measures are still appropriate, and possibly extend beyond what is really necessary in cattle. These tissues, usually referred to as Specified Risk Materials (SRM), are removed from the carcase and destroyed.

- In countries that were at one time classified as being at high risk of having BSE, such as the United Kingdom and Portugal, the list of SRM tissues included at that time: the intestinal tract, spleen, tonsil, thymus, brain, spinal cord, the skull (in the UK the entire head excluding tongue).
- The vertebral column of animals over 12 or 30 months of age at the time of slaughter was also an SRM in the European Union, the age cut-off being dependent on the country's BSE status. In 2008 the age limit was raised to 30 months, based upon earlier advice from EFSA, which took into account the falling prevalence of BSE in the EU[13].
- In other, lower risk, countries the range of tissues may be shorter, and are generally proscribed by international or individual state rules (European Union, Office Internationale des Epizooties) which govern trade and/or public health.
- Given that the variations in definition of SRM from country to country, and with time as new scientific results justify additions or deletions from the list, a separate Position Paper is provided on the TAFs web-site which summarises the current situation in Europe.

**What parts of the carcase are potentially contaminated as a result of abattoir practices?**

- The guidance provided above with regard to which tissues are naturally infectious indicates that the age of the animal at slaughter will influence the degree of risk of contamination during the slaughter/dressing process.
- The brain and spinal cord represent the greatest risk, but only if infected. In other words, the animal has to be infected, and it needs to be most probably within a few months of onset of clinical disease.
- Unfortunately, for any live infected animal, there is no means of precisely defining when it is due to die of clinical BSE while it is still alive. There are no satisfactory tests for live animals.
- Nevertheless, it is possible to use the normal age of slaughter as an indicator of risk. Most infected cattle die of BSE between four and six years of age, with smaller numbers below and above this. If it is assumed that the brain is infectious for up to a year before clinical signs become obvious, it is clear that older animals represent the greatest risk[1]. They are more likely to test positive if included in a surveillance programme, or if tested for public health purposes. This is of course dependent on BSE being present in the first place.
- Consequently, animals slaughtered for human consumption at aged 24 months or less are unlikely to represent a significant risk of contamination. If their brains were tested at slaughter they would invariably be negative.
- The parts of the carcase that are subject to most contamination in an infected animal are head meat and the cut surface of the spinal column. It is for this reason that the vertebral column is now often treated as SRM, rather than due to any inherent risk associated with bone. In addition, nerve ganglia just on the outside of the spinal column (called dorsal root ganglia) may also harbour infectivity if the spinal cord is infectious, so destruction of the vertebral column is doubly protective[13].

**What action is taken to reduce or eliminate these risks?[23, 25]**

- The ideal solution is to ensure that none of the slaughter cattle are infected with BSE, but that is extremely difficult to prove.

- Selection of meat for human consumption only from young animals, as occurred in the UK from 1996 to 2006 (a decision taken for a range of reasons, of which spinal column contamination was but one), is one option.
- Selection of meat for human consumption from animals born after the introduction of an effective feed ban should reduce the risk that the animals are infected. Evidence of effective enforcement of the ban is essential.
- Some attempts have been made to change slaughter/stunning/dressing methods, but solutions have been difficult to find when the meat is to be traded in the form of traditional cuts that are undamaged by the dressing process.
- In the European Union the use of "pithing rods" has been banned.
- In countries where pneumatic stun guns injected air into the skull, the air pressure has been reduced so as to reduce the risk of emboli.
- As abattoirs gain confidence in trying newer methods, some are switching to the use of non-penetrative stunning methods. They still present some risk of creating brain emboli, but research in this area is still in progress.
- Alternative carcase splitting methods have been tried. In the UK Over thirty months scheme (OTMS), where the meat was not consumed, it was possible to split carcases off-centre, so as to avoid cutting through the spinal cord. This still presented serious difficulties in handling half carcases that were no longer supported by the vertebral column. It also has to be recognised that meat hygiene regulations normally require exposure of the spinal cord for meat inspection purposes so that the carcase can be certified fit for human consumption.
- Other methods have attempted to remove the spinal cord within a core of bone, using a circular saw that moves along the length of the spinal column. In theory this prevents any exposure of the spinal cord, but it proved difficult to adapt to high line speeds and to variations in carcase sizes, occasionally resulting in exposure of some spinal cords. Again this approach prevented inspection of the spinal cord.
- A variant on this theme, to use twin blades that cut through transverse processes down each side of the vertebrae, also presented unmanageable carcases in the absence of rigid bone. This also prevented inspection of the spinal cord.
- Aspiration of the spinal cord from the spinal canal, before carcase splitting, is also used in some countries, with variable success. Curvature of the spine and the tough tissue covering to the spinal cord (dura mater) present difficulties in ensuring complete removal.
- Several of these methods cause potential damage to the highest value joints of meat along the spine, and consequently can meet substantial adverse pressure from the meat industry.
- Additional precautions to manage subsequent risks include the use of dedicated equipment, such as knives, to specific functions so that if used on spinal cord removal they are not subsequently used on meat. Such an approach is feasible at decapitation, with one knife used to cut flesh, while a second is used on the spinal cord. The use of such approaches requires careful training and supervision.

**Is it not possible to retool in the meat industry so that the slaughter/dressing process is safe?**

- In theory this should be possible, but industry resistance, together with alternative approaches to risk reduction (SRM, vertebral column removal) have proved to be substantial obstacles to research into alternative methods. With time, as risk declines,

the incentive to develop and introduce such methods also decreases, unless alternative drivers to change take over, such as a desire to reduce bacterial contamination.

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