TAFS

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TAFS[1] Position Paper on Specified Risk Materials

Specified **R**isk **M**aterials, or SRM, are tissues that have been designated for removal from the carcases of cattle, and excluded from human food. They have been shown, or assumed, to contain significant amounts of BSE infectivity in infected animals. By prohibiting their consumption it is considered to provide a substantial reduction in risk to consumers in countries where BSE has been shown to exist and in countries having a likely BSE-risk. SRM are also designated in sheep and goats. This was stipulated as a precautionary measure assuming that sheep and goats may have become infected with BSE. The finding of BSE in one goat has confirmed this assumption.

SRM are also usually removed from animal feed as well, and this strengthens more general feed bans that are intended to prevent infection of cattle and small ruminants with BSE and lead to the elimination of BSE in each country. This document essentially concentrates on SRM in the context of human health, except in explaining the evolution of definitions and protective measures.

Considerable confusion surrounds the term "specified risk materials" or SRM. This confusion ranges from the reasons for designation of such tissues or organs for destruction rather than consumption, and the extent to which it is necessary to ensure full compliance with regulations that require their removal from the food chain. This note briefly summarises the reasons for the designation of SRM, and concludes by listing current rules in the Europe. This table will be modified as rules change. Although the table includes a list of sheep and goat tissues that are defined as SRM, the note primarily addresses the background to bovine SRM.

Why are tissues designated as SRM?

- This note does not propose to describe the full chronology of SRM definition, but will give an explanation for the designation of each current SRM below.
- In 1989, in the early stages of the BSE eradication programme in the United Kingdom, it was recognised that for every cow that was identified with clinical

[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 (TAD).

BSE there must have been others that were infected, but apparently healthy, that were being slaughtered for human consumption. These could not be detected while alive and prevented from being slaughtered for consumption. It was therefore felt that reliance on the slaughter and destruction of clinically affected cattle was insufficient to protect public health, and that additional measures were required.

- As a result, consideration was given to whether the entire carcase represented a risk to consumer, or whether it was possible to identify specific tissues that could be removed and excluded from the food chain. In other words, in the absence of evidence that BSE did actually represent a risk to humans, what acceptable and proportionate additional safety measures could be put in place? Was it a ban on the consumption of any bovine tissues, or was it possible to avoid taking any action at all?
- By 1989 research had not progressed to the point of being able to identify which bovine tissues were infectious, other than brain[3,16]. The authorities therefore resorted to an analysis of known data from the similar disease of sheep, scrapie[20]. Some limited research had been done that indicated the range of tissues that might be infectious, and the extent to which they might be infectious. In other words it was clear that some tissues contained higher levels of infectivity than others, and logically could be considered to represent a greater risk to consumers. This conservative approach aimed to minimise risk of human exposure through food.
- The outcome was a list of tissues that could be removed without destroying the economic basis of the industry, and could still be defended as proportionate should the measures be challenged in court. It was recognized that other tissues, which are not on the list, might be infectious, but at such low levels that detection was difficult.
- The initial listing in the UK excluded these tissues, then called Specified Bovine Offals (SBO), from the human food chain[20]. In September 1990 they were also excluded from all animal food, and this reinforced the feed ban that was the major measure introduced to eradicate BSE. The term SBO was later changed to SRM and also adopted in EU and other legislation.
- The development in recent years of rapid (post mortem) diagnostic tests has not eliminated the need to remove SRM. Although extremely effective, the tests are still only effective in the later stages of incubation, so they cannot detect all infected animals[27].

Has BSE infectivity been detected in all SRM listed later in this position paper?

- Yes. **R**esearch on bovine tissues, from naturally and experimentally infected cattle, has now progressed to the point where there is a clearer picture of which tissues are infectious, and those where no infectivity has been found[1, 2, 5, 13, 17, 18, 19, 21, 23, 26, 28-35].
- In **naturally infected cattle** the brain, spinal cord and retina (eye) have been shown to be infectious[5,16, 35]. In addition, positivity or infectivity was detected in some peripheral nerves that would not normally be removed as SRM[5,17,18,19]. The amount of infectivity present is low, and considered be up to 1000-fold lower than the brain.
- In **experimentally infected cattle**, brain and spinal cord were again been confirmed to be infectious, but in addition the distal ileum (lower small intestine) also contained significant amounts of infectivity[31, 32]. Two key ganglia, which are key intermediate points linking the central and peripheral nervous systems, namely

the trigeminal and dorsal root ganglia (DRG), were also clearly infectious[32, 33]. This is not surprising given their close association with central nervous tissue. Peripheral nerves have also been demonstrated to become positive after the brain and spinal cord[1, 19]. Completion of bioassay studies has also enabled a better understanding of the sequence of events, and rate of accumulation of infectivity, especially in relation to ileum, brain and spinal cord[1,2], and have confirmed the basic assumptions upon risk management policy were based.

- In addition, in **experimentally infected cattle**, a single positive result has indicated the possible presence of infectivity in bone marrow at about the time of clinical onset[33]. Further attempts to resolve this anomaly, by inoculation of cattle with bone marrow collected at different time points, were unsuccessful[21], and concluded that the presence of infectivity was either a rare event, or was more consistently present at levels below the limits of detection. As discussed by EFSA in the context of risk from lingual tonsil[11], this was considered to represent a negligible consumer risk when considered alongside the low prevalence of BSE in the EU at that time.
- In addition, a low amount of infectivity was detected in tonsil early in the incubation and maintained during the time course([13,32, 34)].
- A single calf inoculated with pooled third eyelid tissue from naturally infected cows has succumbed to BSE, indicating the presence of infectivity in the pooled tissue. None of the remaining four inoculated cattle became infected, so this result remains uninterpretable[35].

Why are other tissues/organs not expected to be infectious included in the list for exclusion from consumption?

- Some SRM have not been inherently shown to be infected, but with experience it is clear that their close association with other SRM, especially the central nervous system, represents a real risk of cross contamination[26]. Again, a precautionary approach has been adopted.
- For example, the **skull** has not been demonstrated to be inherently infectious, but it is impossible to remove the brain from the skull without leaving traces of brain tissue behind[26]. Similarly the eye is also infected. Therefore, the definition of skull as SRM acknowledges the remaining risk due to the retained brain tissue, or contamination with brain as a result of the slaughtering process. The designation of skull means that the practicalities of compliance and enforcement are easier to handle, and there is less exposure of abattoir operators to brain tissue while it remains encased within the skull.
- The **vertebral column** is also designated because of its close association with dorsal root ganglia (DRG) and due to contamination with spinal cord tissue. DRG sit just on the outside of the spine where the spinal nerves pass through from the spinal cord[26]. If the vertebral column (spine) was left attached to meat, for example in a T-bone steak, there is therefore a danger that the DRG would be consumed. The spinal cord contamination arises as a result of the splitting process as the saw that cuts the carcase in half passes through the cord and contaminates the cut surface of the spine.
- In both situations described above the use of vertebral column for the production of **mechanically recovered meat**, or mechanically separated meat, would strip off the DRG and contamination, transferring infectivity into the MRM/MSM which is used in manufactured meat products. Indeed, European legislation has gone further

than just designating vertebral column as an SRM. The use of ruminant bones for production of mechanically recovered meat (MRM) is prohibited.

Have all tissues been tested for the presence of infectivity?

- No. There are limits to the number of tissues that can be tested. Decisions on which tissues to test have historically been driven by several factors such as:-
  - which represent a risk to consumers because they are eaten,
  - which are key tissues in understanding the biology of BSE in cattle, and
  - which represent a risk to humans through the manufacture of other products such as pharmaceuticals and medical devices.
- Nevertheless, based upon evidence from other species (sheep scrapie) and the results of assays of bovine tissues, and audits of the use of bovine tissues, it is considered that all key tissues have been assayed.

Will the list be dynamic?

- Yes[(14)]. Research is still ongoing, and it is still possible that infectivity will be detected in tissues that have been negative so far. The use of cattle for infectivity assays, or technological breakthroughs to produce alternative assay systems (see above) mean that the analytical sensitivity of current assays is greater than those used in earlier studies. It is therefore not possible to exclude the possibility that new positive results will arise. Their significance, in terms of quantifying the amount of infectivity present, will be critical to risk assessments that will determine whether authorities define them as SRM.
- Nevertheless, current evidence suggests that this is a theoretical rather than real scenario. Authorities and expert committees cannot however remain oblivious to new findings, and may need to take into account consumer confidence as well as risk assessments in determining whether or not to add new tissues to the SRM list.
- Also it has to be taken into account that new findings of positive tissues may come at a time when the prevalence of BSE is very low and decreasing and the vast majority of cattle consumed have to be considered uninfected. In this situation authorities may conclude that the addition of further tissues to the list may be disproportionate to the risk. This has indeed been the case in relation to peripheral nerves, which have not been designated at SRM.
- In the TSE roadmap of the EU, published in July 2005[(6)], next steps in the BSE policy on different points are evaluated. Concerning SRM it is accepted that the list of SRM could be modified in the medium term, based on new and evolving scientific knowledge and the results of the surveillance programs, and subject to appropriate evaluation and consultation.

Designated bovine SRM in Europe

- **Brain** – expected to be infectious by extrapolation from sheep scrapie, and subsequently confirmed for BSE. Experimental evidence suggests that the brain becomes infectious in the later stages of incubation.
- **Spinal cord** – expected to be infectious by extrapolation from sheep scrapie, and subsequently confirmed for BSE. Experimental evidence suggests that the spinal cord becomes infectious in the later stages of incubation[(1)].
- **Tonsil** – expected to be infectious by extrapolation from sheep scrapie, but **not** subsequently confirmed for BSE from naturally infected cattle, even by bioassay

in cattle. Result from experimentally infected cattle, suggests that the palatine tonsil becomes infectious in the early stage of the incubation and the very low infectivity is maintained during the time course[7,13,34]. Tongue itself is not considered as SRM. However, according to EU-legislation, "tongue should be harvested by a transverse cut rostral to the lingual process of the basihyoid bone", due to possible contamination of tonsil tissue. Further consideration of the residual risk associated with lymphoid tissue that remains within the tongue after adopting this removal procedure did not result in recommendations for more extensive trimming of the tongue[11]. In part this was due to the low prevalence of BSE in the EU by that time.

- **Intestine** – the distal ileum was expected to be infectious by extrapolation from sheep scrapie, and this was subsequently confirmed for BSE in experimentally infected cattle especially in the early stages of incubation. Logic suggests that it must also be infectious in naturally infected cattle in the early stages of incubation. This infectivity was particularly associated with Peyer's patches[29], collections of lymphoid tissue that form a first line of defence against infection through the intestinal wall. This result has not been replicated in naturally infected cattle, although immunostaining methods have shown the presence of abnormal prion protein in the nervous plexuses of the intestine. This discrepancy is considered to be most probably due to the fact that the Peyer's patches regress as cattle reach maturity, and consequently reduce the likelihood of finding any infectivity that may remain. The majority of infected cows die of clinical BSE at five to seven years of age, after the Peyer's patches have regressed. Nevertheless, the positive immunostaining of the nervous plexuses, which extend throughout the intestine, does justify continued listing of intestine as SRM while there is a danger that cattle will have been exposed to BSE[10,25].
- **Skull** – designated because of association with brain and eye, with resultant contamination through the slaughtering process or because of residual brain tissue following removal of the brain.
- **Vertebral column** – designated because of a combination of close association with DRG, and the superficial contamination of the cut surface of the spine with spinal cord during the carcase splitting process.
- Age restrictions[8, 26] – all of the above tissues will not necessarily be designated for all ages of cattle consumed. This is because experimental evidence has suggested that they only represent a risk at particular stages of the incubation. If a tissue is infectious early in the incubation then it is normal to designate the tissue for all ages. If infectivity is detected late in the incubation then it is possible to designate the tissue in older animals only, especially where the designation is a result of contamination (eg. vertebral column).

Designated ovine SRM

- SRM designated in sheep are based primarily on evidence from the study of sheep scrapie, but the outcome is consistent with our understanding of the behaviour of BSE in sheep that are susceptible to infection with BSE[4,9,15].
- The designation adopts a cautious balance between significantly reducing the risk to consumers should BSE be present in the sheep and goat population and the introduction of extensive SRM removal which would significantly damage sheep and meat industries in affected countries[9,22,24].

- There is no doubt that the confirmation that BSE is present in the sheep population will result in an immediate revision of this list, or possibly even a prohibition of the consumption of certain categories of sheep meat. The confirmation of BSE in a goat[12] did not however have this effect on the definition of SRM. The list of SRMs in small ruminants was not modified as a result of this finding (see position paper on BSE in small ruminants).

A summary of designated SRM in Europe, North America and Japan as at January 2009

	European Union and Switzerland
Cattle	
Skull (including brain and eyes)	>12 months
Tonsils	All ages
Spinal cord	>12 months
Vertebral column (including dorsal root ganglia - DRG – but excluding vertebrae of the tail and the transverse processes of lumbar and thoracic vertebrae)	>30 months
Intestines and mesentery	All ages
Sheep and goats	
Skull (including brain and eyes)	>12 months
Spinal cord	>12 months
Tonsils	>12 months
Ileum	All ages
Spleen	All ages
	United States of America
Cattle only	
Skull (including brain, eyes and trigeminal ganglia)	>30 months
Tonsils	All ages
Spinal cord	>30 months
Vertebral column (including dorsal root ganglia - DRG – but excluding vertebrae of the tail and the transverse processes of lumbar and thoracic vertebrae, and wings of sacrum)	>30 months
Distal ileum	All ages
	Canada
Cattle only	
Skull (including brain, eyes and trigeminal ganglia)	>30 months
Tonsils	>30 months
Spinal cord	>30 months
Dorsal Root Ganglia (Vertebral column, excluding vertebrae of the tail and the transverse processes of lumbar and thoracic vertebrae, and wings of sacrum, is not defined in law as SRM, but removal from the human food chain is ensured by administrative action through meat hygiene controls.)	>30 months
Distal ileum	All ages

	Japan
Cattle	
Head (including brain, eyes and tonsils, but excluding tongue and cheek meat)	All ages
Spinal cord	All ages
Vertebral column (including dorsal root ganglia)	All ages
Distal ileum	All ages
Sheep and goats	
Tonsils	All ages
Spleen	All ages
Small and large intestines (including associated lymph nodes)	All ages
Head (including brain and eyes, but excluding tongue and cheek meat)	>12 months
Spinal cord	>12 months
Placenta	>12 months

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