Specified risk material and its amounts removed from cattle carcasses

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Abstract

This paper considers the amount of specified risk material (SRM) that is produced during the slaughter of cattle and whose complete removal and non-hazardous disposal represents a fundamental step in ensuring the safety of the food and feed chain in relation to the risk of bovine spongiform encephalopathy (BSE). SRM was obtained and weighed at two slaughter plants and data such as the age of the animal and its date of birth and breed was obtained from the integrated agricultural register. The cattle were divided into several categories, and the weight of total SRM and its individual parts were monitored in the given categories of cattle in dependence on the age and sex of the animals. It was found that the largest amounts of SRM arise in the category of cows above the age of 30 months, followed by bulls aged between 12 and 30 months, heifers in the same age range, and then young cattle less than 12 months of age. A correlation was demonstrated between the amount of certain types of SRM and the age of the animals. There are significant differences in the weights of the individual parts of the SRM in animals in the same category and of similar age.

Bovine spongiform encephalopathy, cattle, intestines, skull, specified risk material (SRM), spinal cord, tonsils

Introduction

Transmissible spongiform encephalopathy (TSE) is a progressive and fatal disease in humans and animals with a long incubation period causing characteristic histopathological changes in the affected tissue. The cause of the disease is considered to be a prion protein (Prp^{Sc}) that does not differ from the original cellular protein is terms of the order of amino acids in the peptide chain and does not induce an immune response, and whose accumulation leads to a neurodegenerative process (Belay and Schonberger 2005). Widespread awareness of prion diseases grew extremely quickly following the outbreak of BSE and variant Creutzfeldt–Jakob Disease (vCJD), although scrapie had first been described in 1730. Other spongiform encephalopathies include the sporadic Creutzfeldt–Jakob Disease (1920), Gerstmann–Sträussler–Scheinker syndrome (1928), transmissible mink encephalopathy (1947), Kuru (1957), chronic wasting disease (1978), fatal familial insomnia (1986), BSE (1986), and feline spongiform encephalopathy (1990) (Doherr 2003).

Bovine spongiform encephalopathy

Samples of brain tissue from two cows that had shown signs of unusual neurological symptoms were sent for testing in Great Britain in 1986. In view of the fact that the samples showed a similarity to the known sheep disease scrapie during neuropathological testing, the new disease in cattle was classified as bovine spongiform encephalopathy. The first cases of BSE probably appeared in the 1970s, though went unreported. Epidemiological investigation revealed that the common feature in the cases of BSE reported was the feeding of cattle with meat and bone meal (MBM), which is a valuable source of protein.

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The BSE occurred primarily in dairy cows because this method of rearing involves calves being weaned almost immediately and fed a milk substitute, and later hay and MBM concentrates. All kinds of dead livestock animals, as well as waste from slaughterhouses and butcheries, was used in the production of MBM in Great Britain in the 1970s and 80s, although it was proven that none of the processes used at that time in the processing of animal waste was capable of destroying the causative agent of BSE, merely reducing its infectiousness to a certain degree (Smith and Bradley 2003).

The fact that the new form of Creutzfeldt–Jakob Disease, named variant CJD and occurring primarily in young people, was caused by the interspecies transmission of BSE was first made public in Great Britain in 1996 (Belay and Schonberger 2005). A ban on feeding cattle meat and bone meal from ruminants was issued in Great Britain in 1988, though its feeding to pigs and poultry was not banned, which probably led to cross contamination of feed for cattle and to further cases of cattle positive for BSE. An order was issued in 1989 to remove the material considered 99% of the main source of infection, the so-called specified risk material (brain, spinal cord, tonsils, thymus, spleen and small intestine) and its exclusion from the food and feed chain. This measure was shown to be an important step in dealing with BSE infection (Smith and Bradley 2003).

The bovine tissue that it was compulsory to remove at slaughterhouses from 1989 onwards included the brain. It was normal practise for the deboned head to be sawn in half and the brain removed by hand and disposed of, while the skull, including remnants of brain tissue and the eyes, was recycled in a rendering plant. The entire skull was not included in the SRM until 1995 (Colee and Bradley 1997b).

Tissues classified as SRM from a certain age in individual countries in October 2005 are given in Table 1, from which it is clear that stricter standards applied in Great Britain and Portugal for the whole head which, with the exception of the tongue, is considered SRM from the age of 6 months, with the spinal cord, the spleen and the thymus also being classified as SRM from the age of 6 months (FAO 2007).

Table 1. The SRM in Europe (as of October 2005)

Tissue	EU	GB and P*	Switzerland
Skull, including brain and eyes	> 12 m	no	> 6 m
Whole head except tongue	no	> 6 m	no
Tonsils	from birth	from birth	from birth
Spinal cord	> 12 m	> 6 m	> 6 m
Vertebral column**	> 24 m	> 30 m	> 30 m
Small intestine including mesentery	from birth	from birth	> 6 m
Spleen	no	> 6 m	no
Thymus	no	> 6 m	no

* Great Britain, Portugal; ** excluding the vertebrae of the tail, the spinous and transverse processes of the cervical, thoracic and lumbar vertebrae, the median sacral crest and the wings of the sacrum, but including the dorsal root ganglia in animals older than 30 months (m)

Parameters for the processing of render materials, specifically a temperature of 130 °C to 140 °C and a pressure of 3 bars for 30 minutes, were quantities that came into force in the Czech Republic in 1962 on the basis of Ministry of Agriculture Directive No. 154/1961 accompanying the Veterinary Act, while in other countries similar parameters were not required until after 1996. The given values were selected for the effective liquidation of the spore-forming bacterium *Bacillus anthracis* (Duben 2006).

Immunohistochemical tests conducted during the experimental peroral infection of cattle revealed that the primary site of entry of BSE prions are the Peyer's patches in the distal ileum, where they were detected four months post-infection, but only 28 months post-infection in the brain stem. A bio assay has also been performed (bovine transgenic mice were used for the test) to test the infectivity of cattle samples taken, with positivity found in the Peyer's plates in the jejunum 8 months post-infection, in the tonsils 10 to 20 months post-infection, in the sympathetic division 16 months post-infection, in the parasympathetic division 20 months post-infection, and in the brain stem 28 months post-infection. This finding leads to the conclusion that the prion protein gets into the CNS centripetally through the intestines and the autonomous nervous system (Kaatz et al. 2012).

Prions are highly resistant to a number of biocides and physical measures. Prions are resistant to radiation (UV, gamma and microwave) and are not inactivated at 160 °C even after 24 hours. The most effective way of combating them has been found to be 0.1 to 1 M NaOH along with alkaline surfactants for 15 to 60 minutes (surfactants interfere with lipid membranes and sodium hydroxide is then able to interfere with the prion structure) or 2% sodium hypochlorite at 20 °C for 30 minutes. When using chemicals to devitalise prions, a considerable role is played by the type of prion and its sensitivity to the chemical used and the temperature. After burial, a brain with scrapie prions remains infectious for another 3 years and with CJD prions for 28 months (Renčová 2007). Prions are also resistant to alcohol, glutaraldehyde and formaldehyde. Formaldehyde may even increase the resistance of prions to temperature (Colee and Bradley 1997a).

Regulation (EC) No. 999/2001 of the European Parliament and of the Council, which stipulates rules for the handling of SRM and defines specific risk material for cattle, is one of the fundamental EU regulations for the handling of SRM:

- the skull, excluding the lower jaw, though including the brain and eyes, and the spinal cord of animals aged over 12 months,
- the vertebral column, excluding the vertebrae of the tail, the spinous and transverse processes of the cervical, thoracic and lumbar vertebrae, the median sacral crest and the wings of the sacrum, but including the dorsal root ganglia in animals older than 30 months, and
- the tonsils, the intestine from the duodenum to the rectum, and the mesentery of animals of all ages.

This definition was amended, in part, by Commission Regulation (EU) No. 728/2015 which instead of the intestine from the duodenum to the rectum included in the SRM just the last four metres of the small intestine, the caecum and the mesentery of animals of all ages.

Commission Regulation (EU) No. 1162/2015 included just the skull, excluding the lower jaw, though including the brain and eyes, and the spinal cord of animals aged over 12 months as SRM in cattle from countries with a negligible risk of BSE (which includes the Czech Republic) (effective from 5th August 2015).

Materials and Methods

Specified risk material was obtained and weighed from September 2014 to March 2015 at two plants in the Moravian-Silesian Region according to the definition of SRM valid at that time, including the following tissues: the skull excluding the lower jaw, but including the brain and the eyes (hereafter the skull), the spinal cord, the vertebral column excluding the vertebrae of the tail, the spinous and transverse processes of the cervical, thoracic and lumbar vertebrae, the median sacral crest and the wings of the sacrum, but including the dorsal root ganglia (hereafter the vertebral column), the tonsils, the intestine from the duodenum to the rectum including the mesentery (hereafter the intestine). The intestine was weighed with its contents.

This SRM came from animals on which a veterinary inspection had been performed before slaughter and which were found to be suitable for human consumption. The animals were divided into five categories: young cattle

to 12 months of age (young bulls and heifers), cattle from 12 to 30 months (bulls and heifers), bulls from 12 to 30 months, heifers from 12 to 30 months, and cattle older than 30 months (cows).

Data provided in the following form were obtained from slaughter plants: the identification number of the animal, the weight of individual parts of the SRM, and the date of slaughter of the animal. Further details were added from the integrated agricultural register, specifically the date of birth of the animal, the age of the animal in months, and the breed and sex of the animal.

The data were statistically evaluated using the programs Unistat 6.5 and MS Excel. Basic statistical parameters were calculated for the monitored quantities (average, standard deviation, median). Dependences between age and the amount of SRM produced were assessed by means of the Spearman correlation coefficient, including its statistical significance. The average quantity of SRM in relation to breed was calculated in the category bulls from 12 to 30 months.

Results and Discussion

The average quantity of SRM, the median, the standard deviation, the number of valid observations, and the highest and lowest measured weight of SRM are given for the individual categories of cattle in Tables 2, 3, 4, 6 and 7.

The amount of SRM from slaughtered cattle aged up to 12 months

A statistically highly significant dependence was found between the amount of SRM (tonsils, intestine, total SRM) and the age of the animals which, in view of the age category from birth to 12 months of age and the rapid growth of animals at this time, is the expected result. In view of the wide age range of the animals (from 8 days to 11.8 months), the weight of the tonsils ranged from 15 to 175 g, the weight of the intestine from 2 to 22 kg, and the total weight of SRM from 2 to 22.2 kg. The lowest weight of tonsils (15 g) and intestine (2 kg) was found in a young bull of the Holstein black pied breed aged 8 days. The highest weight of tonsils (175 g) and intestine (22 kg) in a young bull of the Czech Fleckvieh breed aged 10.1 months (in this age category, the lightest intestine and tonsils were found in the same animal, and this was also the case for the heaviest intestine and tonsils). The oldest animal in the group was a young heifer aged 11.8 months of the Holstein black pied breed which had tonsils weighing 130 g and intestine weighing 17.5 kg. As the weight of the tonsils makes up just a small proportion of the total amount of SRM in cattle up under 12 months of age, the animal's intestine is of primary importance in determining the total weight of SRM. For example, the difference in weight of the intestine in two young heifers of the same age (11.5 months) and same breed (Holstein black pied) was 5.1 kg (the first had intestine weighing 13.1 kg, the second 18.2 kg).

Table 2. Basic statistical data and extreme values, cattle under 12 months of age (n = 50)

SRM*	Ave	Med	SD	a	A
Tonsils	67.9	63.5	32.8	15.0	175.0
Intestine	10.3	11.0	4.4	2.0	22.0
Total SRM	10.4	11.1	4.4	2.0	22.2

* the weight of intestine and total SRM is given in kg, the weight of the tonsils in g; n = number of valid observations; Ave = average quantity of SRM; Med = median; SD = standard deviation; a = lowest measured weight of SRM; A = highest measured weight of SRM

The amount of SRM from slaughtered cattle aged from 12 to 30 months

The animals in this group were aged from 16.2 to 29.9 months. The weight of the skull ranged from 6 to 18.6 kg, the weight of the spinal cord from 121 to 273 g, the weight of the tonsils from 98 to 296 g, the weight of intestine from 17.9 to 42.3 kg, and the total weight

of SRM from 24.8 to 57.6 kg. Considerable differences were found in the weight of the skull and intestine in animals of a similar age, for example the difference in the weight of the skull between a bull of the Czech Fleckvieh breed aged 26.6 months and a heifer of the Belgian Blue breed aged 22.7 months (the skull of the bull weighed 18.6 kg, the skull of the heifer 6.4 kg) was 12 kg, while the difference in the weight of intestine was 13 kg (a heifer aged 24.2 months with intestine weighing 24.4 kg, a bull aged 24.3 months with intestine weighing 37.5 kg, both of the Czech Fleckvieh breed). The weight of the spinal cord and tonsils amounted to just a small proportion of the total weight of SRM, less than 1%. The cattle in the age category from 12 to 30 months were further divided into bulls and heifers to see whether the sex of the animals had an influence on the amount of SRM produced.

Table 3. Basic statistical data and extreme values, cattle aged from 12 to 30 months (n = 84)

SRM*	Ave	Med	SD	a	A
Skull	12.0	12.2	2.7	6.0	18.6
Spinal cord	200.6	198.0	34.8	121.0	273.0
Tonsils	167.7	162.5	40.7	98.0	296.0
Intestine	29.2	28.6	4.9	17.9	42.3
Total SRM	41.6	41.7	6.6	24.8	57.6

* the weight of the skull, intestine and total SRM is given in kg, the weight of the spinal cord and tonsils in g; n = number of valid observations; Ave = average quantity of SRM; Med = median; SD = standard deviation; a = lowest measured weight of SRM; A = highest measured weight of SRM

The amount of SRM from slaughtered bulls aged from 12 to 30 months

The bulls in this group were aged from 17 to 29.9 months. The weight of the skull ranged from 8 to 18.6 kg, the weight of the spinal cord from 121 to 273 g, the weight of the tonsils from 100 to 296 g, the weight of intestine from 20.4 to 42.3 kg, and the total weight of SRM from 30.8 to 57.6 kg. Large differences in the weight of the skull and intestine were found in bulls of similar age, for example the difference in the weight of the skull amounted to 8 kg between a bull of the Czech Fleckvieh breed aged 26.6 months and a bull of the Charolaise breed aged 26.5 months (the skull of the first bull weighed 18.6 kg, the skull of the second bull 8 kg) and the difference in the weight of intestine amounted to 22 kg (a bull of the Belgian Blue breed aged 24.6 months with intestine weighing 42.3 kg, a bull of the Piedmontese breed aged 23.6 months with intestine weighing 20.8 kg).

A statistically highly significant dependence was found between the weight of the skull and the age of the animals. In view of the age of the bulls (from 17 to 29.9 months) it is probable that this dependence is the result of the bulls' heads growing bigger and gaining in weight during this period.

Table 4. Basic statistical data and extreme values, bulls aged from 12 to 30 months (n = 71)

SRM*	Ave	Med	SD	a	A
Skull	12.8	12.6	2.1	8.0	18.6
Spinal cord	203.6	200.0	35.5	121.0	273.0
Tonsils	174.0	165.0	38.9	100.0	296.0
Intestine	29.9	29.5	4.6	20.4	42.3
Total SRM	43.1	43.0	5.7	30.8	57.6

* the weight of the skull, intestine and total SRM is given in kg, the weight of the spinal cord and tonsils in g; n = number of valid observations; Ave = average quantity of SRM; Med = median; SD = standard deviation; a = lowest measured weight of SRM; A = highest measured weight of SRM

Table 5 shows the average amount of the individual parts of SRM and the total amount of SRM in bulls aged from 12 to 30 months depending on breed. The highest average total weight of SRM was seen in bulls of the Belgian Blue breed (47 kg), followed by bulls of the Czech Fleckvieh (45.1 kg), Simmental Beef (44.4 kg), Charolaise (43.6 kg) and Holstein black pied (41 kg) breeds., Ihe average weight of SRM in bulls of other breeds was less than 40 kg.

Table 5. Average amount of SRM depending on breed in bulls aged from 12 to 30 months

Number of animals	S [kg]	SC [g]	T [g]	I [kg]	SRM Σ [kg]	Average age [m]	Breed
23	14.2	213.6	182.3	30.5	45.1	27.1	C
20	12.6	196.1	166.2	30.6	43.6	24.8	T
10	11.8	176.8	145.2	28.8	41.0	22.6	H
6	10.6	198.7	165.0	28.7	39.6	22.4	Y
3	13.0	257.7	220.0	33.5	47.0	25.7	B
2	13.7	193.0	214.5	24.8	38.8	27.1	Q
2	11.8	213.0	172.5	26.6	38.7	28.0	V
2	10.9	184.5	216.0	26.7	38.0	25.0	P
2	11.9	228.0	189.5	32.2	44.4	23.0	B

S = skull; SC = spinal cord; T = tonsils; I = intestine; C = Czech Fleckvieh; T = Charolaise; H = Holstein black pied; Y = Limousin; B = Belgian Blue; Q = Blonde d'Aquitaine; V = Braunvieh; P = Piedmontese; B = Beef Simmental

The amount of SRM from slaughtered heifers aged from 12 to 30 months

Totally 13 heifers in this group were aged from 16.2 to 28.4 months. The weight of the skull ranged from 6 to 10.4 kg, the weight of the spinal cord from 128 to 221 g, the weight of the tonsils from 98 to 228 g, the weight of intestine from 17.9 to 37.9 kg, and the total weight of SRM from 24.8 to 48.6 kg. The heaviest skull and intestine belonged to the oldest heifer (28.4 months) of the Charolaise breed. A weight difference of 8 kg was found in the intestine of heifers of a similar age (a heifer of the Limousin breed aged 19.7 months and a heifer of the Simmental Beef breed aged 20.3 months).

Table 6. Basic statistical data and extreme values, heifers aged from 12 to 30 months (n = 13)

SRM	Ave	Med	SD	a	A
Skull	7.6	7.1	1.2	6.0	10.4
Spinal Cord	184.3	190.0	26.6	128.0	221.0
Tonsils	133.1	127.0	33.3	98.0	228.0
Intestine	25.5	24.6	4.5	17.9	37.9
Total SRM	33.4	33.2	5.6	24.8	48.6

The weight of the skull, intestine and total SRM is given in kg; the weight of the spinal cord and tonsils in g; n = number of valid observations; Ave = average quantity of SRM; Med = median; SD = standard deviation; a = lowest measured weight of SRM; A = highest measured weight of SRM

The amount of SRM from slaughtered cows aged more than 30 months

All the cows were aged between 30 and 131.8 months, with the exception of one animal aged 29.7 months, whose age was incorrectly calculated. The vertebral column of all the cows was weighed. The weight of the skull ranged from 5.8 to 10 kg, the weight of the

spinal cord from 172 to 650.3 g, the weight of the tonsils from 80 to 230 g, the weight of intestine from 14.5 to 54.5 kg, the weight of the vertebral column from 20 to 35.5 kg, and the total weight of SRM from 49.7 to 97.5 kg. The heaviest intestine and vertebral column belonged to the oldest cow (103.5 months) of the Holstein black pied breed. Differences in the weight of the individual parts of the SRM were found between cows of a similar age (4 kg for the skull, 36 kg for the intestine, and 13 kg for the vertebral column).

Table 7. Basic statistical data and extreme values, cows aged more than 30 months (n = 50)

SRM	Ave	Med	SD	a	A
Skull	7.6	7.6	1.1	5.8	10.0
Spinal cord	306.9	304.5	71.8	172.0	650.3
Tonsils	151.6	153.1	33.2	80.0	230.0
Intestine	34.7	32.8	8.9	14.5	54.5
Vertebral column	26.9	26.5	3.6	20.0	35.5
Total SRM	69.7	68.7	10.7	49.7	97.5

The weight of the skull, intestine, vertebral column and total SRM is given in kg; the weight of the spinal cord and tonsils in g; n = number of valid observations; Ave = average quantity of SRM; Med = median; SD = standard deviation; a = lowest measured weight of SRM; A = highest measured weight of SRM

Evaluating the amount of SRM

A comparison of the average weights of individual parts of the specified risk material is made in Table 8.

Table 8. A comparison of the average weight of the skull, intestine and vertebral column

SRM	Skull	Intestine	Vertebral column
		Weight [kg]	
Cattle (up to 12 months)	0.0	10.3	0.0
Cattle (12 to 30 months)	12.0	29.2	0.0
Bulls (12 to 30 months)	12.8	29.9	0.0
Heifers (12 to 30 months)	7.6	25.5	0.0
Cows	7.6	34.7	26.9

The skull - the average weight of the skull in heifers and cows was the same (7.6 kg), although only 13 heifers of meat breeds tested were, while there were 50 cows tested of which 84% were of the Holstein breed. The average age of the heifers was 21.9 months, the average age of the cows 65.7 months. There were 71 tested bulls, of an average age of 25.2 months, of which around just 14% were of the Holstein breed. The average weight of the skull of the bulls was 12.8 kg, which is considerably greater than that of the females and is associated with sexual dimorphism.

The intestine - the greatest average weight of intestine was found in cows (34.7 kg), followed by bulls (29.9 kg), heifers (25.5 kg) and cattle under 12 months of age (10.3 kg). Considerable differences in the weight of the intestine were recorded in animals of the same age in all categories of cattle (a difference of around 5 kg in young cattle aged 11.5 months of the same breed (Holstein black pied), a difference of around 20 kg in bulls

aged 24 months, a difference of around 8 kg in heifers aged 20 months, and a difference of around 36 kg in cows aged 80 months) and it is clear that the weight of the intestine is also dependent of the physical constitution and nutritional state of the animal.

The vertebral column - is part of the SRM only in cattle over 30 months of age. This category is largely made up of cows, as bulls and heifers are generally slaughtered at an earlier age. The average weight of the vertebral column in cows is 27 kg.

The spinal cord and tonsils - the weight of the spinal cord makes up no more than 0.55% of the total amount of SRM, the weight of the tonsils no more than 0.65% of the total amount of SRM, for which reason these parts comprise only an insignificant proportion of the SRM. An overview of proven correlations is given in Table 9.

Table 9. Overview of proven correlations between the amount of SRM, age and categories of animals

SRM	Cattle (under 12 m)	Cattle*	Bulls*	Heifers*	Cows
Skull	–	A	A	B	–
Spinal cord	–	–	–	–	–
Tonsils	A	A	–	–	–
Intestine	A	A	–	A	–
Vertebral column	–	–	–	–	A
Total SRM	A	A	–	A	–

*Age of 12 to 30 months; A = statistically highly significant correlation between amount of SRM and age; B = statistically significant correlation between amount of SRM and age

The average weight of total SRM

A comparison of the average weights of SRM found in the individual categories of cattle is given in Table 10. The lowest and highest weight found for total SRM in the individual categories of cattle are given in Table 11.

Table 10. A comparison of the average weight of total SRM by categories of cattle

	Weight of total SRM [kg]
Cattle (up to 12 months)	10.4
Cattle (12 to 30 months)	41.6
Bulls (12 to 30 months)	43.1
Heifers (12 to 30 months)	33.4
Cows	69.7

Table 11. Comparison of lowest and highest weight of total SRM by categories of cattle

Category of cattle	a [kg]	A [kg]
Cows	49.7	97.5
Heifers from 12 to 30 months	24.8	48.6
Bulls from 12 to 30 months	30.8	57.6
Cattle under 12 months	2.0	22.2

a = lowest weight of total SRM; A = highest weight of total SRM

The largest average amount of SRM is found in cows (about 70 kg), as in this category the SRM also includes the vertebral column, followed by bulls from 12 to 30 months, in which the average amount of SRM increases due to the weight of the skull, followed by heifers and young cattle under 12 months of age.

Conclusions

Evaluation of the data obtained from the measurement of the weight of individual parts of SRM in five categories of cattle found a correlation between the amount of SRM and the age of the animals. A statistically highly significant dependence between the amount of SRM and the age of the animals was demonstrated in cattle under 12 months of age for all the individual parts of the SRM and total SRM, and in cattle aged from 12 to 30 months for all the individual types of SRM (with the exception of the spinal cord) and the total SRM. In bulls aged from 12 to 30 months, a statistically highly significant dependence was found for the skull only; in heifers aged from 12 to 30 months for the intestine and total SRM; and for cows for the vertebral column only. A statistically significant dependence between the amount of SRM and the age of the animals was demonstrated in the skull in heifers aged from 12 to 30 months.

The precise amount of SRM in the individual age categories of cattle was determined, as well as the fact that there can be considerable differences in the weight of SRM in animals of almost the same age, which leads to the conclusion that the amount of SRM obtained is significantly influenced by the individual body structure of the animals and their gender, state of nutrition and breed.

When analysing the amount of SRM (which is currently comprised of just the skull with the exception of the lower jaw but including the brain and eyes, and the spinal cord in animals older than 12 months) and estimating the accuracy of this amount, it is appropriate to determine the age category and sex of the slaughtered animal and include the differences between male and female animals in the overall calculation.

When performing veterinary inspection during the handling of SRM at slaughterhouses, both the documentary inspection of commercial documentation accompanying animal by-products during their transportation to the receiving establishment and the physical inspection of the elimination of SRM in both qualitative and quantitative terms is to be recommended. Cross control of the amount of SRM, both at slaughter and at rendering plants, or of data on the processing of SRM, regularly provided by the operator of rendering plants, contribute towards uncovering errors made during the processing of data on SRM removed from cattle carcasses at individual slaughter plants.

References

Belay ED, Schonberger LB 2005: The public health impact of prion diseases. Ann Rev Pub Health **26**: 191-212

Colee JG, Bradley R 1997a: BSE: a decade on-part I. Lancet **349**: 636-641

Colee JG, Bradley R 1997b: BSE: a decade on-part II. Lancet **349**: 715-721

Doherr MG 2003: Bovine Spongiform Encephalopathy (BSE) – Infectious, Contagious, Zoonotic or Production Disease? Acta Vet Scandinavica **98**: 33-42

Duben J 2006: Jak nás strašila BSE. 2. Vydání. Praha: Ministerstvo zemědělství České Republiky, 15 p (In Czech)

FAO 2007: Management of transmisible spongiform encephalopathies in meat production. Course manual, Project Capacity Building for Surveillance and Prevention of BSE and Other Zoonotic diseases 4. Rome.

Kaatz M, Fast C, Ziegler U, Balkema-Buschmann A, Hammerschmidt B, Keller M, Oelschlegel A, McIntyre L, Groschup MH 2012: Spread of classic BSE prions from the gut via the peripheral nervous system to the brain. Am J Pathol **181**: 515-524

Regulation (EC) No. 999/2001 REGULATION No 999/2001 of the European Parliament and of the Council of 22nd May 2001 laying down rules for the prevention, control and eradication of certain transmissible spongiform

Regulation (EC) No. 728/2015 Commission Regulation (EU) 2015/728 of 6 May 2015 amending the definition of specified risk material set out in Annex V to Regulation (EC) No 999/2001 of the European Parliament and of the Council laying down rules for the prevention, control and eradication of certain transmissible spongiform encephalopathies

Nařízení Komise (EU) č. 1162/2015 of 15th July 2015 amending Annex V to Regulation (EC) No. 999/2001 of the European Parliament and of the Council laying down rules for the prevention, control and eradication of certain transmissible spongiform encephalopathies

Renčová E 2003: Použitelnost schválených biocidů při kontaminaci zařízení oční a nervovou tkání přežvýkavců pozitivních na TSE. Veterinářství **57**: 43-46 (In Czech)

Smith PG, Bradley R 2003: Bovine spongiform encephalopathy (BSE) and its epidemiology. Brit Med Bull **66**: 185-198