

ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD

**DRAFT REPORT FROM THE *AD HOC* GROUP ON
BOTULISM IN CATTLE, SHEEP AND GOATS**

Discussion paper

1. In March 2007, the Food Standards Agency (FSA) sought ACMSF's advice on the potential risk to human health from food chain issues linked to botulism or suspected botulism in sheep and goats. Specifically, whether the recommendation from the 2006 Botulism in Cattle Report that there should be no requirement to restrict milk and meat from healthy cattle from farms where there have been suspected cases of botulism could also be applied to meat and milk from healthy sheep and goats on farms where there have been suspected cases of botulism.
2. ACMSF reconvened the *Ad Hoc* Group on Botulism in Cattle in May 2007 to consider this issue. The Group revised its membership to include experts on sheep and goats and was renamed to include sheep and goats within its remit. At ACMSF's request the Group examined food chain issues linked to botulism or suspected botulism in sheep and goats and agreed to report back to the Committee with its recommendations.
3. The Chair of the *Ad Hoc* Group on Botulism in Cattle, Sheep and Goats (Professor Peter Williams) will introduce the attached draft final Report that the Group has produced. Members are invited to comment on the report.

**Secretariat
June 2008**

ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD

***Ad Hoc* Group on Botulism in Cattle, Sheep and Goats**

Draft Report on Botulism in Sheep and Goats

Summary

1. In this report the *Ad Hoc* Group has considered the potential risk to human health from food chain issues linked to botulism or suspected botulism in sheep and goats. In its previous report on Botulism in Cattle (ACMSF, 2006) the Group recommended that, in the absence of other signs, there should be no requirement to restrict meat or milk from healthy cattle from farms where there have been suspected cases of botulism. This report follows a request from the Food Standards Agency (FSA) to assess whether the recommendations could also be applied to meat and milk from healthy sheep and goats on farms where there have been suspected cases of botulism.
2. In May 2007 the *Ad Hoc* Group on Botulism in Cattle was reconvened. The original terms of reference of the Group were revised to consider the potential health risks associated with botulism or suspected botulism in sheep and goats (in addition to cattle), particularly in relation to the spreading of poultry litter on agricultural land, and to report back with recommendations to the ACMSF (Annex 1). The Group met on three occasions.
3. The Group considered information on the prevalence and reported outbreaks or incidents of suspected botulism in sheep and goats in the UK and other countries. It examined differences in animal husbandry practices, feeding habits and meat and milk production between the two species and in comparison with cattle. The likelihood of active botulinum toxin being present in meat and milk was explored, and risk factors associated with the consumption of meat and milk (including raw milk and milk products) from sheep and goats, milk dilution factors, and composting and disposal of poultry litter were examined. The Group also reviewed the susceptibility of humans to the botulinum toxin types C and D that are most frequently associated with botulism in animals.
4. The Group concluded, from the limited information available to it, that botulism in sheep and goats in the UK was uncommon, but where outbreaks occurred the numbers affected could be large. Also, it was not possible to determine whether transmission of the disease occurred from affected ewes to their young. The Group concluded that the botulinum toxin types known to affect sheep, i.e. types C and D (as for cattle), have only very rarely been reported to be associated with disease in humans. However, it added that, as is the case for cattle, the incidence of other

toxin types among sheep and goats needs to be kept under review. The Group concluded that there was a strong association between access to poultry litter, either stored or spread on grazing land, and cases of botulism in sheep in England, Scotland and Wales during the period 1999-2007. The Group could find no evidence to show the presence of active botulinum toxin in the milk and meat of affected sheep and goats, but neither was it possible to find evidence that this could not potentially occur. However, evidence from cattle indicated that suckling calves did not acquire toxin from the milk of infected mothers.

5. The Group therefore recommended that, in the absence of other signs, there should be no requirement to restrict sales of meat or milk from clinically healthy sheep or goats from farms where there have been clinically suspected cases of botulism in sheep and goats. In addition, there should be no requirement to restrict the slaughter of healthy sheep and goats from herds where cases of confirmed or suspected botulism have occurred. The Group recommended that UK agriculture departments should reinforce their advice to farmers involved in the production, storage and spreading of poultry litter on measures for the prevention of on-farm botulism. The Group also recommended that UK veterinary authorities continue to encourage sheep and goat farmers to report suspected cases of botulism.

6. The assessments made and the conclusions reached by the Group reflect evidence, oral and written, drawn from the scientific community, government departments and the scientific literature. The Group's conclusions and recommendations are brought together at the end of the report. The ACMSF accepts full responsibility for the final content of the report.

Acknowledgements

The *Ad Hoc* Group wishes to thank Mr Bruce Nelan of the New South Wales (Australia) Food Authority, Mr David Jordan and Mr Paul Freeman from the New South Wales (Australia) Department of Primary Industries.

Introduction

1. Where an outbreak of botulism in sheep or goats is suspected, the FSA currently requests that the farmer agrees to voluntary restrictions on the movement of the flock and on the entry of meat and milk from these animals into the food chain. These restrictions apply for 14 days from the onset of the last clinical case or 17 days from the removal of the suspected source of botulism, and apply to both affected and healthy animals.
2. The FSA had previously requested the same voluntary restrictions for herds of cattle on farms where cases of botulism were suspected. However, in its report on Botulism in Cattle (ACMSF, 2006), the ACMSF recommended that there should be no requirement to restrict meat or milk from healthy cattle from herds where cases of confirmed or suspected botulism have occurred, although it stressed that meat and milk from clinically affected cattle should not enter the food chain due to concerns that these may pose a risk to consumers.
3. The recommendation to remove the restriction on healthy in-contact cattle was mainly based on the finding that the botulinum toxin types identified in animals (types C and D) have very rarely been associated with disease in humans; in addition, there was no evidence to suggest that any human cases of botulism have occurred from consumption of meat and milk from affected animals. Also the likelihood of active toxin in milk was considered to be low because of a lack of clinical cases of botulism occurring in suckler calves in herds in which there were cows affected by botulism.
4. Following publication of the report on Botulism in Cattle (ACMSF, 2006), the FSA implemented the recommended changes to the advice on voluntary restrictions for meat and milk from healthy cattle. The Agency informed stakeholders by sending a letter to interested parties (Annex 2), by publishing a letter in the Veterinary Record (Aish et al, 2006) and by publishing an article on its website (<http://www.food.gov.uk/news/newsarchive/2006/dec/botulismcattle>).
5. In March 2007 the advice of the Committee was sought on whether these recommendations could also be applied to meat and milk from healthy sheep and goats on farms where there have been suspected cases of botulism (ACMSF, 2007).
6. In responding to this request, ACMSF recognised that, although there may be general similarities in the onset and progression of botulism in all three animal species, they would need to explore possible differences in animal husbandry, epidemiology and transmission of the disease in sheep and goats. ACMSF therefore reconvened the *Ad Hoc* Group on Botulism in Cattle and asked it to consider the food chain issues linked to botulism or suspected botulism in sheep and goats and to report back with recommendations to the full Committee.

The ACMSF's approach to its work

7. The *Ad Hoc* Group met three times (twice in 2007 and once in 2008) to consider documentary and verbal evidence relating to the risks to the food chain from suspected cases of botulism in sheep and goats, and to the management of botulism outbreaks in these animals in the UK. The Group amended its original terms of reference to read:

'to consider the potential human health risk associated with botulism or suspected botulism in cattle, sheep and goats, particularly in relation to the spreading of poultry litter on agricultural land. To report back with recommendations to the ACMSF.'

8. The Group considered information on prevalence, incidents and outbreaks of botulism in sheep and goats in the UK and other countries. Differences between the two species (and in comparison with cattle) with respect to epidemiology, animal husbandry, feeding habits, and meat and milk production were considered. The likelihood of botulinum toxin being present in meat and milk was also examined. The Group considered risk factors associated with consumption of meat, milk and milk products (including raw milk and milk products) from sheep and goats, including the effects of dilution of milk. The Group also evaluated risk factors associated with the composting, disposal or spreading of poultry litter. Information gathered was considered in relation to the sequence of events that would be required to result in human disease. The final risk estimate for botulism in sheep and goats is described both in qualitative terms and benchmarked against the level of risk posed by clinically normal cattle in affected herds (ACMSF, 2006).

Factors impacting on food safety

Clinical signs and reported outbreaks

9. The main clinical signs of botulism in ruminants are progressive flaccid muscular paralysis leading to recumbency and death. The clinical signs are caused by the action of botulinum toxins, a group of neurotoxins produced by *Clostridium botulinum* that inhibit the transmission of nerve impulses at neuromuscular junctions. Further information on botulinum toxins and relevant published scientific references can be found in the report on Botulism in Cattle (ACMSF, 2006). Most cases of botulism in ruminants are identified on the basis of typical clinical signs and the exclusion of an alternative diagnosis. However, following recommendations in the ACMSF's report on Botulism in Cattle, the Veterinary Laboratories Agency (VLA) has begun toxin testing and culturing of gut contents (VLA, personal communication).
10. Outbreaks of botulism in sheep have been reported in several countries, including America, South Africa and Australia (Bennetts & Hall, 1938; Trueman et al, 1992; Van der Lugt et al, 1995, Van der Lugt et al, 1996;

Swift et al, 2000). Suspected botulism in goats has also been reported in South Africa (Van der Lugt et al, 1995).

11. There seems to be little difference between ovine botulism cases reported in the literature and the disease in cattle (Radostits et al, 2000). Typical early signs include recumbency, weakness, urinating after getting up, stiff gait, holding the head too high, and being easily startled. Publications by Aitken (2006) and Radostits et al (2000) both refer to late onset in the course of the disease of typical flaccid paralysis in sheep, although neither timescale nor correlation with toxin levels were indicated.
12. In the UK, outbreaks of suspected botulism in sheep are uncommon, only 14 reported in the period 1999-2007, compared with approximately 100 in cattle during the same period (data from VLA), although the numbers affected can be large (Table 1). Twelve of the reported outbreaks of suspected botulism in sheep occurred in England, one outbreak occurred in Wales in January 2002 and one outbreak was reported in Scotland in January 2007. No outbreaks of suspected botulism in sheep have been reported in Northern Ireland.

Table 1: Reported outbreaks/incidents of suspected botulism in sheep and goats in the UK

Species	Date	Location	Enterprise (meat/dairy)	Flock/herd size	No. animals affected ^a	No. animals dead ^a	Lambs affected (age/weaning status)	Suspected source
Sheep	Oct 1999	Gloucestershire	Meat	140	28	28	No information available	Poultry litter – stacked in field, sheep gained access
Sheep	Jan 2002	Monmouthshire	Meat	130	22	19	None, adult ewes only (>24months) ^c	Poultry litter – stacked in neighbour's field, sheep gained access
Sheep	Oct 2004	Worcestershire	Meat	700	55	55	None, shearing ewes (13-24 months) ^c	Poultry litter stacked in field
Goat	Jan 2005	Scotland	Not reported	Not reported	1	1	None, 6 year old male	No additional information available
Sheep	March 2005	Herefordshire	Meat	40	8	6	None, adult ewes only (>24 months) ^c	Poultry litter – stacked on pasture
Sheep	Sept 2005	Gloucestershire	Meat	55	12	9	None, adult ewes only (>24 months) ^c	Poultry litter – stacked on field
Sheep	Dec 2005	Lancashire	Meat	230	97	80	None, adult ewes only (>24 months) ^c	Poultry litter – spread on pasture
Sheep	March 2006	Gloucestershire	Meat	30	22	20	None, adult ewes only (>24 months) ^c	Poultry litter – spread on pasture where animals grazing
Sheep	June 2006	Cheshire	Meat	45 ^b	27	21	None, adult ewes only (>24 months) ^c	Poultry litter – spread on land where animals grazing
Sheep	July 2006	South Yorkshire	Meat	100 ^b	4	3	One lamb affected. 3-4 months of age. Weaned. ^c	Poultry litter – spread on pasture

Sheep	Dec 2006	Herefordshire	Meat	217 ^b	38	22	None, adult ewes only (>24 months) ^c	Poultry litter – stacked on field
Sheep	Jan 2007	Lancashire	Meat	50 ^b	20	6	None, shearling ewes (13-24 months) ^c	Poultry litter – stacked on field
Sheep	Jan 2007	South West Scotland	Meat	300 ^b	100	100	Incident occurred before lambing – no lambs affected	Poultry litter – spread on pasture
Sheep	March 2007	Staffordshire	Meat	250	5	5	None, 12-month old fattening lamb only	Poultry litter – stacked on field
Sheep	Sept 2007	Warwickshire	Not reported	300	34	14	None, adult ewes only	Poultry litter – stacked on field

Compiled from data provided by the Veterinary Laboratories Agency (VLA), the Scottish Agricultural College (SAC) and the Department of Agriculture and Rural Development, Northern Ireland (DARDNI). Data for number of animals affected include numbers that died.

^aFigures may be based on interim investigation data.

^bThese figures refer to the affected group size, which may be epidemiologically different from the flock size.

^cNo suckling lambs were present in the affected groups; suckling lambs may have been present in other groups on the affected farms but data on this is not available.

13. It is not clear whether the smaller number of suspected outbreaks in sheep compared with cattle in the UK is due to flock behaviour, different management practices, under-reporting, less exposure or differences in the pathogenesis of the disease in these hosts. The relative susceptibility to botulinum toxin of sheep compared to cattle is unknown.
14. No reports of suspected botulism have been found for goats in England, Wales or Northern Ireland in the period 1999-2007, while in Scotland, one suspected case of botulism in a goat was reported in January 2005 (SAC, 2005).
15. No suckling lambs or goats were present in the affected groups listed in Table 1 and so it is not possible to infer whether botulinum toxin can pass from affected animals to their offspring via the milk. In its earlier report (ACMSF, 2006) the Group noted that there were no known cases in cattle of calves being affected by transmission of botulinum toxin from their mothers' milk.
16. The Group concluded that botulism in sheep and goats in the UK was uncommon, but where outbreaks occurred the numbers affected could be large. It was not possible to determine whether transmission of the disease from affected ewes to their young can occur.

Botulinum toxin types

17. Seven serotypes (A-G) of botulinum toxin are recognised, of which types A, B and E are associated with human disease (Cherington, 1998). The main botulinum toxin types reported to affect sheep are C and D, with type C being the commonest toxin type involved in botulism outbreaks (Lewis, 2007). In an investigation of two outbreaks in South Africa, type C and type D toxins were detected in the feed and intestinal contents of sheep from one outbreak and type D toxin was found in the intestinal contents of sheep from the second (Van der Lugt et al, 1995). An outbreak associated with feeding poultry litter to sheep in South Africa was attributed to toxin type C (Van der Lugt et al, 1996). Botulinum toxin type C was considered the most likely cause of an outbreak in sheep in the Mojave Desert (California, USA) in 1995 following the detection of this toxin type in haemolysed blood by mouse bioassay and immunological analysis (Swift et al, 2000). VLA has reported to the FSA the results of botulinum toxin testing for three outbreaks of suspected botulism in sheep in England. Toxin type D was detected in a sample of gut contents from one of the outbreaks, but toxin testing of gut content samples from the other two outbreaks was negative (VLA, personal communication). The Group is not aware of any information on the susceptibility of sheep and goats to toxin types A, B or E.
18. The Group concluded that the botulinum toxin types known to affect sheep, i.e. types C and D, were the same as those primarily affecting cattle. These types have only very rarely been reported to be associated with disease in humans (ACMSF, 2006). As is the case for cattle, however,

the incidence of other toxin types among sheep and goats needs to be kept under review.

Poultry litter

19. Poultry litter was identified as a suspected source in all 14 outbreaks of suspected botulism in sheep reported in Table 1. Poultry litter was also identified as a suspected source in most of the outbreaks of botulism in cattle previously reported (ACMSF, 2006), although in many of these cases the exposure was indirect.
20. Under the EU Animal By-Products Regulation (Regulation (EC) No. 1774/2002), which is enforced in England through the Animal By-Products Regulations 2005, and through equivalent legislation in Scotland, Wales and Northern Ireland, no carcase material should be present in poultry litter that is disposed of or used for spreading on land. In practice, however, some carcase material or other material which may support the growth of *C. botulinum* may be present (ACMSF, 2006).
21. Approximately 67 million tonnes of livestock manures are produced annually in England and Wales (Chambers et al., 2000), of which about 3.3 million tonnes are poultry waste (manure and litter) from all classes of poultry (ACMSF, 2006), of which an estimated 1 million tonnes are broiler litter. Most of this is used to fuel electricity generating plants in the UK; only about 250,000 tonnes of broiler litter are thought to be spread on agricultural land.
22. Based on the information presented in Table 1, the Group concluded that there was a strong association between access to poultry litter, either stored or spread on grazing land and the cases of botulism in sheep in England, Scotland and Wales reported during the period 1999-2007.

Potential risk to human health from meat, milk and milk products from sheep and goats

23. In the previous report on Botulism in Cattle (ACMSF, 2006), the Group considered the potential risks to human health associated with meat, milk and milk products from cattle on farms where cases of botulism were suspected or confirmed. Aspects considered included the biological activity of botulinum toxins in cattle and humans, and toxin presence and activity in meat and milk. For the purposes of the present report, the Group considered similar risk factors associated with the consumption of meat, milk and milk products from sheep and goats on farms where cases of botulism were suspected or confirmed.

Meat and milk production in sheep and goats

24. Population estimates of livestock for dairy, meat and other purposes in the UK (Table 2) indicate that, while the number of sheep reared for meat is very high, the dairy sector of the market for both sheep and goat milk is small compared with cattle. These figures, based on data from a variety of sources (including Defra¹, the Meat & Livestock Commission, specialist veterinary societies² and educated 'best estimates') are good approximations of the various livestock sectors, but it should be noted that accurate data on national or regional trends are difficult to obtain. Data on the number of animals slaughtered during 2007 confirms the relative sizes of the sheep, cattle and goat meat sectors of the market (Table 3).

Table 2: UK breeding populations of cattle, sheep and goats

Species	Production purpose	Breeding population
Cattle	Dairy	2,065,000
	Beef	1,767,000
Sheep	Dairy	12,000
	Meat	16,990,000
Goats	Dairy	45,000
	Meat	12,000
	Show	15,000
	Fibre	15,000

Table 3: UK livestock slaughtered for human consumption in 2007

Species	Numbers slaughtered
Prime cattle	2,168,000 (52% originate from the dairy herd and 48% from the beef herd).
Cows	434,000
Bulls	13,000
Clean sheep	13,581,000 (lambs, young meat animals)
Ewes and rams	2,223,000
**Goats	7,753

¹ <http://statistics.defra.gov.uk/esg/publications/auk/2005/5-15.xls>

² <http://www.genesis-faraday.org/downloads/pdf/proceedings%20neonatal%20survival%20workshop%20-%202023%20may%202005.pdf>

Data provided by the Meat and Livestock Commission

** Data provided by the Meat Hygiene Service (MHS) and is for Great Britain only. The figure represents the total number inspected by MHS staff at the point of slaughter in approved establishments as it was not possible to estimate the number of goats for human consumption.

Meat

25. The feeding habits of sheep and goats are very different – sheep, like cattle, tend to graze along the ground, while goats look for bushes and shrubs on which to browse (Roberts and Scott-Park, 2008). The risk of exposure to contaminated fertiliser or waste spread over pasture is therefore significantly lower for goats than for sheep or cattle.
26. Sheep and goats affected by botulinum toxin (intoxication) show rapid onset of the condition following exposure and so it is highly unlikely that an affected animal would be slaughtered before the appearance of clinical signs.
27. In the case of slower progression of disease following germination of ingested spores and vegetative growth of *C. botulinum* bacteria (toxicoinfection), the risk of an affected animal being slaughtered before the appearance of clinical signs may be greater. However, any toxin present at the neuromuscular junctions of affected carcasses would be inactive as far as subsequent intoxication is concerned. Moreover, any such toxin would be denatured by proper cooking procedures. The Group concluded, therefore, that the risk of active botulinum toxin being present in meat from affected sheep and goats was negligible. A detailed description of the mechanism of action of botulinum toxin, its inactivation during internalisation and binding at neuromuscular junctions and its destruction by heat is provided in the report on Botulism in Cattle (ACMSF, 2006).

Milk

28. Dairy sheep and goats, as opposed to those kept for meat, are generally fed concentrated feedstuffs and either are not grazed or are kept in closely monitored pastures where it is unlikely that poultry litter would be used, since the potential for taint in dairy produce is high (Jacobson, 1970). The risk of botulism in dairy sheep and goats is therefore low because exposure to a potential source of infection is unlikely.
29. The Group considered information on dilution rates for the milk from an infected individual. It was noted that, in contrast to bovine milk (for which overall dilution factors of 1,000- to 10,000-fold can be estimated), sheep and goat's milk for human consumption is not usually sent to regional centres for processing and so there is no readily available data on dilution rates. Figures from producer-retailers (rather than centralised dairy

manufacturers) suggest that milk yields in goats and sheep are approximately 3-5 litres/day/animal, and that average milking herds of goats yield of the order of 1000-5000 litres/day and an average dairy sheep flock yields about 150-500 litres/day. These figures imply significantly lower dilution factors for the milk from individual goats or sheep compared with bovine milk.

30. The effects of pasteurisation on botulinum toxin in milk is described in the report on Botulism in Cattle (ACMSF, 2006). It is likely that pasteurisation of milk (71.7 C for 15 seconds) would reduce toxin levels, but not eliminate the toxins; therefore pasteurisation should not be relied upon as a control for the toxin. The Group considered the availability of unpasteurised sheep and goat milk and cheese. Unpasteurised milk is available only from some farms. Unpasteurised sheep and goat's milk cheeses are generally available only from farm shops, but some types are sold from larger retail outlets. The quantity of unpasteurised cheese produced in the UK from sheep and goat milk is very small compared to that produced from unpasteurised cow's milk. Based on information provided by the Provision Trade Federation, the total average volume of unpasteurised speciality cheese produced in the UK is 142,908 kg per month, of which 125,130 kg/month is from cow's milk, 8,017 kg/month from goat's milk, 8,511 kg/month from sheep milk and 1,250 kg/month from buffalo milk.

31. Lactation is an active process in which the protein content of the milk relates to the energy level (rather than the protein content) of the diet. The onset of botulism in sheep results in markedly reduced milk yields. Moreover, the entry of extraneous proteins such as botulinum toxin into any milk that is produced would occur only if there were a breakdown of the blood:milk barrier mechanism, which is likely to occur only after the onset of clinical signs. The Group therefore concluded that it is very unlikely that milk containing botulinum toxin could enter the human food chain (Jacobson, 1970).

Estimation of risk of human botulism from sheep and goats

32. The theoretical events correlating ruminant food animal exposure to toxin and potential human disease due to consuming milk/meat derived from affected animals are depicted in Table 4:

Table 4: Events required to cause illness in humans and their likelihood*

Event	Likelihood*	Mitigating barriers
Exposure of sheep/goats to risk material**	Low	Good agricultural practice in handling and storage of poultry litter. Farmer education
Disease in sheep/goats develops following exposure to risk material	Medium for toxin types C and D Very low for toxin types linked to human disease	

Disease not observed and milk/meat not withheld from food chain	Very low for milk Low for meat	Farmer observation and removal from food chain (milk, meat). Ante- and post-mortem inspections at abattoir (meat).
Active toxin present in milk/meat	Negligible	Blood:milk barrier (milk). Bound toxin no longer in active form (meat).
Toxin survives further processing	Low for milk Very low for meat Medium for meat steaks/joints cooked as rare/medium rare	Pasteurisation (milk). Cooking (meat).
Probability of all above events occurring: Disease in humans as a result of consumption of meat or milk from animals suffering botulism or exposed to a source of botulin toxins	Negligible for all toxin types	

* Based on OIE (Office International des Epizooties) descriptors:

Negligible	So rare that it does not merit to be considered
Very low	Very rare but cannot be excluded
Low	Rare but does occur
Medium	Occurs regularly
High	Occurs very often

**Risk material: poultry litter contaminated with carcasses where *C. botulinum* has multiplied to produce toxin

33. The primary consideration is that the toxin types associated with animal infection and with poultry litter (i.e. types C and D) are different from those associated with human botulism. No disease has been noted in cattle, sheep or goats from the types of toxin likely to affect humans.

34. In the unlikely event that disease did occur in sheep or goats, if clinical signs were observed then the risk management measure of removing affected animals from the food chain would be an added assurance.

35. Moreover, even if milk from affected animals were taken, either before or after the appearance of clinical signs, the likelihood of contamination with botulinum toxin would be negligible, since there is no evidence that the toxin can cross the blood:milk barrier during lactation. Furthermore, if affected animals were slaughtered for meat, either before or after the appearance of clinical signs, the likelihood of contamination with active botulinum toxin is negligible because of the mechanism by which the toxin is processed during the progress of the disease. In the unlikely event that

meat or milk were to be contaminated, proper cooking procedures for meat should inactivate any toxin present and pasteurisation of milk would also reduce toxin levels.

36. Since all of the events described in Table 4 are required to occur prior to observing disease in humans, the Group concluded that the combined likelihood of the individual events leading to human disease as a result of the spreading of poultry litter on agricultural land is negligible for any toxin type. Furthermore the Group concluded that the risk to human health from the consumption of meat and milk from affected sheep and goats was also negligible. The fact that humans are rarely affected by toxin types C and D commonly seen in animals and the fact that no cases of botulism observed in humans have been attributed to meat or milk consumption from affected animals gives confidence that the risk to the human food chain of botulism in sheep and goats is negligible.

Conclusions

37. On the basis of oral and written evidence presented to it, the Group concluded that:

- Botulism in sheep and goats in the UK is uncommon, but where outbreaks occurred the numbers affected could be large (paragraph 16).
- From the limited information available, it is not possible to determine whether transmission of the disease from the affected ewes to their young can occur (paragraph 16).
- The botulinum toxin types known to affect sheep, i.e. types C and D (as for cattle), have only very rarely been reported to be associated with disease in humans (paragraph 18).
- As is the case for cattle, the incidence of other toxin types among sheep and goats needs to be kept under review (paragraph 18).
- There was a strong association between access to poultry litter, either stored or spread on grazing land, and cases of botulism in sheep in the England, Scotland and Wales during the period 1999-2007 (paragraph 22).
- The risk of active botulinum toxin being present in meat from affected sheep and goats is negligible (paragraph 27).
- There is no evidence for the presence of active botulinum toxin in the milk of affected sheep and goats (paragraph 31).

- The risk to human health from botulinum toxin in meat and milk from affected sheep and goats is negligible (paragraph 36).

38. Based on the risk assessment outlined above, and with the caveat that there is less published information available for botulism in sheep and goats than in cattle, the Group concluded that the risk to humans from consuming meat and milk from clinically normal sheep or goats in flocks/herds in which clinical cases occurred is negligible, i.e. as low as or lower than the risk associated with clinically normal cattle in affected herds (ACMSF, 2006).

Report Recommendations

39. The Group recommends that:

- In the absence of other signs, there should be no requirement to restrict meat or milk from healthy sheep or goats from farms where there have been suspected cases of botulism.
- The incidence of toxin types other than C and D among sheep and goats should be monitored and the situation should be reviewed if there is evidence for the types associated with human disease.
- UK agriculture departments reinforce their advice to farmers involved in the production, storage and spreading of poultry litter on measures for the prevention of on-farm botulism and that the FSA works closely with the poultry industry to ensure good practice in litter management and disposal, while recognising that that practical solutions will need to take into account local factors such as availability of arable land or other means of disposal of litter. This advice should be extended to sheep and goat farmers.
- UK veterinary authorities continue to encourage sheep and goat farmers to report suspected cases of botulism.

Annex 1

***Ad Hoc* Group on Botulism in Cattle, Sheep and Goats**

Terms of reference

To consider the potential human health risk associated with botulism or suspected botulism in cattle, sheep and goats, particularly in relation to the spreading of poultry litter on agricultural land. To report back with recommendations to the ACMSF.

List of Membership

Chair

Professor Peter Williams

Members

Dr Moira Brett

Mr Alec Kyriakides

Ms Eva Lewis

Mr Paul McMullin

Mr John Bassett

Mr Paul Roger

Assessors

Mr Stephen Wyllie (Defra)

Dr Seamus Kennedy (AFBI) Agri-Food Institute and Biosciences Institute

Secretariat

Dr Lucy Foster (Administrative Secretary)

Dr Joanne Aish (Scientific Secretary)

Mr Adekunle Adeoye (Administrative Secretariat)

Miss Sarah Butler (Administrative Secretariat)

Annex 2

Revised FSA Advice on Botulism in Cattle

To: Interested Parties

Reference:

7 December 2006

CHANGE TO FOOD STANDARDS AGENCY'S ADVICE ON BOTULISM IN CATTLE

Dear Sir/Madam,

In January 2006, the Advisory Committee on the Microbiological Safety of Food (ACMSF) sought your views and those of other interested parties on a draft ACMSF report on botulism in cattle.

We would like to make you aware that the FSA is implementing the recommendations in the ACMSF's report that there should be no requirement to place voluntary restrictions on the entry into the food chain of meat and milk from healthy cattle from farms where cases of botulism are suspected.

Prior to the Committee's report, the FSA requested voluntary restrictions on the movement of livestock and on the entry of meat and milk into the food chain from herds where cases of botulism were suspected. These restrictions applied for 14 days from the onset of the last clinical case or 17 days from the removal of the suspected source of botulism and applied to both affected and healthy cattle within the herd.

In June 2004, the ACMSF set up an ad-hoc group to develop advice on the potential risk to human health from food chain issues linked to botulism or suspected botulism in cattle. In line with the general principle that animals that are diseased should not enter the food chain, the report arising from the work of this Group concluded that the current voluntary restrictions on meat and milk from **clinically affected cattle** appear to be appropriate. However, the report also concluded that based on current scientific evidence voluntary restrictions applied to **unaffected cattle** were considered to be over-precautionary as the botulinum toxin types identified in animals (C and D) have rarely been associated with disease in humans. In addition, there have been no reports of human botulism from meat or milk. The report therefore recommended that in the absence of other signs, there should be no requirement to restrict entry into the food chain of milk or meat from healthy cattle from farms where there have been clinically suspected cases of botulism in cattle.

The draft ACMSF report and recommendations were the subject of a three month consultation with stakeholders and other interested parties. Responses received wholly supported the recommendations to relax restrictions on

healthy cattle from farms where cases of botulism are suspected. Following the outcome of the consultation exercise, the draft report was finalised and adopted by the Committee at the main ACMSF meeting on 28th September 2006 and has been published on the Agency's website at the address below. Printed copies of the report will be available by the end of the year.

<http://www.food.gov.uk/multimedia/pdfs/botulismincattlereport.pdf>

Following publication of the ACMSF's recommendations, the FSA is implementing the change to its advice and will no longer request voluntary restrictions for healthy cattle from farms where cases of botulism are suspected. However, this will need to be reviewed if new evidence emerges that the botulinum toxin types that affect humans (such as A, B and E) are causing outbreaks in cattle. The FSA will still be informed of cases of suspected botulism in cattle as there may be additional issues for the FSA to consider to ensure that the food chain is protected.

The ACMSF did not assess the risk to human health from food chain issues associated with suspected botulism in sheep or goats. The FSA will therefore continue to request voluntary restrictions for healthy sheep and goats from farms where cases of botulism are suspected until this has been reviewed by the ACMSF. The Agency aims to seek ACMSF views on this issue over the next few months.

The ACMSF's report considered the potential risk to human health from food chain issues linked to suspected botulism in cattle particularly in relation to the spreading of poultry litter on agricultural land. Circumstantial evidence suggests that access to broiler litter is a risk factor in most recent outbreaks of suspected and confirmed botulism. Litter containing carcase material would be expected to be especially high risk. In some cases the litter had been spread on land on which cattle were grazing or on adjacent fields, in others animals gained access to a stack of stored litter. The disposal of poultry carcasses and any carcase material in litter spread on agricultural land is contrary to the Animal By-Products Regulations 2005 in England, with equivalent legislation in Scotland, Wales and Northern Ireland. Any carcasses need to be taken out before litter is removed from the broiler house. The ACMSF report recognised the need to reinforce advice on the use and disposal of poultry litter. Guidelines which aim to control the risk of botulism in cattle associated with poultry litter can be found at;

<http://www.defra.gov.uk/Animalh/diseases/zoonoses/botulism.htm>

<http://www.defra.gov.uk/animalh/by-prods/guidance/manureguidanceev4.pdf>

Yours,

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Microbiological Safety Division

Tables

Table 1	Reported outbreaks/incidents of suspected botulism in sheep and goats in the UK
Table 2	UK breeding populations of cattle, sheep and goats
Table 3	UK livestock slaughtered for human consumption in 2007
Table 4	Events required to cause illness in humans and their likelihood

Glossary of Terms

Broiler	A young chicken raised for meat
Pasteurisation	A heat process designed to destroy pathogenic micro-organisms. For example, milk is pasteurised at 71.7°C for 15 seconds or using different time and temperature combinations to obtain an equivalent effect. Different pasteurisation processes may be used for other foods. In the cooking of burgers recommended guidelines suggest a heat treatment of 70°C for 2 minutes or equivalent
Poultry litter	A mixture of bedding material (wood shavings, chopped straw, shredded paper) and faeces and urine of commercially reared poultry
Taint	A broad descriptor for any chemical substances that can vary the taste or smell of dairy produce. It is detected by nose or taste rather than by analysis

Glossary of Abbreviations

FSA	Food Standards Agency
DEFRA	Department of Farming Food and Rural Affairs
VLA	Veterinary Laboratories Agency
SAC	Scottish Agricultural College

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