

EVALUATION OF ANIMAL FEED USE AND SUPPLY ROUTES IN THE UNITED KINGDOM AND THEIR VULNERABILITY TO CROSS-CONTAMINATION

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BACKGROUND

In April 2005 the Spongiform Encephalopathy Advisory Committee (SEAC) ad hoc Epidemiology Subgroup on bovine spongiform encephalopathy (BSE) cases born after the reinforced feed ban¹ (BARB cases) recommended that the Department for Environment, Food and Rural Affairs (Defra) “*perform prospectively an evaluation of animal feed use and supply routes currently and in the recent past to provide information on their vulnerability to cross-contamination.*”

Later in April 2005, the SEAC Subgroup reported their recommendation to SEAC. The Committee agreed that a study of feeding practices was important and noted that, although it was unlikely that conclusive evidence would be obtained for particular feeding practices being associated with BARB cases, such a study might give insight into possible controls that might be applied if such cases continue (SEAC 2005^a).

¹ Born after July 1996

DATA SOURCES

a. ADVISORY COMMITTEE ON ANIMAL FEEDINGSTUFFS REVIEWS

The Advisory Committee on Animal Feedingstuffs (ACAF)² was set up in June 1999 to advise on the safety and use of animal feeds and feeding practices, with particular emphasis on protecting human health and with reference to new technical developments and new feed materials. ACAF advises the Food Standards Agency (FSA); Defra and the Devolved Administrations on the safety and use of animal feeds and feeding practices, with particular emphasis on protecting human health and with reference to new technical developments.

The SEAC Subgroup's recommendation is addressed in part by the ACAF Review of On-Farm Feeding Practices. The ACAF Review of Feed Law Enforcement provides further insight into the feed supply chain and risk-based enforcement of feed law. However, both of these reviews consider feed risks in addition to those associated with transmissible spongiform encephalopathies (TSEs).

The ACAF reviews are essential references for this paper, which only summarises their contents. The reviews are available at <http://www.food.gov.uk/multimedia/pdfs/farm.pdf> and <http://www.food.gov.uk/multimedia/pdfs/acaffeedlaw.pdf>

(i) ACAF REVIEW OF ON-FARM FEEDING PRACTICES 2003

Overview

The ACAF Review of On-Farm Feeding Practices was commissioned as a result of similar concerns to those of the SEAC Subgroup. These arose from the BSE Inquiry report³ published in October 2001 which concluded that the chain of animal feed manufacture, distribution, on-farm mixing and on-farm use was complex, and the ease with which cross contamination occurred within it was one of the most concerning issues in the BSE epidemic.

ACAF undertook to carry out a review of on-farm feeding practices that would:

1. Identify current practices with a view to issuing recommendations on "best practice" for all stakeholders and their advisors involved in supplying, storing and using feeds;
2. Include all aspects of feed sourcing, transport, storage, feeding on-farm, including on-farm mixing, liquid feeding systems, the use of

² http://www.food.gov.uk/science/ouradvisors/animalfeedingstuffs/more_about/background

³ <http://www.bseinquiry.gov.uk/>

bought-in feed materials (such as co-products from the food industry) and handling home-grown feeds; and

3. Identify the main hazards and risks arising from the above processes and increase awareness of these amongst the farming communities and other stakeholders.

The consultation commenced in December 2001 and the review was published in September 2003.

Possible Hazards and Risks Associated with On-Farm Mixing and Feeding Practices

The review sought to identify possible hazards and risks associated with on-farm feeding practices. The review identified the following areas of concern in relation to on-farm mixing and feeding practices:

- sourcing and selection of feedingstuffs;
- transport;
- receipt and handling;
- on-farm storage;
- manufacturing and mixing;
- feeding practices;
- competence and training; and
- documentation and traceability.

Recommendations

The review aimed to recommend practical control measures. The review's conclusion generated twelve recommendations and these are available at **Annex 1**. The FSA leads on the response to these recommendations⁴.

(ii) ACAF REVIEW OF FEED LAW ENFORCEMENT 2005

Overview

The responsibility for enforcing animal feed legislation in the United Kingdom (UK) rests with a number of bodies. In 2002, ACAF decided that the effectiveness of feed law enforcement should be reviewed. The consultation commenced in June 2003 and the review was published in April 2005.

The review noted that the feed chain is complex and comprises a wide range and number of businesses including compound feed and feed additive manufacturers, importers and merchants, and food manufacturers that sell products for animal feed. Farms are engaged in various operations related to feed including growing, buying, storing, mixing and feeding.

⁴ <http://www.food.gov.uk/multimedia/pdfs/info050502.pdf>

Although most of the bulk finished feed sold to farmers in Great Britain (GB) is manufactured in the UK, many of the vitamins, additives and a significant tonnage of materials such as soyabean meal and maize gluten are imported.

Risk Points in the Feed Supply Chain

The review addressed enforcement at risk points in the feed supply chain. In relation to feeds, hazards include contaminants which should not be present (including TSE agents). Operations which may need particular attention include premises:

- dealing in imported feeds;
- buying feeds from unverified sources;
- buying feeds from multiple sources;
- dealing with multiple feed types; and
- selling to large numbers of end users.

It is important that enforcement checks include:

- ensuring traceability;
- correct labelling and identification;
- separation of feeds;
- ensuring existence of relevant quality control systems;
- ensuring existence of relevant personnel and production procedures;and
- quarantine and disposal of rejected, contaminated or unacceptable feeds.

Legal Requirements and Enforcement

The review provided details of legislative requirements, enforcement roles and responsibilities. It provided details of the voluntary feed-related assurance schemes in place.

Recommendations

The review's conclusion generated twelve recommendations and these are available at **Annex 2**. In October 2005, the FSA launched a consultation on a proposed code of practice on the enforcement of animal feedingstuffs legislation in the UK⁵ in response to these recommendations. Defra contributed to the consultation. Defra also participates in the Animal Feed Law Enforcement Liaison Group, which first convened in May 2005 and is chaired by the FSA.

⁵ <http://www.food.gov.uk/foodindustry/Consultations/ukwideconsults/feedingstuffscop>

b. FEED FACTS QUARTERLY (Simon Mounsey Ltd 2005)

Overview

This publication provides details of key recent developments in, and the current structure of, the UK feed industry. It also collates a range of data from sources including Defra, relating to the UK feed market, UK compound feed production, feed materials, prices, demand and the final consumer.

c. HILL REVIEW OF BARB CASES 2005

Overview

Professor William Hill independently reviewed the evidence for the occurrence BARB cases. Professor Hill noted that otherwise unpublished results of the BSE “attack rate” studies at the Veterinary Laboratories Agency (VLA), showed that extremely small oral doses of infectious raw brain tissue administered to calves are sufficient to cause the disease: BSE has occurred following oral doses as low as 1 milligram (mg).

Professor Hill recommended that Defra continued to operate on the basis that BSE transmission via feed was the major route in BARB cases. He concluded that the feed controls in place in the UK seemed adequate but required vigilant enforcement and that elimination of feed borne sources was now, as before, the key to elimination of BSE.

Professor Hill speculated about possible feed borne sources of infection for BARB cases. These included:

- imported contaminated feed;
- unintentional carry-over of contaminated feed; and
- access to non-livestock feeds.

However, Professor Hill concluded that it might not be possible to attribute BARB cases to any single source of feed contamination. SEAC considered the review in June 2005 and agreed with its main conclusions (SEAC 2005^b).

Professor Hill’s review is available at

<http://www.defra.gov.uk/animalh/bse/pdf/hillreport.pdf>

d. DEFRA INVESTIGATIONS INTO BARB CLUSTERS 2005

Overview

The State Veterinary Service (SVS) carries out an epidemiological investigation into all BSE cases, with a detailed focus on BARB cases.

In December 2005, Defra published details of its epidemiological investigations into multiple BARB cases originating from a small number of

herds, and the cluster of BARB cases in South West Wales. Defra updated SEAC on these investigations in November 2005 (SEAC 2005^c).

Defra and the SVS carried out detailed epidemiological investigations into farms producing more than one BARB case, and farms generating a cluster of BARB cases in South West Wales.

The investigations found that cattle feeds in use between 1998 and 2002 on some of these farms contained a range of UK-produced and imported ingredients. Imported ingredients included maize by-products, citrus pulp, cottonseed meal, sunflower, soya, copra meal (coconut by-product). Some ingredients originated in the European Union (EU), others were imported from Third Countries including United States of America (USA), Brazil, Argentina, Indonesia and Malaysia⁶.

Imported ingredients typically arrived in the UK by boat at one of a number of UK sea-ports. These included Liverpool, the London ports (Erith/Tilbury), the Bristol ports (Avonmouth or Portbury), Hull (Immingham), Teignmouth and others. Imported consignments were of the order of 100 000 tonnes. Consignments were transferred to a number of haulage vehicles for onward transmission to one or more intermediaries (bulk stores) or feed mills/merchants etc.

The investigation also found epidemiological evidence that some BARB cases might have been infected by contaminated feed retained in on-farm storage/handling systems. This was likely to be feed produced before either the 1996 UK feed ban, or the 2001 EU-wide feed ban. As a result, Defra and the Devolved Administrations published advice on cleaning feed bins in the veterinary and farming press (including Gibbens 2005). This advice was consistent with that contained in an FSA poster produced in response to the ACAF review of on-farm feeding practices.

Further information on BARBs and a copy of the report are available at <http://www.defra.gov.uk/animalh/bse/controls-eradication/feedban-bornafterban.html>

e. OTHER

The following sources provide statistical data on the agricultural industry and livestock feed use:

- Agriculture in the UK 2004 available at <http://statistics.defra.gov.uk/esg/publications/auk/2004/complete.pdf>

⁶ Commodities originated from other EU Member States are regarded as intra-community trade rather than "imports".

- Defra Economics and Statistics website available at http://statistics.defra.gov.uk/esg/index/list.asp?i_id=021
- Department for Agriculture and Rural Development in Northern Ireland (DARD NI) website available at <http://www.dardni.gov.uk/econs/snot0000.htm>

Field reports from the SVS provide data on the feed industry.

BSE CONTROLS ON FEED

History

The key BSE-related UK and EU-wide feed controls are listed below:

- 1988 - ban on feeding ruminant protein to ruminants (GB)
- 1989 - ban on feeding ruminant protein to ruminants (NI)
- 1994 - ban on feeding mammalian protein to ruminants (EU)
- 1996 - ban on feeding mammalian protein to farmed livestock (UK)
- 2001 - ban on feeding animal protein to ruminants and processed animal protein (PAP) to farmed animals (EU) with certain derogations⁷
- 2003 - definition of PAP amended and farmed animal feed ban extended to cover products no longer included⁸ with certain derogations⁹.

The 1996 feed ban came into force in April 1996 and was enhanced by a feed recall scheme. The ban is considered effective from 1 August 1996.

The 2001 ban on feeding PAP to farmed animals applied from 1 January 2001, although EU Member States might not have fully implemented the ban for some time after this date. This is particularly the case for the ten Member States which joined the EU in May 2004.

Further details of the current feed ban, including the derogations which permit the feeding of “restricted proteins”, are available at <http://www.defra.gov.uk/animalh/bse/animal-health/feedbanguide.pdf>

⁷ Derogations to permit feeding of fishmeal, gelatine, dicalcium phosphate and hydrolysed proteins, milk, milk products and eggs subject to conditions.

⁸ Banned feeding of ruminant gelatine, blood products, hydrolysed protein, animal di- and tri-calcium phosphate.

⁹ Derogations to permit feeding of fishmeal, hydrolysed proteins, di- and tri- calcium phosphate, milk, milk-based products and colostrums, eggs and egg products, non-ruminant gelatine, non ruminant blood products and bloodmeal subject to conditions.

Current UK Legislation

On 1 March 2006, the Transmissible Spongiform Encephalopathy Regulations 2006¹⁰ came into force in England. The Regulations consolidated existing TSE control provisions, including the feed-related controls, which featured some new measures. These included requirements to identify both reject petfood containing animal protein and feed ingredients originating on premises where PAP is used, to prevent their inadvertent use in livestock feed. On 3 May 2006, the TSE Regulations 2006 were replaced by the TSE (No.2) Regulations 2006¹¹. Equivalent legislation applies in Wales and Northern Ireland and is expected to apply in Scotland later in 2006.

Further guidance on the feed control provisions in the TSE (No.2) Regulations 2006 is available at <http://www.defra.gov.uk/animalh/bse/animal-health/feedbanguide.pdf>

National Feed Audit

The National Feed Audit (NFA), delivered by the SVS, monitors and enforces the feed ban in Great Britain – the exclusion of prohibited animal proteins from farmed animal feed. The feed ban is the primary BSE eradication measure. The NFA covers the feed supply chain from production and distribution through to end-use. A risk assessment model, as currently provided in Commission Recommendation 2004/163/EC, was used to design the NFA programme. This model helps to establish the appropriate level of visits required to premises involved in feed manufacture, handling, storage or use, according to specific risk criteria given appropriate weighting. The NFA programme is kept under constant review.

Commission Recommendation 2004/163/EC advises that the minimum numbers of feed inspections and feed samples per year should be 10 and 20 respectively, per 100 000 tonnes of compound feed produced in a Member State. Calculated against the level of compound feed production in the GB in 2005¹², the recommended minimum annual level of monitoring was approximately 900 feed inspections and 1800 feed samples. In 2005, the SVS carried out over 2000 risk-based feed inspections at a wide range of premises (**Table 1**) and collected over 12 000 feed samples (**Table 2**).

Feed samples are tested for prohibited animal proteins by a variety of laboratory methods including the validated Microscopy Analysis Test (MAT)

¹⁰ SI 2006 No.68 (replaced the TSE (England) Regulations 2002, SI 2002 No. 843 for which there was equivalent legislation in the devolved administrations of Scotland, Wales and Northern Ireland.)

¹¹ SI 2006 No.1228

¹² <http://statistics.defra.gov.uk/esg/statnot/mcompspn.pdf>

by the method stipulated in Commission Directive 2003/126/EC, the Enzyme-Linked Immunosorbant Assay (ELISA) and Counter Immuno Electrophoresis (CIE). The results of the NFA programme indicate wide compliance with the feed controls. None of the livestock feed samples tested in 2005, contained evidence of prohibited PAP of terrestrial animal origin.

Table 1 : National Feed Audit Inspections in GB 2005

Premises Type	Number of Inspections
Importer	3
Store	12
Feed mills	515
Home mixers/mobile mixers	302
Intermediary	38
Haulier	14
Farms keeping non-ruminants	41
Farms keeping ruminants	168
Farms keeping both ruminants and non ruminants	943
Total	2 036

Table 2 : National Feed Audit Samples Collected in GB 2005

Premises	Number of Official Samples Tested for Processed Animal Protein		
	Feed Materials	Compound Feedingstuffs	
		For Ruminants	For Non-Ruminants
At Import	314	0	0
Feed Mills	2648	1368	1416
Intermediaries/Storage	247	89	9
Home Mixers/Mobile Mixers	779	487	681
On Farm	540	1 988	1 960
Fats & Vegetable Oils	44	0	0
Sub-Totals	4 572	3 932	4 066
Grand Total	12 570		

Further information is available at

<http://www.defra.gov.uk/animalh/bse/controls-eradication/feed-ban.html>

The Veterinary Service of the Department of Agriculture and Rural Development carries out a similar programme in Northern Ireland. By the end of March 2006, a total of 13570 feed samples had been tested in Northern Ireland (i.e. total since testing commenced). No problems were identified in 2005.

Import of Fishmeal

In addition to the NFA, Commission Directive 2003/126/EC requires importing Member States to sample all Third Country imports of fishmeal intended for animal feed, at the Border Inspection Post (BIP) of entry to the EU. The sample must be examined microscopically for the presence of mammalian meat and bone meal (MMBM). Consignments are not released from the BIP until a negative result is available.

BIPs are supervised by Official Veterinary Surgeons (OVS) employed either by the relevant Port Health Authority / Local Authority, or, in the case of BIPs handling only consignments not intended for human consumption, the SVS.

Further information on product imports from Third Countries is available at <http://www.defra.gov.uk/animalh/int-trde/prod-im/3rd-imp.htm>

Over 130 samples of fish meal were collected at GB ports in 2005 and 2006 (to 06/06/2006) and all tested negative for terrestrial animal protein. Countries of origin included Chile, Equador, Morocco, Peru, Thailand, Uruguay and USA. Receiving ports included Felixstowe, Grangemouth, Gunness, Heathrow, Invergordon, Liverpool and Tilbury.

UK CATTLE POPULATION

UK census data for 1995 to 2004 indicates that the UK cattle population declined by approximately 11% to a total of 10.6 million (**Table 3a**). The UK cattle population figure for 2005 was 10.4 million (**Table 3b**).

During 2004, the dairy industry continued its long-term decline falling by 2.8%, while the beef-breeding herd increased by 2.3%. The trend for larger holdings (area) and larger farming enterprises (by financial potential) continued.

Table 3a : Cattle Population in UK 1995-2004

Livestock Group (Thousands)	1995	2004	% Change 1995-2004
Breeding herd	4 443	3 870	-12.9
Dairy	2 603	2 131	
Beef	1 840	1 739	
Heifers in first calf	775	690	-11.0
Dairy	566	460	
Beef	209	230	
Bulls for service	90	100	+11.1
Total other heifers for breeding	841	748	-11.0
Other cattle and calves	5 707	5 193	-9.0
TOTAL CATTLE & CALVES	11 857	10 601	-11.0

Table 3b : Cattle Population in UK 2005

Livestock Group (Thousands)	GB	NI	UK Total
Cattle aged less than 1 year	2 274	457	2 731
Cattle aged between 1 and 2 years	2 340	438	2 778
Cattle aged over 2 years	4 132	770	4 902
Total	8 746	1 665	10 411

UK FEED INDUSTRY**The Livestock Feed Industry**

Most bulk finished feeds sold to GB farmers are manufactured in the UK, but some vitamins and other additives, particularly enzymes of genetically modified (GM) or GM-derived origin, and significant amounts of feed materials such as soyabean meal and maize gluten are imported.

Livestock feed may be either produced on the farm where it is to be used or purchased. Purchased feed may be obtained directly from:

- other farms;
- compound feed mills;

- feed merchants;
- feed supplement suppliers; or
- food processing factories (e.g. brewery/ bakery/ confectionary wastes)

Data from Her Majesty's Revenue and Customs (HMRC) indicate that in 2004, there were 315 feed manufacturing businesses in the UK. The inclusion of feed supplement manufacturers boosted this figure to 465. Both datasets indicate a decline in the number of such businesses since the mid 1990s, particularly in the smaller businesses (as determined by turnover or number of employees). Commercial pressures are believed to be responsible for this decline.

UK Feed Production

In recent years, the UK has produced approximately 10 million tonnes of compounds, blends, concentrates and other processed animal feed for UK consumption. Of this, 4 million tonnes has been feed specifically identified for cattle and calves in the UK. The following provides a breakdown of these figures:-

(i) Great Britain

GB retail production data indicates that approximately 8 million tonnes of compounds, blends and concentrate feeds were produced in 2005. A further 153 000 tonnes of processed feeds were produced for delivery in unincorporated form. These included maize and molasses products.

Approximately 3.5 million tonnes of feed identified for cattle and calves were produced in 2005.

(ii) Northern Ireland

NI delivery data indicates that approximately 1.8 million tonnes of compounds and processed feeds were delivered in 2004, of which 130 000 tonnes were delivered elsewhere.

Of the 1.8 million tonnes of compounds and processed feeds delivered, approximately 870 000 tonnes of compounds and processed feeds were delivered for cattle and calves in NI and approximately 44 000 tonnes were delivered for cattle and calves elsewhere.

A further 70 000 tonnes of other compounds and processed feed (including maize and barley products) were delivered in NI, and 9 000 tonnes delivered elsewhere.

(iii) Regional Production

Data from 1995 and 1996 (in Simon Mounsey Ltd 2005) indicates significant regional variation in UK compound feed production. Almost 2 million tonnes of compound feed were produced in South West England, while only about 500 000 tonnes were produced in the North of England.

The most cattle compound feed production was in South West England and the least in East Anglia. East Anglia, Yorkshire and Humberside had the greatest pig and poultry compound feed production.

This historic regional variation in compound feed production correlates broadly with the regional populations of the relevant livestock species.

Defra's Food Chain Analysis and Farming Regulatory Directorate (FCAFRD) advises that it is unable to provide more recent regional statistics for GB as the source data is not robust enough.

UK Feed Use

The total amount of animal feed purchased in UK has remained constant at approximately 20-21 million tonnes per year between 1992 and 2005.

The amount of compound feed purchased in the UK declined from approximately 11 million tonnes per year in the early 1990s to approximately 10 million tonnes per year in 2005. These net totals include imports less exports. Most of this decline is attributable to the pig sector.

The amount of compound feed purchased for cattle (not including calves) in UK has remained relatively constant at approximately 4 million tonnes per year between 1992 and 2005. However the amount of compound feed purchased for calves declined from approximately 300 000 tonnes per year in the mid 1990s to approximately 200 000 tonnes per year in 2005.

The amount of unincorporated concentrates (cereals, cereal offals, proteins and other high energy feeds) purchased (for all species) increased from approximately 6 million tonnes per year in 1992 to approximately 7 million tonnes per year in 2005.

The amount of other feed materials (low-energy bulk feeds including brewers grains, hay, milk by-products) purchased remained constant at approximately 550 000 tonnes per year between 1992 and 2005.

The amount of feed traded between farms also remained constant at approximately 3 million tonnes per year between 1992 and 2005.

The Compound Feed Industry

The compound feed industry may be divided into three types of company: national compounders, farmer controlled companies or co-operatives and

independent compounders. **Table 4** provides a further explanation of these terms and their market share in 2005.

A partial response to a Defra survey of compounders indicated that in 2001, there were:

- 14 national compounders¹³;
- 5 farmer controlled companies or co-operatives; and
- 31 independent compounders.

A more recent source suggests that by 2005, there were only two compounders operating nationally but it does not provide any indication of the number of companies in the other two categories.

Table 4 : Structure of the Compound Feed Industry in GB

Type	Description	Market Share 2005		
		Compound Feed	Other Processed Feed*	Total Feed
National Compounders	Deliver the majority of their products throughout GB	Total =60% Cattle=42%	23%	60%
Farmer Controlled Companies or Co-operatives	Variable in size and may also have significant retail businesses			
Independent Compounders	Do not manufacture and distribute nationally, but may have significant regional manufacturing capacity.	Total =40% Cattle=58%	77%	40%

*processed feeds for delivery in unincorporated form

¹³ In this context "national companies" were those that claimed they could deliver the majority of their products anywhere in Great Britain. Comments from the industry indicate that in recent years there have only been two companies truly manufacturing and distributing animal feed on a nation-wide basis.

Feed Ingredients

The major feed ingredients (50%) used in the production of animal feedingstuffs in GB in 2005 were:

- Wheat 31%
- Soyabean cake & meal 10%
- Wheat feed 9%

The major feed ingredients (50%) used in the production of compound and other processed animal feeds in NI in 2004 were:

- Wheat 26%
- Soyabean cake & meal 13%
- Whole and flaked maize 11%

Table 5 shows the relative usage of all feed ingredients by UK feed compounders in 2003. Feed ingredients are grouped as

- Cereals – wheat, barley, oats, maize.
- Grain Residues – rice bran extractions, maize gluten, cereal by-products.
- Oilseed Cakes & Meals – whole oilseeds, oilseed rape, soyabean cake and meal, sunflower cake and meal, other oilseed meal.
- Vegetable Residues – sugar beet pulp, molasses, citrus pulp.
- Animal Substances – fishmeal.
- Miscellaneous – minerals, oils and fat, protein concentrates, confectionary by-products, other materials.

Table 5: Relative Usage of Feed Materials by UK Compounders in 2003

Feed Material	Inclusion Rate %		
	GB	NI	UK
Cereals	36.7	42.8	37.6
Grain Residues	18.8	18.0	18.7
Oilseed Cakes & Meals	24.5	23.7	24.4
Peas & Beans	1.7	1.7	1.7
Vegetable Residues	6.1	7.2	6.2
Animal Substances	1.5	0.4	1.4
Miscellaneous	10.7	7.9	10.3
TOTAL (%)	100	100	100

Imported Feed Ingredients

Defra's FCAFRD has provided a detailed analysis of animal feeds imported into the UK in 2005. This analysis is based on data provided by HMRC and

includes the import of feed and feed ingredients for all animals including farmed animals and non-farmed animals (e.g. domestic pets). **Tables 6 and 7** provide a summary of the considerably more detailed source data. In some cases the HMRC product codes are broad. Any source data for products specified as “dog and cat food” are not included in the summary. The statistics do not reflect situations in which a raw commodity is exported from the country in which it is grown/produced, processed in an intermediate country and then exported to the UK. For example, several EU countries are listed as dispatching rice and/or soya products to the UK. A small number of countries (e.g. Australia/New Zealand) are listed as exporting small amounts of meat meal. Previous investigations have revealed the use of Australasian meat meal in petfood production.

The tables also provide details of each exporting country’s Geographical Risk of BSE (GBR), where such an assessment¹⁴ has been published. GBR is a qualitative indicator of the likelihood of the presence of one or more cattle being infected with BSE, pre-clinically as well as clinically, at a given point in time, in a country. Where the presence of BSE is confirmed, the GBR gives an indication of the level of infection. There are four levels: I – highly unlikely; II-unlikely but not excluded; III-likely but not confirmed, or confirmed at a lower level; IV-confirmed at a higher level. The assessment is based on 8 factors – structure and dynamics of cattle population; BSE surveillance; BSE related culling; import of cattle and MBM; feeding; MBM-bans; SRM-bans; rendering practices.

In summary, the UK received 1.4 million tonnes of animal feed from nineteen EU countries in 2005, most of which have confirmed BSE. The UK imported 3.5 million tonnes of animal feed from forty-one non-EU countries in 2005. Some of these countries:

- have confirmed BSE;
- have been categorised as being at some risk of having undetected BSE; or
- are uncategorized with regard to BSE risk.

The details of the exporting countries in 2005 are consistent with those identified in Defra’s investigations of feeds consumed by some BARB cases between 1998 and 2002.

¹⁴ Assessment by the European Food Safety Authority (EFSA), or previously by the EU’s Scientific Steering Committee. See http://ec.europa.eu/food/fs/sc/ssc/out113_en.pdf for further details

Table 6: Arrivals of Animal Feed from EU Countries in 2005

EU	Tonnage (%)	Top Commodities	GBR	Date BSE confirmed (indigenous)
Netherlands	696 738 (49)	<ul style="list-style-type: none"> • Soya • Straw • Sunflower 	III	1997
Ireland	171 184 (12)	<ul style="list-style-type: none"> • Unspecified • Starch • Soya 	III	1989
Spain	122 630 (9)	<ul style="list-style-type: none"> • Oilseed • Vegetable residues • Sugar beet 	III	2000
Germany	96 086 (7)	<ul style="list-style-type: none"> • Rape • Soya • Fishmeal 	III	1992 (2000)
Poland	72 337 (5)	<ul style="list-style-type: none"> • Rape • Unspecified • Fishmeal 	III	2002
Belgium	67 658 (5)	<ul style="list-style-type: none"> • Rape • Unspecified • Soya 	III	1997
Denmark	53 685 (4)	<ul style="list-style-type: none"> • Oilseed • Fishmeal • Sunflower 	III	1992 (2000)
Portugal	32 775 (2)	<ul style="list-style-type: none"> • Sunflower • Oilseed • Legumes 	IV	1990 (1994)
France	26 854 (2)	<ul style="list-style-type: none"> • Unspecified fodder • Starch • Unspecified 	III	1991
Lithuania	22 703 (2)	<ul style="list-style-type: none"> • Sunflower • MBM • Unspecified 	III	-
Greece	14 878 (≤1)	Oilseed	III	2001
Hungary	9 237	Unspecified	III	-
Italy	5 457	Sunflower	III	1994 (2001)
Latvia	9 429	Sunflower	III	-
Estonia	5 321	Oilseed	III	-
Sweden	2 220	Oilseed	II	2006
Austria	140	Unspecified	III	2001
Finland	51	Sugar beet	III	2001
Czech Republic	46	Unspecified	III	2001

Total EU	1 409 429 (100)	
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Table 7: Imports of Animal Feed from Third Countries in 2005

Third Country	Import Tonnage (%)	Top Commodities	GBR	Date BSE confirmed (indigenous)
Brazil	1 066 170 (30)	<ul style="list-style-type: none"> • Soya • Vegetable residues • Sunflower 	II	-
USA	1 003 713 (28)	<ul style="list-style-type: none"> • Unspecified • Brewing waste • Vegetable residues 	III	2003 (2005)
Malaysia	723 756 (20)	<ul style="list-style-type: none"> • Palm nuts • Unspecified • Soya 	-	-
Argentina	317 811 (9)	<ul style="list-style-type: none"> • Soya • Sunflower • Vegetable residues 	I	-
Indonesia	82 378 (2)	<ul style="list-style-type: none"> • Palm nuts • Unspecified • Fishmeal 	-	-
Uruguay	49 017 (1)	Soya	I	-
British Virgin Islands	43 103 (≤1)	Soya	-	-
Switzerland	41 622	Soya	III	1990
China	40 183	Soya	-	-
Iceland	33 346	Fishmeal	I	-
Ukraine	24 836	Sunflower	-	-
Nigeria	22 934	Palm nuts	II	-
Peru	21 381	Fishmeal	-	-
Faroe Islands	14 871	Fishmeal	-	-
Chile	12 154	Fishmeal	III	-
Tunisia	11 387	Oil seed	-	-
Antigua and Barbuda	10 664	Soya	-	-
Russia	7 118	Sunflower	-	-
Norway	4 676	Fishmeal	II	-
Canada	4 057	Lucerne	III	1993 (2003)
Morocco	2 844	Fishmeal	-	-
Belize	1 525	Soya	-	-
Barbados	1 186	Soya	-	-
New Zealand	9 43	Meat meal	I	-
Australia	499	Meat meal	I	-
Bolivia	557	Soya	-	-
Ecuador	543	Fishmeal	-	-
Dubai	356	Unspecified	-	-
Turkey	270	Unspecified fodder	III	-

Taiwan	131	Unspecified	-	-
Japan	126	Unspecified	-	2001
India	89	Unspecified	II	-
Thailand	76	Unspecified	-	-
South Africa	72	Unspecified	III	-
Egypt	26	Rice	-	-
Yugoslavia	20	Vegetable residues	(III)*	-
Macao	16	Unspecified	-	-
Hong Kong	10	Soya		-
Singapore	3	Unspecified	I	-
Romania	1	Unspecified	III	-
Ghana	1	Straw	-	-
Total Non EC	3 544 471			

*Croatia and Former Yugoslav Republic of Macedonia are GBRIII

TRANSPORT OF FEED & FEED MATERIALS

Most feed materials entering UK arrive by ship and are then transported by road to mills or intermediaries.

Feed may be transported inland using either:

- a road haulier;
- a specialist contractor (e.g. harvested forage); or
- the farmer's own equipment or that of another farmer.

Farm equipment used may not be designed specifically for, nor exclusively used for the transport of feed materials.

Feed may be delivered by tipping, blowing or pumping. Bagged feed will be unloaded. Feed may be delivered to farms via an intermediate point and moved by the farmer's own equipment which is rarely dedicated to feed handling. Forages may be harvested and moved by a combination of dedicated and undedicated machinery.

Assurance Schemes

Many UK-based hauliers involved in feed transport subscribe to an independent code of practice. Agricultural Industries Confederation (AIC) was formed in 2003 and has over 300 members. AIC members represent the agri-supply industry which provides agricultural inputs into the agricultural and farming sector. The sectors and percentage representation are shown below:

- Animal Feed - 90 %
- Crops Protection and Agronomy - 90 % Distributors
- Fertilisers - 95 %
- Grain and Oilseeds - 90 %
- Seed - 80 %

The feed trade assurance schemes established by the (AIC) are:

- Universal Feed Assurance Scheme (UFAS) - covering production and delivery of compound feed and supply of feed materials to the farm
- Feed Material Assurance Scheme (FEMAS) - providing assurance to purchasers of feed materials that such materials are safe and meet specified criteria
- Trade Assurance Scheme for Combinable Crops (TASCC) – covering standards for grains, oilseeds and pulses after they have left the farm.

Further information on these assurance schemes is available at

<http://www.agindustries.org.uk/>

UFAS is audited and certified by the independent certification body, EFSIS and full details of UFAS-certified sites are available at <http://efsis.com>

There are also assurance schemes which apply to shippers and importers such as the Comité du Commerce des céréales, aliments du bétail, oléagineux, huile d'olive, huiles et graisses et agrofournitures (COCERAL) European Code of Good Trading Practice. Further information is available at <http://www.coceral.com/main.html>

Although the participation in trade assurance schemes may be a condition of membership of trade associations, these schemes are non-statutory. However, the EU Feed Hygiene Regulation (Regulation (EC) No.183/2005) which applied from 1 January 2006 (with transitional measures for most farms until 1 January 2008) includes a number of requirements for feed business operators (a term which includes almost all livestock farmers and feed growers). These requirements may include registration, Hazard Analysis and Critical Control Points (HACCP) systems, record keeping, good practice, training and other minimum standards.

FEED STORAGE

Traditionally there have been many options for storage of feed. These have included:

- storage bins or silos for bulk materials which may be sealed or unsealed;
- bunkers or bays for storing bulk materials on the floor, usually separated by concrete or wooden partitions;
- tanks for liquids;
- sheds or other farm stores for bagged ingredients; and
- feeds stored in heaps in unsealed buildings.

Dry Feedingstuffs

Dry feed or feed stored in bulk has typically been held in sealed hoppers, lofts or bins. Dry feed has also been stored in bays or bunkers on the floor. Bagged feeds has been stored in sheds.

Moist Feedingstuffs and Dried Forages

Silage has been stored on farms in large covered bunkers (clamps), with open sides for access, or in smaller sealed bales. Brewers' grains has been ensiled in clamps on farms or otherwise stored fresh. Hay and straw has been stored in buildings or otherwise under cover.

Feed Hygiene Requirements and Cross Compliance

Some traditional methods of feed storage e.g. in the open, in unsealed bins or on the floor, may contravene Feed Hygiene requirements. Under the Single Payment Scheme, the Cross Compliance Handbook for England 2006 lists fifteen Statutory Management Requirements (SMRs). SMR11 covers food and feed law and will be expanded to take into account the changes in food and feed legislation. The requirements of SMR 11 include the following:

“You must not place unsafe feed on the market or feed it to food producing animals if it is unsafe. Feed is deemed to be unsafe for its intended use if it is considered either to have an adverse effect on human or animal health, or if it makes the food derived from food producing animals unsafe for human consumption”

The Cross Compliance Handbook for England 2006 is available at <http://www.defra.gov.uk/farm/capreform/pubs/pdf/xCHandbook2006.pdf>

ON-FARM FEEDING PRACTICES

Feeds Used on Livestock Farms

Feeds may either be produced on the farm where they are used or purchased. On-farm produced feeds are primary agricultural products such as forages, cereals and pulses. Purchased feeds include by-products associated with the manufacture of human food and drink and straights, compounds and blends. **Table 8** summarises the types of feed materials used on livestock farms.

Table 8: Feed Materials Used on Livestock Farms

Type	Origin	Use
Forages such as Grass/Hay/Silage; Maize Silage; and Whole Crop Cereal Silage	Generally used on farm where grown, except grass hay, dried grass and cereal straws	Fibrous feeds used alone or supplemented with concentrate feeds
Concentrate Feeds derived directly from cereals and other plant products e.g. wheat, pulses; or as by-products from the food Industry e.g. soyabean and oilseed meals	Ingredients traded globally from Asia including Indian sub-continent, Africa and North and South America. Generally the higher the moisture content, the closer the source	Used straight or in compounds or blends to provide supplementary nutrition e.g. energy, protein, vitamins

On-Farm Mixing

The ACAF Review of On-Farm Feeding Practices 2003 indicated that the Royal Pharmaceutical Society of Great Britain (RPSGB) held records of 1820 on-farm manufacturers of medicated/ zootechnical feeds. The RPSGB has since shed its veterinary enforcement role to the Veterinary Medicines Directorate.

Under the previous legislative regime, only producers who incorporated additives such as trace elements and vitamins were required to register with Local Authorities¹⁵. The ACAF Review indicated that approximately 14000 farms were registered in GB and that it was likely that some eligible farms had yet to register. This represented approximately 14% of the 101 000 livestock holdings in GB in 2003.

Complete diet feeding is used increasingly to mix home grown forages, cereals, by-products and other bought-in feeds to produce ruminant rations. Although detailed figures are not available the ACAF Review estimated that there might be 6 000 feeder wagons in use in GB. This represented approximately 32% of the 19 000 dairy cattle holdings in GB in 2003.

Approximately only half of the animal feed purchased in the UK is compound feed and it appears that on-farm mixing of feeds is widely practised.

Mixing and Feeding Practices for Ruminants

¹⁵ Under the new feed hygiene rules, there is no distinction made between on-farm mixers and other farmers. All are required to register with their Local Authorities

Home mixing is practised on a high proportion of dairy and beef farms. Home-grown forages may be mixed with concentrate feeds to produce a total mixed ration. The main feed mixing systems are:

- Feeder wagons – an increasing proportion of cattle farmers use feeder wagons to produce a total mixed ration. Feeder wagons have weighing facilities and deliver a standard mix of forage and concentrates into the feeding areas;
- Dry mixing – a few ruminant farms mix feed materials into their own compound feed or blend, either manually or mechanically, to be fed separately from the forage component; and
- Mobile mill and mix units – these vehicle-mounted milling/mixing facilities travel from farm to farm mixing feed materials into compound feed or blends.

Ruminant livestock are generally fed on a group basis. However young dairy calves are typically penned individually and fed purchased milk replacer and compound feed, which may be a coarse mix or pelleted. Dairy cows are often fed compound (pelleted) feed either in the milking parlour or in programmed out-of-parlour dispensers.

HAZARDS & RISKS

Epidemiological evidence linked the initial BSE cases in the UK epidemic to the feeding of MMBM. The MMBM was derived from the processing of ruminants in rendering plants. The BSE controls which aim to eliminate infected carcass material from cattle feed have had a massive impact on the incidence and prevalence of BSE. It is important to note that MMBM does not necessarily contain BSE infectivity. As the incidence and prevalence of BSE declines, the risk of new MMBM produced being infectious declines.

A **hazard** is a substance or an event that could potentially cause an adverse effect.

A **risk** is the probability of a particular hazard resulting in an adverse effect.

In relation to BSE and the feed supply chain:

- the hazard is a bovine animal consuming feed contaminated with an infectious dose of the BSE agent, resulting in a new BSE infection; and
- the risk is the probability of a bovine animal consuming feed contaminated with an infectious dose of the BSE agent, resulting in a new BSE infection.

There continue to be a very small number of BSE cases in the UK and in other EU Member States born after feed controls were imposed: i.e. born after July 1996 in the UK and/or born after January 2001 in the EU. This suggests

that small amounts of feed contaminated with the BSE agent continued to be fed to ruminants after the feed bans were imposed.

Experimental data indicates that the potential infectious oral dose of the BSE agent in cattle is extremely low and this increases the risk posed by contamination of cattle feed. However the experimental “attack rate” studies involved challenge with raw infectious brain rather than MMBM derived by rendering raw material. It is reasonable to assume that the rendering process would reduce the level of any infectivity in raw material but the extent of this reduction in infectivity would depend on the rendering method employed (Taylor and Woodgate 2003).

In 2005, the European Food Safety Authority (EFSA) published a quantitative risk assessment of the animal BSE risk posed by MMBM. The assessment concluded that the risk is determined by various factors including feed composition (%MMBM), feeding system (intensive/extensive), GBR status, SRM removal and reliability of BSE surveillance.

As an unrealistic worst case scenario, cattle in an intensive system consuming 8 kilograms of compound feed containing 0.1% meat and bone meal (MBM) with a 40% bovine origin from a GBR IV country with unreliable BSE surveillance and no SRM removal prior to rendering, could be exposed to a median (p50) of 5×10^{-5} CoID₅₀ units of BSE infectivity per animal per year. Based on a UK cattle population of 10 million (assuming all equally exposed), this would result in five hundred new BSE infections per year.

However cattle in an extensive system consuming 1.5 kilograms of compound feed containing up to 2% MBM with a 40% bovine origin produced in a GBR III country with reliable surveillance and all SRM removed prior to rendering, could be exposed to an average of 1.2×10^{-7} CoID₅₀ units of BSE infectivity per animal per year. Based on a UK cattle population of 10 million (assuming all equally exposed), this would result in fewer than two new BSE infections per year.

The EFSA risk assessment is available at http://www.efsa.eu.int/science/biohaz/biohaz_opinions/1148_en.html

Potential Sources of Infectivity

Potential historic, current and future sources of BSE infectivity in ruminant feed include:

- Ruminant feed produced/handled in UK before the 1996 feed ban, either inadvertently or deliberately contaminated with infectious MMBM, persisting at one or more points in the feed supply chain.
- Ruminant feed produced/handled in UK after the 1996 feed ban, either inadvertently or deliberately contaminated with infectious MMBM,

entering and possibly persisting in the feed supply chain at one or more points.

- Ruminant feed produced/handled in EU (not UK) before the 2001 feed ban, either inadvertently or deliberately contaminated with infectious MMBM, persisting at one or more points in the feed supply chain.
- Ruminant feed produced/handled in EU (not UK) after the 2001 feed ban, either inadvertently or deliberately contaminated with infectious MMBM, entering and possibly persisting in the feed supply chain at one or more points.
- Ruminant feed produced/handled at any stage outside the EU, either inadvertently or deliberately contaminated with infectious MMBM, entering and possibly persisting in the feed supply chain at one or more points.

The physical consistency of MMBM (i.e. its fat content) facilitates its adherence to surfaces and, without thorough cleaning, it may persist in milling equipment, vehicles, stores etc.

Milling equipment, feed stores and feed transporters pose a particular risk of producing ruminant feed contaminated with MMBM if they are used for both ruminant feed and MMBM:

- simultaneously;
- with time separation but without adequate decontamination in between;
or
- with some, but inadequate, spatial separation.

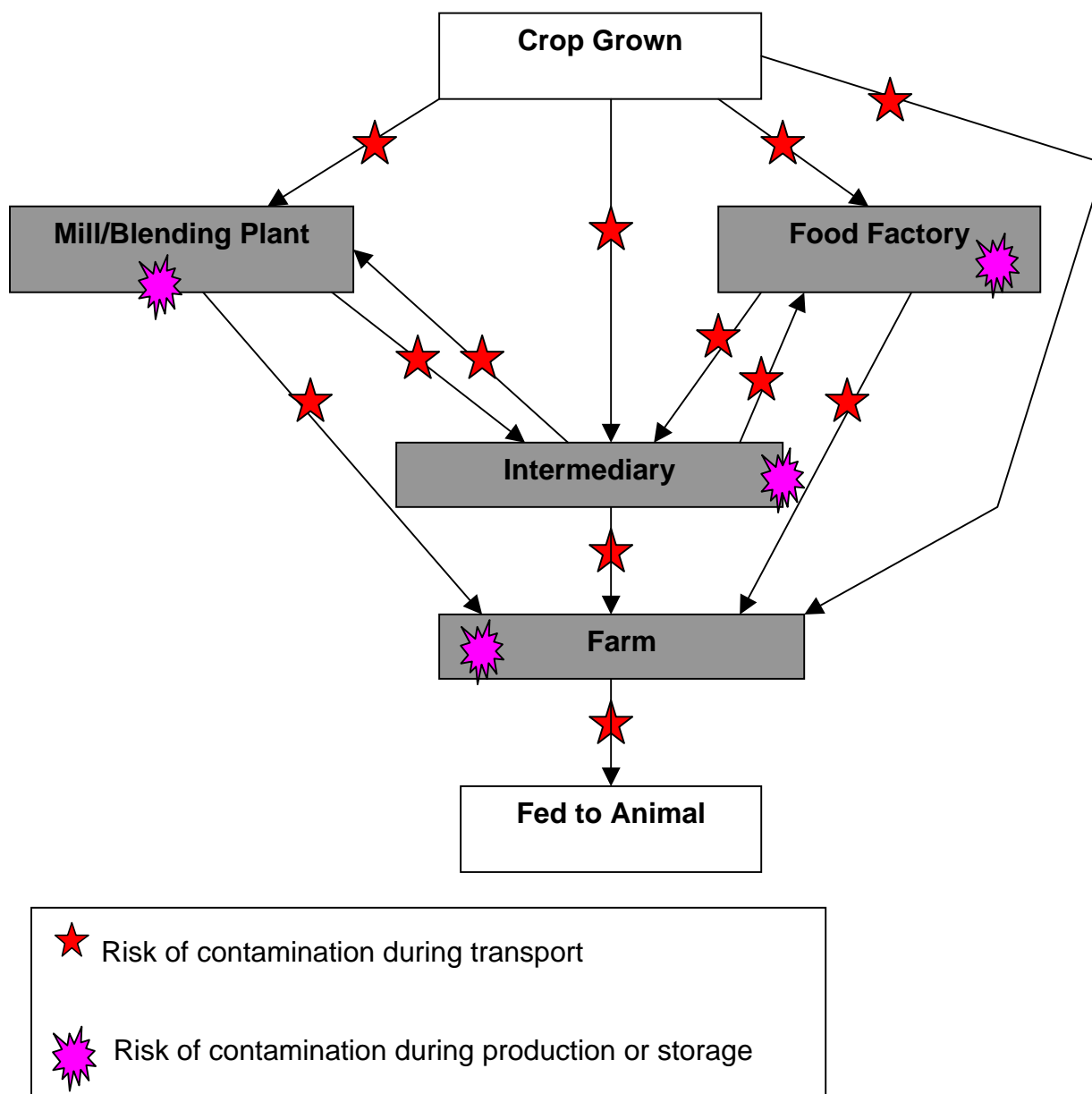
The BSE risk is then determined by the BSE infectivity in the MMBM concerned, the concentration of MMBM contamination in the ruminant feed and the feed being fed in sufficient quantities to susceptible animals.

Clauss *et al.* (2006) provided local evidence of the potential for cross contamination before the EU-wide 2001 feed ban. They reported that in the German state of Bavaria, 60 to 75 per cent of ruminant feed samples taken between 1996 and 2000 were contaminated with animal material. Even single batches of feedstuffs derived from plant materials, such as soyabean or oilseed rape, were contaminated, indicating that the contamination did not only occur during the mixing and transport of proprietary (compound/blended) feed. The proportion of ruminant feedstuffs in Bavaria that were cross-contaminated with animal material decreased significantly after the 2001 (EU-wide) feed ban, and decreased close to zero in 2002. These results underline the high efficiency of the 2001 feed ban (Clauss and Kunzle 2003). By 23 March 2006, Bavaria had reported 141 (35.6%) of Germany's 396 BSE cases. (<http://www.bmvel.de>)

The risks of cross-contamination of ruminant feed with MMBM used for other feed purposes (e.g. in petfood) were addressed by the removal of MMBM from the UK feed supply chain in 1996. Official monitoring in the UK has consistently shown a high level of compliance with the BSE-related feed controls introduced from 1996. GB statistics are available at <http://www.defra.gov.uk/animalh/bse/statistics/nfa.html>.

Figure 1 provides a schematic representation of the feed supply route and the critical control points in relation to contamination of ruminant feed with MMBM.

Figure 1: Schematic Diagram of Feed Supply Chain and Critical Control Points in Relation to Contamination of Livestock Feed with MMBM.



In reality, the feed supply chain may be significantly more complicated. A recent example of this is outlined below.

During a routine NFA inspection, the SVS sampled a feed ingredient described as maize flour at an assured feed mill. The maize flour tested positive for MMBM using the MAT and feed tracing was undertaken. The maize flour was identified to be waste screenings from a petfood plant producing rabbit, guinea pig and parrot food from pulses and a pelleted wheat product. The petfood plant had a history of using UK MMBM itself. It also received the pelleted wheat product from another similar petfood plant. These wheat pellets have previously contained MMBM historically sourced from New

Zealand but more recently sourced from the UK. Six tonnes of the original twelve tonne consignment of maize flour were mixed (at an inclusion rate of 21%) with twenty-two and a half tonnes of bread and pudding waste at the mill where sampling took place. The resultant twenty-eight and a half tonnes of dough were supplied to another feed mill where they were further mixed (at an inclusion rate of 9%) with just over three hundred tonnes of biscuit waste. The final product (estimated to contain less than 2% of the original maize flour) was distributed and exported. Following tracing the product was itself sampled and tested with no evidence of MMBM detected. The original concentration of MMBM in the maize flour is unknown. Since this incident occurred the legislation has been tightened with respect to feed ingredients originating from premises in which MMBM is handled and reject petfood.

This example also demonstrates the potential effect of dilution and mixing on contamination with MMBM. Shorter chain supply routes, involving fewer dilution and mixing steps, particularly where the MMBM is not distributed homogeneously (i.e. is aggregated) may not benefit as much from this effect. In this respect it is hypothesised that animals fed home-mixed feed produced from relatively small amounts of purchased feed materials may be relatively more vulnerable to BSE infection compared to animals fed commercial compound feeds.

Risk from Petfood

The risk of PAP produced either in the EU, or in Third Countries for use in the EU, containing an infectious dose of the BSE agent, is believed to be very low.

The Animal By-Products Regulation (No.1774/2002) (ABPR) which has applied in EU member states since 1 May 2003, and which is administered in England by the Animal By-Products Regulations 2005¹⁶, only permits the use of specific types of Category 3 animal by-products in petfood. These may be used raw or as PAP. Category 3 animal by-products are low risk materials derived from carcasses that were formerly considered fit for human consumption. The Animal By-Products Regulations 2005 prohibit intra-species recycling.

ABPR also permits the import of PAP (including fishmeal) from Third Countries for use in animal feed. However, it must:

- come from a European Community listed plant;
- have been produced in accordance with the Regulation;
- be imported through a BIP; and
- accompanied by a Veterinary Health Certificate

¹⁶ SI 2005 No.2347 (and equivalent legislation in the devolved administrations of Scotland, Wales and Northern Ireland).

The Competent Authority of the importing EU Member State is required to sample¹⁷ all incoming consignments for *Salmonella* and *Enterobacteriaceae* before release from the BIP. Third Country rendering plants approved to produce PAP for export to the EU are subject to independent FVO audit. As indicated previously, imports of fishmeal from Third Countries are additionally subject to MMBM testing at BIPs.

ABPR imposes requirements on the cleaning of vehicles transporting both animal by-products and processed products such as PAP.

Within the EU, the TSE Regulation (No. 999/2001) requires that the carcasses of emergency slaughtered cattle aged over 24 months, and the carcasses of cattle aged over 30 months intended for human consumption, must first test negative for BSE before any parts of their carcasses can be released into the food or feed chains. Specified risk material (SRM) controls are estimated to remove over 99% of any BSE infectivity that might be present in bovine carcasses. The TSE (No.2) Regulations 2006 implement the ban on feeding prohibited animal proteins to farmed animals and impose additional requirements where PAP is transported. Advice on the feed-related legal requirements in the TSE (No.2) Regulations 2006, is available at <http://www.defra.gov.uk/animalh/bse/animal-health/feedbanguide.pdf>

Risk from Imported Feed

There is a potential BSE risk from imported feed if it is contaminated with MMBM derived from high-risk material. In some Third Countries, such MMBM may still be used legitimately in feed.

The amount of feed ingredients imported into the UK in 2005 was equivalent to 25% of the total feed used in the UK. Feed ingredients are sourced globally. In 2002, Wilesmith hypothesised about the risks from imported feed in a letter to the Veterinary Record describing the first sixteen BARB cases in GB (Wilesmith 2002). Wilesmith cited the delayed implementation of BSE-related feed controls in other BSE-affected countries, particularly that the feeding of processed animal protein to all species of farmed livestock was not necessarily prohibited in other EU Member States until 2001. The data provided by Clauss and Kunzle (2003) and Clauss *et al.* (2006) provide some local evidence of the potential for cross-contamination of ruminant feed with animal material in mainland Europe before the 2001 EU-wide feed ban, and the favourable effects of that ban.

The BSE risk from imported feed, concerns feed handled in countries in which BSE is present but where BSE feed controls, equivalent to those currently in force in the EU, are either absent or inadequately complied with. Although PAP produced in Third Countries for export to the EU for feed use must meet EU standards, these standards do not apply to MMBM produced for non-EU

¹⁷ Although this is an animal health measure, it is **not** a TSE control measure.

feed use. Thus there is potential for cross-contamination of ruminant feed ingredients with MMBM derived from high-risk material (e.g. SRM) used in feed outside the EU. Without adequate controls, there is also potential for cross contamination of ruminant feed with high-risk MMBM intended for other purposes e.g. disposal.

The amount of feed ingredients imported into the UK from the USA in 2005 was equivalent to 5% of the total feed used in the UK. In 2004, EFSA published a report¹⁸ on the assessment of the GBR of the USA. The report noted that until August 1997, ruminant MBM was legally fed to cattle. In August 1997, a ruminant MBM ban was introduced, but feeding of non-ruminant MBM to cattle and feeding of ruminant MBM to non-ruminants remained legal. A ruminant MBM-ruminant ban is difficult to maintain, as the UK discovered before 1996. Other areas of concern to the assessors included the rendering industry and SRM removal. The assessment reported that SRM was still rendered for feed use. In 2006, the USA confirmed its second indigenous case of BSE. Despite these observations there is an absence of evidence linking UK BSE cases to feed containing feed materials received from any particular country, and any such study would present significant practical difficulties due to the extensive mixing of feed ingredients.

Calculations derived from the 2005 EFSA quantitative risk assessment may be used to quantify the BSE risks from MMBM contaminating imported feed.

LIMITATIONS OF CONTROLS

MMBM Detection Sensitivity

EU-wide laboratory ring trials in 2003 and 2004 revealed that the revised MAT method (Commission Directive 2003/126/EC) was unable to detect a 0.1% MMBM level in the presence of 5% fishmeal in feed reliably.

For practical reasons, it is impossible to detect all feed contamination with MMBM. This is because of the statistical improbability of examining a contaminated sample from a bulk consignment in which the overall contamination level is low, particularly where the contamination is aggregated rather than homogeneous.

Given the experimental data suggesting that the potential infectious oral dose of the BSE agent in cattle is extremely low, the limits of MMBM detection sensitivity mean that feed can never be guaranteed to be BSE risk-free on the basis of a negative MAT result for MMBM.

Limits of Surveillance

For practical reasons, it is not possible to monitor constantly, all premises handling animal feed, or to sample all livestock feed. Hence the NFA operates

¹⁸ http://www.efsa.eu.int/science/tse_assessments/gbr_assessments/573_en.html

a risk-based inspection and sampling programme. To maximise its monitoring efficiency, NFA feed sampling is weighted at the production end of the supply chain: in 2005, 43% of samples were collected at feed mills and 35% of samples were collected at farms. Short chain supply routes, involving small numbers of intermediates and by-passing feed mills, reduce the probability of detection of MMBM contamination of livestock feed. In this respect animals fed home-mixed feed, produced from relatively small amounts of purchased feed materials, may again be relatively more vulnerable to BSE infection compared to animals fed commercial compound feeds.

Retrospectivity

Compliance monitoring is, to some extent, retrospective rather than prospective, as by the time MMBM is detected, the feed concerned may have been widely distributed and fed. Therefore it is essential to provide clear advice on feed controls and their purpose and encourage good agricultural practice, good manufacturing practice and participation in industry-led feed assurance schemes. However, where feed testing reveals the presence of prohibited animal proteins in livestock feed, every effort is made to trace any animals which may have consumed the feed. Where there are reasonable grounds to believe that TSE susceptible animals have had access to prohibited animal proteins, there are statutory powers to restrict the movements of, and slaughter, these animals.

Imported Feed

For imported feed, the UK relies heavily on other countries implementing BSE controls on feed. There is reliance on documentation and independent EU Food and Veterinary Office (FVO) audit where this applies.

Compliance

Although BSE-related statutory feed controls may be sound, it is important not to be complacent and assume that there is either 100% compliance or 100% detection of non-compliance. However, official monitoring in the UK has consistently shown a high level of compliance with the BSE-related feed controls introduced from 1996.

RISK MITIGATION

Mitigation of the risk of contamination of ruminant feed with BSE infectivity is the responsibility of both Government and industry.

Statutory Controls

The Government is responsible for providing a statutory basis for feed controls. This is the prohibited animal protein feed ban including controls

reducing the risk of cross contamination of ruminant feed e.g. separate facilities, cleaning between different commodities, identification.

Encouraging Best Practice

The Government works with industry to provide advice on BSE-related feed controls and encourage good agricultural practice, good manufacturing practice and participation in feed assurance schemes.

Risk-Based Monitoring

The Government is also responsible for monitoring compliance with, and enforcing the feed ban. The NFA is a risk-based programme which monitors and encourages compliance with the feed ban and operates as an enforcement tool where necessary. Official monitoring in the UK has consistently shown a high level of compliance with the BSE-related feed controls introduced from 1996.

Improving Detection Sensitivity

In recent years the EU, supported by the VLA, has conducted a series of EU-wide ring trials to standardise and improve the sensitivity of the MAT. Defra also strongly supports the continuing development of new methods to improve the ability to differentiate species specific animal proteins in feed, such as the Polymerase Chain Reaction (PCR) method based on Deoxyribonucleic Acid (DNA) technology, and the Near Infra-Red (NIR) test which has the potential to enhance the microscopy test. In addition to supporting test development at EU level, the UK has its own test development programme where these methods are showing promise.

CONCLUSIONS

1. In his independent review of BARB cases, Professor Hill recommended that Defra continued to operate on the basis that BSE transmission via feed was the major route in BARB cases. Professor Hill concluded that that the feed controls in place in the UK seemed adequate but required vigilant enforcement. Professor Hill noted the extremely small experimental dose for BSE and concluded it may not be possible to attribute BARB cases to any single source of feed contamination.
2. There is a wealth of information on the UK feed supply chain available to Defra from a range of sources.
3. The ACAF reviews of on-farm feeding practices and feed law enforcement identify hazards and risk points in the feed supply chain and make recommendations accordingly. Defra is contributing to the FSA's response to these recommendations.

4. The feed supply chain is complex with a significant amount of feed ingredients received into the UK both from EU and non-EU countries. Some of these countries either have confirmed, or are deemed at risk of, BSE.
5. In relation to BSE and the feed supply chain, the risk is the probability of a bovine animal consuming feed contaminated with an infectious dose of the BSE agent, resulting in a new BSE infection. The risk of PAP produced currently either in the EU, or in Third Countries for use in the EU, containing an infectious dose of the BSE agent, is believed to be extremely low. MMBM produced in Third Countries for non-EU feed use or other purposes, may generate a BSE risk if it is derived from high-risk infectious material and cross contaminates feed materials intended for ruminants. However MMBM is not necessarily synonymous with BSE infectivity.
6. The feed industry is subject to the requirements of the EU Feed Hygiene Regulation, which requires all feed business operators, including almost all livestock farmers and feed growers, to register with their Local Authority and comply with minimum standards. The feed industry also operates a number of voluntary feed assurance schemes, which address the risk of cross-contamination of feedstuffs with MMBM and other contaminants during the production and supply of livestock feed.
7. The NFA is a risk-based programme, which monitors and encourages compliance with the BSE feed controls and operates as an enforcement tool where necessary. NFA feed sampling is weighted at the production end of the supply chain to maximise its efficiency. Official monitoring in the UK has consistently shown a high level of compliance with the BSE-related feed controls introduced from 1996. The NFA programme is kept under constant review. Through the NFA, the SVS is well placed to monitor significant developments in the GB livestock feed supply chain.
8. Fishmeal imported from Third Countries is tested for the presence of MMBM at Border Inspection Posts. The NFA programme covers the sampling of other imported feed ingredients either at import or throughout the feed supply chain.
9. Dilution and mixing of small amounts of aggregated MMBM contamination in a single feed ingredient may reduce the BSE risk. The effects of dilution and mixing may be reduced in short chain supply routes. The probability of detection of MMBM contamination may also be reduced in short chain supply routes. Thus it is hypothesised that animals fed home-mixed feed produced from relatively small amounts of purchased feed materials may be relatively more vulnerable to BSE infection in comparison to animals fed commercial compound feeds.

10. The limitations of the BSE-related feed controls include the sensitivity of diagnostic tests, the limits of surveillance, the possibility that animals have consumed feed before contamination is detected and cannot be traced, the difficulties in verifying BSE controls in exporting countries and the limitations on detecting 100% of non-compliance.
11. The mitigation of the risk of the contamination of ruminant feed with an infectious dose of the BSE agent, includes the statutory feed controls, encouraging best practice, risk-based monitoring and the development of more sensitive tests.
12. The 2005 EFSA qualitative risk assessment calculated that if 10 million cattle were all fed extensively on MMBM produced in a GBRIII country with reliable surveillance and all SRM removed prior to rendering, it would result in fewer than two new BSE infections per year.

GLOSSARY OF TERMS & ABBREVIATIONS

ABPR

The Animal By-Products Regulation (Regulation (EC) No.1774/2002).

ACAF

Advisory Committee on Animal Feedingstuffs.

BARB

This term is used to describe BSE cases Born After the Reinforced Ban on feeding mammalian meat and bone meal to farmed livestock (i.e. born after July 1996 in UK).

BIP

Border Inspection Post.

Blend

A mixture of unmilled (unground) feed materials intended for feeding either as a complete or complementary feed.

BSE

Bovine Spongiform Encephalopathy.

By-products (Co-products)

By-products of human food or drink manufacture which are used as feed materials (e.g. soyabean meal, brewers' grains, wheat feed).

CIE

Counter Immuno Electrophoresis.

Complementary Compound Feed

A compound feed mixture of feed materials with a high concentration of certain nutrients (e.g. protein) which is sufficient to provide a daily ration only if fed in combination with other feedingstuffs.

Complete Compound Feed

A compound mixture which supplies the total dietary needs of an animal (i.e. the daily ration).

Compound Feed

A mixture of milled (ground) feed materials intended for feeding either as a complete or complementary feed, usually pelleted.

Concentrate

A term used to describe an animal feedingstuff with a higher nutritional value relative to its weight. It can be applied to both compound feedingstuffs and feed materials (i.e. uncompounded, unblended single ingredients formerly known as "straights")

DARD NI

Department for Agriculture and Rural Development in Northern Ireland.

Defra

Department for Environment, Food & Rural Affairs.

Devolved Administrations

Scottish Executive Environment and Rural Affairs Department, National Assembly for Wales Agriculture Department, Department for Agriculture and Rural Development in Northern Ireland.

DNA

Deoxyribonucleic Acid.

Dry Mixing

A method of home mixing feed materials, which may either be manual or mechanised. Feeds are usually mixed in batches and stored prior to feeding.

EFSA

European Food Safety Authority.

ELISA

Enzyme-Linked Immunosorbant Assay.

EU

European Union.

FCAFRD

Defra's Food Chain Analysis and Farming Regulation Directorate.

Feed Blocks

Types of compound feed consisting of compressed feed materials (e.g. molasses and minerals) usually with added minerals and vitamins and trace elements and shaped into a block. Used to supplement animals' nutritional requirements over a prolonged period of time.

Feed Materials

Any products of vegetable or animal origin, in their natural state, fresh or preserved; any products derived from the industrial processing of such products or organic or inorganic substances which are intended for animal feeding, either directly or in a compound feed. (This term has replaced the older term "straights")

Feed Supplement

Complementary compound feed used to supplement the ration where it is lacking in particular nutrients.

Feeder Wagon

A mixing wagon in which feed is mixed and then delivered by chute into feeding areas, usually for cattle. These wagons are generally restricted to single farm use – see Total Mixed Ration.

Forage

High fibrous crops either fresh e.g. grass, or preserved e.g. silage, hay.

FSA

Food Standards Agency.

FVO

European Commission's Food and Veterinary Office.

GB

Great Britain.

GBR

Geographical Risk of Bovine Spongiform Encephalopathy.

GM

Genetically modified

HACCP

Hazard Analysis and Critical Control Points

Hazard

A substance or an event that could potentially cause an adverse effect.

HMRC

Her Majesty's Revenue and Customs.

Home Mixer

Person who mixes feed ingredients, which may be home produced and/or purchased feed materials, additives etc. on the premises at which they are to be fed.

Intermediary

Persons holding feed materials and products at an intermediate stage between production and end use.

MAT

Microscopy Analysis Test.

Member State

A country that is a member of the European Union.

MMBM

Mammalian meat and bone meal.

MBM

Meat and bone meal.

Mobile Mill and Mix Unit

A vehicle mounted facility for milling grain and/or mixing feed materials and additives. The mobility of these units means that mixtures can be tailored to meet the needs of specific livestock groups on individual farms, using the feed materials available.

NFA

National Feed Audit, monitoring compliance with the ban on feeding processed animal protein to farmed animals.

NI

Northern Ireland.

NIR

Near Infra-Red test.

OVS

Official Veterinary Surgeon.

PAP

Processed animal protein:-

PAP was initially defined in Commission Decision 2000/766/EC as "*meat and bone meal, meat meal, bone meal, blood meal, dried plasma and other blood products, hydrolysed protein, hoof meal, horn meal, poultry offal meal, feather meal, dry greaves, fishmeal, dicalcium phosphate, gelatin and other similar products including mixtures, feedingstuffs, feed additives and premixtures, containing these products*".

In September 2003, Regulation (EC) No.1234/2003 amended the definition of PAP, in line with Regulation (EC) No.1774/2002, to “*animal proteins derived entirely from Category 3 material, which have been treated in accordance with Chapter II of Annex V [of Regulation (EC) No. 1774/2002] so as to render them suitable for direct use as feed material or other use in feedingstuffs, including petfood, or use in organic fertilisers or soil improvers; however it does not include blood products, milk, milk-based products, colostrums, gelatine, hydrolysed proteins and dicalcium phosphate, eggs and egg-products, tricalcium phosphate and collagen*”.

Regulation (EC) No.1234/2003 and Regulation (EC) No.1292/2005 also made amendments to Regulation (EC) No.999/2001 addressing the ban on feeding other products no longer covered by the current definition of PAP.

Further details of the current feed ban, including the derogations which permit the feeding of “restricted proteins”, are available at <http://www.defra.gov.uk/animalh/bse/animal-health/feedbanguide.pdf>

PCR

Polymerase Chain Reaction.

Restricted Proteins

Animal proteins which are restricted to non-ruminant feed use only. Their feed use is subject to conditions.

Risk

The probability of a particular hazard resulting in an adverse effect.

RPSGB

Royal Pharmaceutical Society of Great Britain.

SEAC

Spongiform Encephalopathy Advisory Committee.

SMR

Statutory Management Requirements

SRM

Specified Risk Material.

Straight Concentrates (Straights)

See **Concentrates** and **Feed Materials**

SVS

State Veterinary Service, a Defra Agency.

Third Country

A country that is not a Member State of the European Union.

Total Mixed Ration

A complete diet produced on farm using a feeder wagon that weighs and blends forages, concentrate feeds and other ingredients into a complete diet.

TSE

Transmissible Spongiform Encephalopathy.

UK

United Kingdom of Great Britain and Northern Ireland.

USA

United States of America.

VLA

Veterinary Laboratories Agency, a Defra Agency.

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ANNEX 1: RECOMMENDATIONS ARISING FROM ACAF REVIEW OF ON-FARM FEEDING PRACTICES

1. The Committee recommends that all home mixers and livestock farmers adopt arrangements based on recognised risk management approaches.
2. The Committee recommends that all home mixers should have a risk assessment and control programme in place. The system chosen must be proportionate to the potential risks to animals and human health which will be related to the types of feeds being fed, the number of livestock involved, the market outlets for those products and whether the farmer is also selling feed manufactured on-farm.
3. The Committee recommends that farmers seek outside help if necessary, whether from the feed industry, feed material suppliers, private consultants, assurance scheme auditors or other advisers in assessing hazards and risks on their farm.
4. The Committee recommends that farmers undertake appropriate targeted feed analyses to demonstrate that practical control measures are working and that feeds are safe.

5. The Committee urges that codes of practice and assurance schemes should be further developed where necessary to address the particular hazards associated with on-farm mixing and feeding. It also encourages farmers in the use of/participation in such codes and schemes.
6. The Committee recommends that farmers should take particular care when purchasing either new types of feed or feed material, or from new suppliers, especially when the material in question is abnormally cheap.
7. The Committee recommends that all materials, purchased by farmers for animal feeding, should come from sources and suppliers who can demonstrate compliance with recognised quality assurance standards.
8. The Committee notes that the EC Commission's proposals on feed hygiene will introduce the registration of all feed businesses, including producers of feed materials, who would be required to apply Hazard Analysis and Critical Control Point principles. The Committee supports this development.
9. The Committee encourages farmers selling manufactured feed to be independently assessed for compliance with an appropriate assurance scheme.
10. The Committee recommends that farmers responsible for organizing their own road haulage comply with the code of practice for road haulage, which will provide them with a level of independent assurance.
11. The Committee recommends that farmers keep clear records enabling traceability of all purchased feed materials, additives or compound feeds used and fed on-farm.
12. The Committee recommends that everyone involved in on-farm feeding should be able to demonstrate their competence, having appropriate skills to match the scale, risks and complexity of the feed operation.

ANNEX 2: RECOMMENDATIONS ARISING FROM ACAF REVIEW OF FEED LAW ENFORCEMENT

1. The committee recommends that the current responsibilities for feed law enforcement in the UK should continue with significant modifications made to processes and procedures to ensure the necessary improvements to feed law enforcement.
2. The committee recommends that enforcement authorities adopt a proportionate risk-based approach to the enforcement of feed law.

3. The committee recommends that risk-based schemes for feed law enforcement should be extended or introduced to take into account risks from hazards such as contaminants, unauthorised additives and feeds from unverified sources.
4. The committee recommends that there should be a greater sharing of information and co-operation between official enforcement authorities and assurance scheme auditors.
5. The committee recommends that there should be greater co-ordination between enforcement authorities.
6. The committee recommends that further co-ordination of feed law activities is required and considers that the Food Standards Agency is well placed to take on this role.
7. The committee recommends the compilation of a central database of feed businesses available to all enforcement agencies. The Committee further recommends that all relevant information should be considered for inclusion in a central database to help establish enforcement priorities.
8. The committee recommends that animal feed imports should be part of a risk-based enforcement programme. The Committee further recommends the introduction of a statutory requirement for the prior notification of imports of animal feed.
9. The committee recommends that local authorities should make better use of existing funds by targeting higher risk areas. The Committee further recommends that if funds for new work become available, the Food Standards Agency and other government departments should consider providing such funds direct to the appropriate enforcement agencies.
10. The committee recommends the introduction of codes of practice for all areas of feed law enforcement.
11. The committee recommends that the codes of practice that apply to local authorities should be included within the scope of the Food Standards Agency's Framework Agreement with local authorities.
12. The committee recommends that compliance with the codes of practice should be audited by the Food Standards Agency under the terms of the Framework Agreement.