The use of Animal By-products

The improving opportunities to add value to the beef and sheep slaughtering sectors.

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The report outlines the historical destinations for animal by-products and the progress that has been made in moving more of the product into the higher value markets for human consumption. Since the export market opened in 2006 there has been increasing opportunity to keep product in the human food chain rather than down-grading the product for petfood or rendering.

GLOSSARY, DEFINITIONS AND ABBREVIATIONS

ABP Animal By Products

BSE Bovine Spongiform Encephalopathies

bTB Bovine Tuberculosis

Cat 1 Category 1 Material

Cat 2 Category 2 Material

Cat 3 Category 3 Material

CJD Creutzfeldt–Jakob disease is a degenerative neurological disorder that is incurable and invariably fatal.

Carcase means the body of an animal after slaughter and dressing.

CW carcase weight for the purposes of this report the carcase weight is assumed to be 318kg. The carcase weight is the dressed weight of an animal ie the weight on which a farmer gets paid. It includes carcase meat, bones and an acceptable amount of fat.

Casings: Runners which have been processed to remove all the layers of the intestines apart from the sub-mucosa.

Salted casings: Casings which have been covered and rubbed in salt. Or have been counted combined into skeins of 50 and put into barrels of salted water.

Iced casings: some companies collect casings, in bundles of 50 and store them in ice rather than salt.

DBES The export of beef animals and beef products was banned in 1996. This ban was enforced for 10 years. In 1999 the Date based export scheme was introduced which eased the export ban by allowing exports of boneless British beef from animals aged between six and 30 months . Live animals were still banned from export. In 2006 the U.K. was once again able to export live cattle born after 1996, to ensure no export cattle could be part of the generation that could have had MBM feed

DEFRA the Department of Farming and Rural Affairs

DSM Desinewed Meat. Up until May 2012 DSM was not recognised as MSM but as a different product which was recovered from bones using the Baader process. A Baader machine is a machine which uses low pressure to remove meat from bones. The process does not break the bones down nor add haemoglobin to the meat. Up until May 2012 the meat was called desinewed meat and could be used in the percentage of meat on the product label; Due to the redefinition all desinewed meat is now reclassified as MSM and bovine and ovine product is classified as Cat 3 and cannot go for human consumption

DW dead weight see CW below

ECP Edible Co products, also known as green offal. Products that require further processing before they become safe and palatable for human consumption e.g. Stomach, small intestine, large intestine, mesentery, omental fat, hides, hooves

EFPRA European Fat Processing and Renderers Association represents the European animal by-product processing sector

EU European Union

FABRA is Foodchain and Biomass Renewables Association . FABRA is one of two the U.K. rendering associations

FBO Food Business Operator

FFHC Fit for human consumption. Products that are suitable fo human consumption and should stay in the food chain.

FSA Food Standards Agency

Greaves is the protein-containing residue of rendering edible fats after partial separation of fat and water.

HMRC Her Majesties Revenue and Customs

KKCF Kidney, knob and Channel Fat

Lights is another word for lungs

LW Live weight is the weight of an animal before slaughter. For the purposes of this report the assumption is that the average live weight was 600kg in 2006, while it has risen to 632kg in 2012.

MBM Meat and Bone Meal derived from rendering Cat 1 material

Meat means edible parts of the animals, including blood. Although meat includes offals and MSM, hooves and cheek meat "carcase meat" does not. This report is not addressing carcase meat.

MLC is the Meat and Livestock Commission; predecessor to EBLEX and the AHDB

MSM Mechanically Separated Meat means the product obtained by removing meat from flesh bearing bones after boning or from poultry carcases, using mechanical means resulting in the loss or modification of the muscle fibre structure. MSM from ovine and bovine bones is classified as category 3 material. Product from poultry and pork bones is allowed to ener the human food chain but must be declared as MSM on the ingredients labels.

MRM Mechanically Recovered Meat same as above

NESOI Not elsewhere specified or included

'Offal' means fresh meat other than that of the carcase, including viscera and blood. It can be split into red and green offal

> Red offal: Red offals are non carcase parts of the animal which can be sold directly to the consumer without further processing although cooking is of course required. They are all harvested in the abattoir rather that in the cutting plant e.g. lungs, liver, heart, kidneys, trachea, oesophagus, spleen and pancreas

O1Y Over one year old - for sheep. A sheep is defined as an ovine animal that is over one year old or has one or more permanent incisors broken through the gum. A sheep has to have the carcase split.

Oleo chem Oleochemicals are chemicals derived from plant and animal fats. The most common application of oleochemicals is biodiesel production, detergents, many personal care products, production of lubricants, green solvents, and bioplastics.

OTM over thirty month The OTM Rule bans meat from most cattle aged over 30 months at slaughter from being sold for human consumption the carcases had to be rendered and destroyed as part of the scheme. This was to remove older animals which were more likely to have developed a significant amount of BSE agent in any tissue, from the human food chain. It applied equally to home-produced and imported meat.

OTM Over thirty months

OTMS: Over thirty month scheme. Since 7 November 2005, meat from OTM cattle born after the 1st August 1996 could be sold for human consumption, within the UK, provided that the OTM animal was slaughtered at an abattoir which has been approved to slaughter OTM bovines by the Meat Hygiene Service. Every OTM animal underwent a BSE test of the brain stem sample which was removed and sent to a laboratory.

OV Official veterinarian

PAP Processed Animal Protein derived from Cat 3 rendered material is the protein-containing residue of rendering, after partial separation of fat and water.

PFMA the Pet Food Manufacturers Association

Pluck The pluck is the collective name for the heart, lungs and trachea

Rendering entails crushing carcases and animal by-products into particles of a uniform size, heating the particles and then separating out the fat, proteinaceous material and water into, where possible, useful products including processed animal proteins PAP (cat 3) meat and bone meal MBM (Cat 1) and tallow (CAST, 2008a; Kalbasi-Ashtari et al., 2008; Woodgate and van der Veen, 2004). In the EU, mammalian meat and bone meal must now be land-filled, incinerated/co-incinerated or used as a fuel source (Anon, 2002); Tallow from rendering Cat 3 (no Cat 1) material can be used in, amongst other things, soaps, washing powders, as lipids in the chemical industry and cosmetics (Kalbasi-Ashtari et al., 2008; NABC, 2004). Tallow from Cat 1 and Cat 3 may also be burnt for energy production and due to its high fat content a considerable amount of energy may

be recovered which would otherwise be lost; thus reducing the net environmental footprint of the process (Woodgate and van der Veen, 2004). As with incineration, rendering has a high energy demand but if tallow is recovered for subsequent energy production then the net GHG emissions are likely to be low.

Runner: Intestine which has been separated from stomachs and mesentery and pulled out with removal of intestinal contents.

SRM Specified Risk Material

TSE Transmissible Spongiform Encephalopathies

U.K. The United Kingdom of Great Britain and northern Ireland. EnglaND, Scotland, Wales and Northern Ireland

UTM Under thirty months

vCJD is believed to originate consuming BSE material that infects humans, the resulting disease is known as (new) variant CJD (nvCJD).

'Viscera' means the organs of the thoracic, abdominal and pelvic cavities, as well as the trachea and oesophagus and, in birds, the crop.

Rendering entails crushing carcases and animal by-products into particles of a uniform size, heating the particles and then separating out the fat, proteinaceous material and water into, where possible, useful products including greaves (edible material) processed animal proteins PAP (cat 3) meat and bone meal MBM (cat 1) and tallow (CAST, 2008a; Kalbasi-Ashtari et al., 2008; Woodgate and van der Veen, 2004). In the EU, mammalian meat and bone meal must now be land-filled, incinerated/co-incinerated or used as a fuel source (Anon, 2002); Tallow from rendering cat 3 (no cat 1) material can be used in, amongst other things, soaps, washing powders, as lipids in the chemical industry and cosmetics (Kalbasi-Ashtari et al., 2008; NABC, 2004). Tallow from cat 1 and cat 3 may also be burnt for energy production and due to its high fat content a considerable amount of energy may be recovered which would otherwise be lost; thus reducing the net environmental footprint of the process (Woodgate and van der Veen, 2004). As with incineration, rendering has a high energy demand but if tallow is recovered for subsequent energy production then the net GHG emissions are likely to be low.

EXECUTIVE SUMMARY

An investigation of English cattle and sheep slaughtering and processing sectors has shown that in 2011/2012 the proportion of a beast being harvested and packed for human consumption, as an estimation of live-weight, increased by approximately 10%. The average percentage by weight of a live beast that is being consumed by humans has increased from approximately 38% in 2006 to 48% in 2012 with some plants sending as much as 59% to human edible. During the same period, the average percentage of a sheep or lamb being consumed improved from 46% to 53% of the live weight of an animal.

In the past four years the markets have changed significantly, due to the new Animal By-Product (ABP) regulations (see Appendix 2) and improved export opportunities. An increase in consumption of 5th quarter products i.e. red offals and edible co-products (ECP), soft bones and tendons as well as the opportunities to use the ABP for pet-food, fertilizer and energy generation is financially and environmentally benefitting the meat industry. The larger abattoirs sell the majority of their fifth quarter products either directly to the home market or vacuum packed and/or frozen to the export market rather than disposing of these products for rendering or pet food.

In the previous carbon footprint work[1] most of the non-carcase meat and few of these non-meat products including offal, rumen contents, hides, edible co products, fat and bone were included in the calculation. Even when the tallow is used to produce energy, the meat received no offset credit from the energy generated. In 2012 an estimated extra 10% of the live weight of a bovine animal is being consumed when compared with 2008. This has the effect of reducing the carbon footprint by over one quarter (26%).

In 2006[2], a review of red meat offal and by-products could not collect information on the weight of ABP going as Category 1 (Cat 1) or Category 3 (Cat 3). However, the prices published for ABP collection were the same for Cat 1 and Cat 3 ABP. Visits to several large and small abattoirs confirmed the anecdotes that most FBO's combined material suitable for petfood or Cat 3 material with Cat 1 material and sent all of it to be rendered as a Cat 1 ABP. Approximately 2% of the best fat was been collected as fat fit for human consumption (FFHC). Some product was also going as petfood although there are no accurate estimates. It was thought that tripe, thin and thick skirt and even flanks in some cases tended to be sent to petfood manufacturers. Although UK sourced product for pet food was low in price, the petfood manufacturers wanted the flexibility to export product, and up until 2006, due to the export ban this was not possible with U.K. meat. Since 2006, the percentage of product being sent as Cat 3 ABP has increased to approximately 20% for cattle and sheep including fat for bio-fuel and product going for wet or dry petfood, pharmaceuticals, fashion, automotive, energy, cement production, building materials, oleochem e.g. soaps, lipsticks, bio-fuels and pharmaceuticals etc. rather than being rendered as a Cat 1 ABP.

The industry has also benefited by a reduction in percentage of the weight of material from live cattle classified as specified risk material (SRM). It has reduced by 6 percentage points from 16.4% to 10.5%. This could be a further 50% lower if abattoirs empty the cattle intestines. The percentage of the weight of material that is SRM from ovine live animals is less than 1 % for lambs or 6.5% for

[1] EBLEX Change in the air: The English beef and sheep production roadmap – Phase 1
Benchmarks the industry's environmental impact in terms of greenhouse gases (GHGs) and energy use, and outlines how this can be reduced (published November 2009).

[2] A Review Of The Red Meat Offal & By-Products Industry Conducted For The English Beef & Lamb Executive (EBLEX) By MLC Industry Consulting March 2006

ewes and rams. The amount of ABP going to Cat 1 which used to mean complete destruction with little carbon benefits has been conservatively calculated to have reduced by 6% percentile points from 19[3]% to 13% of the carcase weight. Rendering ABPs as Cat 1 required a certain amount of energy however the process was sustainable with the production of tallow, however the resulting meat and bone meal (MBM) had no suitable markets and much of it went to landfill. Recently the by-products from Cat 1 rendering tend to go as a biofuel displacing coal and petro carbons which has additional benefits due to the consequential decreases in their carbon footprint.

It was stated that current fluctuating economics are such that still a minority of the large companies and many of the medium and smaller abattoirs will send (for a positive financial benefit) much of the green offal (tripes and hooves) and sheep heads as well as some red offals to pet-food or the renderers rather than selling it for human consumption. This should be the focus of further assistance to increase efficiencies and further improve yield to reduce the industry's carbon footprint.

As part of the research the author was given the full co-operation of the English beef and sheep slaughtering sector. Thanks go to the many abattoirs that provided confidential information to enable a detailed analysis of the supply chain for 5th quarter material.

[3] This is believed to be a conservative estimate as some experts estimated that up to 25% of the bovine live weight was rendered in 2006.

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1. BACKGROUND TO THIS STUDY

This study was commissioned by EBLEX in order to gain a greater understanding of the current situation regarding the harvesting and collection of sheep and beef 5th quarter products, including bones, hides and skins, offal, edible co-products and animal by-products from slaughtering only. In addition the uses of offals and ABP as identified in various historical reports, (listed in Appendix 1), have been updated to reflect the current economic situation and export opportunities. In this report the supply chains for any beef or sheep product that is outside the definition of carcase meat have been reviewed. The Food Standards Agency's (FSA) definition of edible products (meat) does include red offals and blood; however, for the purpose of this report these products are not considered as carcase meat and are therefore included in this review. Fifth quarter products tend to go through alternative supply chains than those of carcase meat.

During the research and writing of this report (in May 2012) the EU altered the classification of desinewed meat DSM which has considerably increased the amount of meat product that cannot currently enter the human food chain.

Information on the value of offal and by-products or the costs of disposal (for those items with no commercial value) has been updated by obtaining additional economic and costing data

The report was compiled using a combination of desk based literature and data reviews, interviews and extended discussions with processors and third parties, including renderers, hide and skin companies and offal consolidators.

1.1. OBJECTIVES

The report will provide the following

1. An overview of the current position for beef and lamb as regards the income and costs involved with the sale and disposal of by-products from the slaughtering industry in England.
2. The flow of ruminant products (starting from a complete carcase breakdown) for different types and sizes of companies going into
    a. A variety of edible products for human consumption either domestically or overseas
    b. The range of products that use ruminant ABPs as their raw material
3. An estimation of the amount of products produced in England (extrapolating information from company interview to detail the quantities from small and medium sized companies
4. An outline of the obstacles (economic, manpower, space constraints, facility investment needs, etc) that prevent abattoirs harvesting more of their 5th quarter products
5. Identify industry recommendations and priorities with regard to strategy, technical and market development for delivering more opportunities to add value and/or reduce disposal costs through developing new products and markets and the adoption of innovative and more efficient treatment and disposal methods.

The findings will enable carbon footprinting activity to be updated with the most recent information.

2. BACKGROUND

2.1. THE SITUATION PRE 1996

Pre 1996, the meat industry often referred to the offals and by-products from slaughtered animals as the 'fifth quarter'. These products traditionally provided the operating profit for the slaughterhouse after the carcase quarters had been sold (often at little profit). The rendered by-products were considered a valuable resource used to generate new products and functional ingredients. Before the Transmissible Spongiform Encephalopathies (TSE) Regulations were introduced in 1996, most of the rendered product would be sold as valuable protein ingredients for animal feeds and tallow. This meant that renderers paid abattoirs for their by-products. When the Bovine Spongiform Encephalopathies (BSE)/ (TSE) regulations came into force, it covered the nomenclature of by-products and their treatment and disposal. For example the heads, spleen and intestines of cattle under thirty month (UTM) were reclassified as SRM and banned from use in all animal feeds. All over thirty month (OTM) carcases including all offal were also classified as SRM and had to be rendered and destroyed as Cat 1 as part of the over thirty month scheme (OTMS) and were banned from entering the human food chain. **The export of all bovine meat was also banned**.

2.2. A SUMMARY OF THE CATTLE SITUATION 1996- 2006

During these ten years there was little financial pressure to improve the under-utilization and profitability of the by-products markets from the rendering processes because

- EU regulations made it difficult to market much of this material eg. Regulation 1774 prohibited the use of tallow as a fuel alternative;
- Renderers were being paid by the abattoirs to remove the ABP therefore practically guaranteed a profit.
- No real competition for different ABP markets

Table 2.1 shows the £ per tonne in October 2005 before the export ban was lifted. These costs are representative of the period and also show the small cost differentials between Category 1 (Cat 1) (**labelled SRM**) in the table and Category 3 (Cat 3) (**labelled Bones and Offal**) costs of removal which explains why many abattoirs especially the small and medium combined Cat 1 and Cat 3 ABP.

Table 2.1 : £ per Tonne Collection Charges: October – December 2005 (published January 2006)

Material Type	£ Per tonne	
	10 to 50 tonnes per week	Over 50 tonnes per week
Best fat	10.00 (7.00)	59.00 (60.00)
Other fat	- 4.00 (-8.00)	10.00 (7.00)
Bones	- 84.00 (92.00)	- 64.00 (70.00)
Offal	- 85.00 (92.00)	- 56.00 (62.00)
SRM	- 82.00 (90.00)	- 55.00 (62.00)

Source: A Review Of The Red Meat Offal & By-Products Industry (by Industry Consulting 2006 (reprinted from Meat Trades Journal) This is for a three month average from Oct to Dec 2005 and published in Jan 2006.

2.2.1. Review of Red Meat, Offal and By-Products Industry

A review of the red meat industry carried out by Industry Consulting (IC) for EBLEX of the English situation in 2005 gives good insights to the industry. In 2006 several abattoirs were also visited by the author to understand the state of the industry. The following summarises the key findings

- Many of the abattoirs were paying the same for collection of Cat 1 waste as they were paying for (Cat 3). Many small and medium (SME) slaughterhouses saw no benefit in splitting their ABP and consigned lungs, spleen, head minus tongues, bible, reed, oesophagus, trachea, aorta, and hooves into the Cat 1 bin. The consequence was that many abattoirs lost the skills and contacts necessary to harvest and sell the fifth quarter.
- In 2006, there were no markets for the ash generated from the process of rendering Cat 1 material. It had to be landfilled at a cost to the renderer.
- The Cat 3 meals and fats tended to go for pet foods and biofuels (there was an issue with the regulations as tallow was not legislated to be used as a fuel although many of the renderers used it to power their own plants).
- There was a small financial incentive to split the fat between the “best fat bin” fit for human consumption (FFHC) and the “Cat 3” (labelled other fat in table 1) for the large abattoirs. Best fat was being traded for approximately £50-£60 per tonne while Cat 3 fat only realised a small amount £5 - £10 per tonne. Often the SME abattoirs felt they were not receiving sufficient a premium for “best fat ” bins which were required to be maintained in the chill chain and seldom received a payment for Cat 3 fat. However the renderers commented that in some cases the state of the “fat only” or edible fats were too contaminated to pay a premium.
- Without the export market, there was little demand for certain cuts eg flanks, red offal such as liver and kidneys and no market for cheek meat, tripes and hooves. Less than 50 % red offal was going for human consumption which benefitted some pet-food manufacturers. In fact, only about 38% of the live carcase weight (mainly carcase meat, some fats and offals) was sold as edible. This meant that approximately 45% animal live weight was rendered or went as petfood and not used as a human food. A few plants were harvesting fats, livers, kidneys, tripes, hides for collagen etc. for human consumption
- Many companies were harvesting the tongue for human consumption but putting the rest of the head in the Cat 1 bins. Of the abattoirs visited in 2006, not one was harvesting cattle cheek meat, lips and snouts.
- None of the abattoirs, visited in 2006, were processing cattle stomach as tripes, however there were several companies e.g. Heys & Sons, Scraggs, Fishers and Harder Bros that bought for a nominal amount or took free of charge the green tripes and sheep casings which were further processed for human consumption.
- Only a small number of hides were processed to harvest collagen, e.g. Scotch Tanning Industry STI and Devro.

The IC report in 2006 outlined the main and best case disposal channels for the carcase which have been transcribe into Table 2.2 below.

Table 2.2 – Outline of best case scenario in 2006.

Disposal Channel	Cattle 2006 Kg/Head (carcase wt 318kgs) (A)	Cattle 2006 % of liveweight	Sheep 2006 Kg/Head (carcase wt 350kgs)	Sheep 2006 % of liveweight
Carcase Lean	192.54	32%	11.7	28%
Carcase fats	65.76	11%	4.67 (Intestinal, KKFC, & caul fat) 1.99	11%
Abattoir fats	30.21	5%		5%
ECP (tripes, hooves etc)	9.28	2%	Intestines only 1.31 (No tail or tongue)	3%
Offals (heart, tails, kidneys, liver, tongue etc)	17.36	3%	1.09	3%
Edible Human *	**315.15**	**53%**	**20.81**	**49%**
Petfood	4.91	1%	1.3	3%
Cat 3 **	64.46	11%	8.39	20%
Cat 1 SRM *65.40*	*98.52*	*16%*	*1.92*	*4%*
Hide and Skin	42.49	7%	4.66	11%
Gut Content (-15kg intestinal fill)	74.45	12%	5.11	12%
Total Live Weight	599.98	100%	42.14	100%

See appendix 3 for the origin of 2006 figures

The above table was a suggested best case scenario without the blood weight reduction

(A) 318kg is an estimate of the average dressed carcase weight. It includes fat and bones and meat. It does not include offals and ECP.

Cattle SRM** Was 98.53 Inc. unfiltered blood, (20.13), and intestinal gut fill (15.0)

The Cat 3 weight of 64.46kg included weight of bible and reed to Cat 3

The edible human included all the edible co products and offals

A more accurate picture of the practices in 2006 and the destination for the by-products is shown in table 2.3 below. This is derived from a study by the RMIF in 2006

Table 2.3 Outline of best estimate of what was happening in 2006

Disposal Channel	Cattle 2006 Kg/Head (carcase wt 318kgs)	Cattle 2006 % of liveweight	Sheep 2006 Kg/Head (carcase wt 350kgs)	Sheep 2006 % of liveweight
Carcase Lean	**192.54***	32%	11.7	28%
Carcase fats (Approx 50% rendered ** ; 50% FFHC)	65.76 (**32.88***)	11%	4.67 (Cat 3 except KKFC)	11%
Abattoir fats (Cat 3) **	30.21	5%	0.68	2%
ECP (tripes, hooves etc) # ***	9.28	2%	1.31	3%
Offals (heart, tails, kidneys, liver, tongue etc)* ~	17.36 (**4.97***)	3%	1.09	3%
Edible Human * Estimate based on interviews	**230.39***	**38%**	**19.5**	**46%**
Petfood ~	23.16	4%	1.3	3%
Cat 3 ** (Could go in the Cat 1 bin too)	125.94	21%	6.95	16%
Weight of Cat 1 product ***	109.55	18%	4.62	11%
Actual SRM	*62.67*	*10%*	*1.92*	*4%*
Hide and Skin	42.49	7%	4.66	11%

Gut Content	68.45	11%	5.11	12%
Total Live Weight	599.98	100%	42.14	100%

BEEF
~Pet food includes rumen, reticulum and offals
*Edible wt of 230.39 = 192.54+32.88+ 4.97 includes some intermuscular fat but most fat and offals were disposed of as Cat 3, pet food or as Cat 1
**Cat 3 includes abattoir fats and some intramuscular fats
*** Cat 1 includes SRM and intestinal contents of 15kg, bible and reed and 6kg of fill, 20.13 kg blood
SHEEP
**Cat 3 includes abattoir and gutroom fats
***Cat 1 includes sheep heads, blood, ileum and spleen

2.3. A SUMMARY OF THE SHEEP SITUATION 1996-2006

The TSE regulation listed ovine animal by-products and their treatments due to scrapie.

- Lamb meat (under 1 yr)was still allowed to be exported
- During this time there was some demand for the lamb offals and nearer to 46% of the animal live weight was going for human consumption, including liver and kidneys. There was still over supply which meant that some abattoirs consigned this product to the renderers or pet food collections.
- All green offal, heads (although only heads of sheep older than 1 year were classified as SRM), feet and a small percentage of red offal tended to go in the Cat 1 bin.
- Surprisingly, because of the slump in the fleece and runners market, at certain times during this period these products were disposed as Cat 1, especially from the smaller abattoirs.

2.4. A SUMMARY OF THE INDUSTRY 2006 - 2009

In November 2005, a comprehensive BSE testing scheme was introduced for cattle born after 1st August 1996. This is referred to as the Over Thirty month Schemes (OTMS). This meant only those animals testing positive for BSE along with adjacent carcases on the line had to be rendered and destroyed, with those testing negatively being permitted into the food chain, albeit subject to SRM controls. All animals born before 1st August 1996 remained permanently excluded from all food chains.

In 2006, the Date Based Export Scheme (DBES) was revoked and the U.K. was able to restart beef exports to the EU and a few other countries. It was apparent that many of the abattoirs were slow to engage in the 5th quarter side of the business preferring to concentrate on carcase meat.

Since then, the export market has been undergoing accelerated development with more countries accepting our product being added to the list. Progress was slow and even up to late 2008/2009 English bovine slaughterhouses and meat processing plants still generated significant amounts of ABP. In 2006 the average percentage of live weight recovered as human edible was 38% although, the percentages ranged from 34% to 43%. Since 2008 a slow but accelerating transformation has been underway with the large and many medium sized slaughter houses. Some of the changes observed are listed below:

- In 2009, meat companies paid the renderers between £80 and £120 per tonne plus transport costs to remove and treat product that could have been fit for human consumption.
- The large retailer facing plants started to invest in facilities (processing rooms, tripe and hoof washing equipment and staff) to enable them recover, process and pack more of the product for human consumption that used to go for petfood, Cat 3 or Cat 1 rendering.
- In turn this reduced the amount of tripes being sold by the large abattoirs to pet food companies allowing the medium and small abattoirs to move into this market.
- Because more of the animal was either being consumed by humans or going for pet food, there was a shortage of raw material going for rendering, causing competition. The renderers dropped their prices to make it less financially beneficial for the abattoir to process ABP
- There was spare capacity in the rendering industry

3. FIFTH QUARTER

Fifth quarter is a catch all term for non-carcase meat. It includes all products harvested from the carcase in the abattoir such as:

- offals, eg liver, kidneys, heart, tongue etc as well as heads, cheek meat, skirt, tail
- edible co-products (ECP), eg fat, hooves, stomachs/tripe, intestinal runners/sausage casings
- animal by-products (ABP) which can include and intestinal contents and hide.

It can also include some products harvested in either the abattoir or cutting plant such as tendons, bones, paddywack, membranes etc. Historically, it was the 5th quarter that derived an abattoir's profit. The sale of carcase meat paid for the running of the abattoir including wages, overheads and utility costs, but the exploitation and sales of the 5th quarter determined the profitability of the business.

After slaughter there are three main categories of products derived from all animals

1. Edible products (meat)

2. ECP- parts of animals that are unsuitable for human consumption when they are produced at the slaughterhouse, but which can later be processed into human food

3. ABP - parts of an animal that are not intended for human consumption. The ABP regulations classify products in three categories as shown in the table below.

The table below describes simply the way the carcase products can be broken down and lists some key examples of each ABP and as what it should be classified.

Table 3.1 List of products fit for human consumption (FFHC) and ABP

Edible products (meat)	**Edible Co-products**	**Animal By-products**		
Examples	**Examples**	**Examples**		
		Category 3	**Category 2**	**Category 1**
• Wholesale and retail meat • Carcase material used for meat recovery (eg MSM from pigs and poultry only) • Blood, offals, cheek meat, bones used to make edible products • Paddywacks, tendons and membranes	• Raw fatty tissues for edible fat and greaves ('rendered animal fats and greaves') • Raw fit bones and hide splits for edible gelatine and collagen • Sheep or pig intestines used for edible casings or mucosa production • Stomachs and hooves processed into tripes and beef heels	• Parts of an animal slaughtered and found fit but not intended for human consumption • Product going for pet food • Blood • MSM and DSM from ruminants • Floor waste in "clean plants" e.g.boning halls and cutting plants	• Whole bodies of ruminants, pigs or poultry • Dead on arrival DOA • Post mortem failures e.g TB positive reactors carcase and by-products • Soiled or contain medicine residues • Rumen contents and manure • Floor waste from abattoirs • Sludges from drain traps in non-ruminant plants	• TSE positives • SRM (see below) • Sludges from drain traps in ruminant slaughterhouses • Bodies of wild game animals with zoonoses
Downgrading >>>>>>>>>>> one way only >>>>>>>>>>>>				

3.1. ANIMAL BY-PRODUCTS

On 22 May 2001, regulation (EC) No 999/2001 was implemented which laid down rules for the prevention, control and eradication of certain TSE's. The regulation defined ABP and the means of treatment and disposal. It also prohibited the feeding of processed animal protein (PAP), gelatine of ruminant origin, blood products, hydrolysed protein, dicalcium and tricalcium phosphates of animal origin and feed containing such protein to farm animals (ruminants, pigs, poultry and fish) with the exception of carnivorous fur-producing animals.

Since 2001, as a result of a reduced risk, the ABP regulations have been revised to decrease the amount of product classified as SRM and improve the market opportunities for the rendered by products. In 2013, the regulations were further amended to allow poultry and porcine PAP to be fed to fish for aqua culture from 2014, subject to a valid testing regime. There is also further discussion to allow the feeding of pigs with poultry PAP and vice versa.

3.1.2. SPECIFIED RISK MATERIAL

SRM comprises those tissues of ruminant animals (cattle, bison, buffalo, sheep and goats), that are considered most likely to contain the BSE causing prions. Under EU regulations, SRM is classified as ABP Cat 1 and must be removed as soon as possible from the both the human and animal food chains and destroyed.

Sheep and goats are included in SRM controls as a precautionary risk reduction measure as sheep may also have received feed containing ruminant derived material. Whilst BSE has not been found to occur naturally in sheep or goats; it has been confirmed that sheep can be infected with BSE under clinical trial conditions in the laboratory. Sheep and goats are known to contract Scrapie which is another type of TSE, although this is not considered transmissible to humans.

Since the original introduction of the TSE regulations, the number of BSE cases detected in Europe has gradually declined. To date, there have been three revisions to the legislation which have reduced the number of ruminant products classified as SRM. This has reduced the weight of product that has to be classified as Cat 1 and rendered, and then incinerated or landfilled. The ability to improve the economic value of the rendered product was changed in the 2009 revision. The industry is now allowed to use Cat 1 rendered material as a biodiesel. Table 3.2 shows the reduction of weights of SRM product that needs to be dispatched as Cat1.

Table 3.2 Raw material for rendering and SRM in 1998 and 2012– per species UK

	SRM – as defined by legislation 1998		SRM - as defined by legislation 2012 Cattle (> 1 yr)	SRM in older animals OTM cattle O1Y sheep
Cattle	45kg (a)	All OTM cattle (600kg)	37.60 kg (b)	55.6 kg (c)
Sheep	1.92kg		0.13 kg (d)	1.9 Kg

(a) Includes spinal cord, head including tonsils but excluding tongue, spleen, thymus intestines and intestinal fat

(b) In 2007 the regulation revisions in relation to bovine animals delisted the spleen and whole heads of animals over 12 month so they were no longer SRM. This enabled the harvesting of head meat and removal of mandible to lighten Cat 1. In 2013 the SRM includes:

- the skull excluding the mandible and including the brain and eyes, and spinal cord of bovine animals aged over 12 months;
- the tonsils, the intestines from the duodenum to the rectum and the mesentery of bovine animals of all ages;

(c) The vertebral column excluding the vertebrae of the tail, the transverse processes of the lumbar and thoracic vertebrae and the wings of the sacrum, but including dorsal root ganglia of bovine animals aged over 30 months (18kg)

(d) In relation to ovine and caprine animals

- In animals aged over 12 months or which have a permanent incisor erupted through the gum: the skull including the brain and eyes, the tonsils and the spinal cord
- All ages: the spleen and ileum

3.2. RENDERING

The animal by-products industry (pet food and rendering) has always had an integral role in the supply chain of meat. However, ABP contain high levels of water and have a biological and microbiological composition which, if not stabilised, can lead to decomposition and environmental pollution, especially odours. The most conventional way of stabilising raw material is to cook or process the raw material with heat to produce protein meal and tallow. This serves to both evaporate the water content and sterilise at the same time; this process is known as “rendering”. Prior to the 1996, the renderer paid the abattoirs a price for collection based on weight and location. The tallow had many markets in the food manufacturing (human and petfood and livestock feeds), soaps and oleo chemical e.g., make-up, fuel alternatives etc. while the protein meals or processed animal proteins (PAP) were used to manufacture the animal or pet feedstuffs and fertilizers. The practice of feeding ruminant by-products back into the ruminant production chain was believed to be the most likely cause of the BSE, which was in turn linked to a new variant strain of CJD (vCJD) in humans.

The belief was that the old rendering process which was controlled differently by different operators did not operate at a high enough temperature or pressure or for a long enough time to destroy the prion responsible for causing BSE. Consequently, EU regulations were introduced to detail the specific process required to treat the different ABP’s. Categories 1, 2 and 3 can only be rendered if the premises are approved for that particular ABP category. The regulations state the material must be rendered by cooking at above 133^{o} C for at least 20 minutes without interruption and at a pressure of at least 3 bars; the heat treatment may be applied as the sole process or as a pre- or post-process sterilisation phase.

After BSE, with the introduction of the ABP regulations and the banning of feeding farmed animals PAP, there was little to no value in these products. The regulations also banned using the fat to produce tallow that could be used in commercially as a biofuel. In 2006, many abattoirs referred to the ABP as a waste and aimed to get the product removed in the cheapest manner possible. The majority of slaughterhouses were harvesting the hides and skins and maybe sheep runners and a small amount of offal; however the rest of their 5th quarter and, in some cases this included red offals, went as either Cat 1 material for rendering/incineration or Cat 3 materials for pet food. The

by-products from rendering Cat 1 material are meat and bone meal MBM and tallow which in 2006 used to be incinerated and disposed in landfill.

4. 5TH QUARTER MARKETS

In the past most 5th quarter product went to the renderers, normally as Cat 1 from the small and medium abattoirs. The larger abattoirs split the waste between Cat 1 and Cat 3. The renderers used to sell the Cat 3 MBM to a few customers however there was a lot of confusion as to whether the tallow could be used as a biofuel. The markets for Cat 1 MBM and tallow were very restrictive with a lot of the Cat 1 being incinerated and the ash going to landfill. Recently there has been a revision of the regulations which have improved the markets for Cat 1 and Cat 3 by products.

Cat 3 products could always go to a anaerobic digester (AD) however it has only been recently that the government has provided some financial support for AD. Table 4.1 subdivides the 5th quarter into the different by-products and details all the main destinations.

Table 4.1 A breakdown of the flow of 5th quarter products going to their final market.

<table>
<tr><td colspan="2"></td><td colspan="8">Ruminant 5th quarter products
Inc. red offal, stomachs, sheep intestines, hooves, fats, hides, rumen, intestinal contents SRM material</td></tr>
<tr><td rowspan="10">Main human edible (low value cuts & offal) for home consumption or export Eg,Tongues, tails, liver , heart, head meat and kidneys</td><td rowspan="2">ECP:- further processing requires to convert into edible products</td><td colspan="2"></td><td colspan="6">ABP</td></tr>
<tr><td colspan="2">Cat 1 & Cat 2</td><td colspan="2"></td><td colspan="4">Cat 3</td></tr>
<tr><td colspan="2">Cat 3 downgraded to Cat1</td><td colspan="2"></td><td colspan="2">Cat 3 chill/frozen</td><td colspan="2">Cat 3 trailers</td></tr>
<tr><td colspan="2">Cat 1 Rendering</td><td rowspan="2">Fresh or frozen petfood</td><td>Hides</td><td colspan="3">Cat 3 Rendering</td><td colspan="2">Heat Treatment</td></tr>
<tr><td>Fat to cooking oils and pharma</td><td>MBM</td><td>FAT</td><td>Leather Tanning</td><td>PAP</td><td>FAT</td><td colspan="2">A D</td></tr>
<tr><td>Export</td><td>Bones to gelatine</td><td>Incineration</td><td>Energy</td><td>Tinned pet food</td><td>fashion,</td><td rowspan="2">Dried petfood meal</td><td></td><td>Methan e</td><td>Digestate</td></tr>
<tr><td>Retail - dressed and packed</td><td>Stomachs to tripe</td><td>Landfill</td><td></td><td>Auto-motive</td><td></td><td>Bio-fuel</td><td rowspan="2">Fertilizer Soil improver</td></tr>
<tr><td>Wholesale / Food service/ catering</td><td>Cattle hides to collagen</td><td>Co-incineration with cement</td><td>Bio fuel</td><td>Dried premium petfood</td><td></td><td>Albumen used in petfood and immuoglobli</td><td>Oleo-chem</td><td></td></tr>
<tr><td>Manufacturing: - Pies, burgers, ready meals</td><td>Intestines to casings</td><td>Biofuel</td><td></td><td></td><td></td><td>Blood meal</td><td>pharma ceutical</td><td></td><td></td></tr>
</table>

Category 2 Manure and stomach contents is not included above. It is allowed to be land spread without the need of any special heat treatment. However no animal is allowed graze on the land for 6 weeks.

4.1. DESTINATION CONSIDERATIONS

The destinations for 5th quarter product are dependent on many business factors:

- size and location of the operation
- type of animals slaughtered
- available space
- business structure, i.e. is part of a larger organisation or an independent company
- access to markets
- staff availability and training and management practices

- there are no Cat 2 rendering facilities available in the U.K. due to market economics

Products such as the trachea, cattle and sheep feet, etc. are not popular human food stuffs on the domestic market; therefore tend to go in the Cat 3 skip. The use of Cat 1 MBM and tallow as fuel alternatives is far more lucrative than using a Cat 2 rendered product as a fertilizer, hence all Cat 2 rendering has ceased.

The increased use of the offals in the human food chain has reduced the amount available for pet food. This has changed the types of raw materials going for pet-food e.g. less tripe and liver, more lungs, cattle spleen and udder.

5. TYPE OF OPERATION

5.1. BREAKDOWN OF THE ENGLISH CATTLE SLAUGHTER INDUSTRY

Table 5.1 groups the abattoirs currently slaughtering cattle in England into five groups. Table 5.2 shows a breakdown of the weight (tonnes) of product estimated to be produced from the different types of abattoir. (For a further breakdown see Appendices 4 to 8) By extrapolating the findings from the sample interviews with various abattoirs undertaken as part of this report, a representative picture can be established.

The group of plants supplying retail outlets, although large, can be split into two types:

- those that harvest as much 5th quarter product as possible and market and sell it using their own group
- those who have good relationships with traders, who may be purchasing product for human edible or pet food companies.

Table 5.1 The five groups of abattoirs slaughtering cattle in England (definitions of groups below)

Cattle slaughter in England	Number of companies	Number of Abattoirs	No of abattoirs interviewed	% of kill	Edible Tonnes of product	% LW sold FFHC
Retail suppliers : best practice	3	5	5	18%	103,292	59%
Retail suppliers: good practice	6	15	6	42%	205,564	51%
Average good practices	4	6	3	14%	68,090	50%
Medium abattoir 1,000-10,000	8	8	1	11%	35,702	34%
Small abattoirs < 1000	115	115	8	15%	49,759	34%
TOTAL	136	166	23	100%	462,406	47%

These groups are defined as

1. Retail suppliers: best practice - make every effort to harvest as much carcase material, offal and ECP, including emptying and processing omasum (bible) for human consumption. They have good management practices to enable them to harvest the fat for human consumption; they also chill their hides to enable the tanneries to trade-on the drop splits to manufacture either collagen or gelatin. However these abattoirs could make further improvements by emptying the intestines of semi digested grass which could reduce the weight of Cat 1 material by an extra 25-35 kg per animal (currently uneconomical).
2. The retail suppliers good practice - tend not to trade hides as FFHC, fat was going as tallow (however with the recent price changes this may have altered), all tripes and hooves were washed and sold FFHC. The intestines and omasum (bible) were being despatched with semi digested grass to Cat 1 bin. Other 5th quarter went as Cat 3

3. Average good practice abattoirs tended to harvest main offals though they tend not harvest tripes, hooves and fats which tend to leave the abattoir as refrigerated Cat 3 product to the fresh pet food companies or to the renderers.
4. Medium abattoirs – are smaller companies that harvest the main offals FFHC. However, most of the products which could be processed as ECP including fats are despatched as Cat 3.
5. Small abattoirs - only 34% of the total live weight is being harvested for human consumption demonstrates the significant advantages in being large scale. Most of their by-products were shipped as Cat 1 as it was not worth the renderers sending separate lorries.

Table 5.2: Breakdown of the weight (tonnes) of product estimated to be produced from the different types of abattoir

Cattle slaughter in England	Tonnes of fat to Cat 3 (pet food or biofuel)	% of carcase	Tonnes of Product to Cat 3	% of Carcase	Tonnes of Product to Cat 1	% of Carcase
Retail supplier : best practice	-	0%	24,945	14%	20,790	12%
Retail suppliers: good practice	12,939	3%	65,276	16%	47,060	12%
Average good practices	3,942	3%	25,129	19%	16,492	12%
Medium abattoirs 1000 – 10000	16,864	16%	16,531	16%	16,397	16%
Small abattoirs < 1000	23,503	16%	9,412	6%	36,481	25%
TOTAL	57,248	6%	141,293	14%	137,219	14%

5.2. BREAKDOWN OF THE ENGLISH SHEEP SLAUGHTER INDUSTRY

The sheep slaughtering sector is less integrated than the cattle sector. In 2011 there were 166 abattoirs registered to slaughter sheep. Of these, 21 abattoirs each slaughtered over 100,000 head per year (6,700,000hd collectively), accounting for 77% of the sheep slaughtered in England. Of these 21 large lamb or mixed abattoirs, only seven are involved with servicing the home market via multiple retailers. Some of these of businesses put a lot of emphasis on complete carcase recovery while others only harvest the red offals. Export lamb tends include the red offals[4] so much of the available offal is exported as part of the carcase. (This might explain why the lamb offal export figures are so low.)

[4] The pluck is the common term for the lungs and trachea (sometimes includes heart)

Abattoirs slaughtering fewer than 100,000 head per annum tend to be the more traditional abattoirs, some of which specialise in slaughtering lambs for the Halal market.

Table 5.3 The five groups of abattoirs slaughtering sheep in England (definitions of groups below)

Sheep slaughter in England	No of companies	% of kill	Sample of abattoirs	Edible product (t)	% live weight
Large good practice	4	12%	1	25,798	59%
Large & Halal independent abattoirs	7	42%	1	79,989	52%
Retailer abattoirs	12	25%	6	43,668	48%
Medium Lamb 10k to100k	45	18%	3	38,929	43%
Small Lamb under 10,000pa	77	3%	2	3,841	41%
TOTAL	**215**	**100%**	**13**	**192,224**	**53%**

Table 5.3 breaks the industry into 5 groups. These groups are defined as:

1. Large good practice - processed and sold as FFHC: lambs' heads, by skinning or dehairing and washing (similar to tripe), lambs' hooves, stomachs, soft bones, membranes. They would also empty the large sheep intestines and put the emptied intestines to Cat 3 rather than sending the full intestine to rendering as Cat 1. Large abattoirs tended not to be linked to retailers.
2. Large and halal independent abattoirs - tended to harvest most of the 5th quarter excluding lamb heads, hooves but including tripes, fat and bones (either exported as a carcase or harvested in the cutting plant)
3. Retailer abattoirs - harvest and export tripes and bones as edible although they were unsure what the butcher, wholesaler or final customer did with the bones and it was assumed that they were discarded or rendered for pet food. They did not harvest heads or hooves.
4. Medium lamb -only recover approximately 43% red offals , eg runners, kidneys and liver
5. Small lamb - would only recover approximately 41% of the live carcase lamb weight. They struggle to harvest any ECP so no runners or tripes but kidneys and livers.

Table 5.4 Breakdown of the weight (tonnes) of product estimated to be produced from the different types of abattoir

Sheep slaughter in England	Fat going for Cat 3 (pet food / biofuel) (t)	% of Carcase	Cat 3	% of Carcase	Cat 1	% of Carcase
Large good practice	-	0%	2,188.01	5%	1,406.58	3%
Large & Halal independent	7,288.36	5%	21,572.08	14%	4,944.37	0%
Retailer abattoirs	5,052.02	6%	10,754.51	12%	4,640.05	0%
Medium Lamb 10k to100k	2,341.71	3%	17,757.94	19%	8,347.75	9%
Small Lamb under	162.83	2%	1,087.03	12%	2,035.43	22%

10,000pa						
TOTAL	**14,844.92**	**4%**	**53,359.58**	**15%**	**21,374**	**4%**

5.3. AN IDEAL SCENARIO

Table 5.5 is an estimate of the ideal situation showing the weights using all product available that could be harvested as FHCC. It uses 2012 carcase weight and a live weight estimate of 632kg for cattle. For the sake of calculations, the assumptions are that the carcase weight has increased however offals, bones and fat weights have remained the same. The two different Cat 1 weights are included for cattle; the higher includes filled intestines (25kg contents) and 20kg blood. The extra 35kg is removed for the lower figure. It also includes a weight for the drop split of the hide going for human consumption. This 4% is included in the ECP as well as all the fats.

Table 5.5 Situation when all products that could be sold as FFHC are harvested for cattle and sheep

Slaughter in England	**Cattle 2012**			**Sheep 2012**		
	1,610,973			**8,690,337**		
Total product	**Kg/Head (carcase wt 350kgs)**	**Tonnes**	**% of live weight 632kg**	**Kg/head (carcase weight 20kgs**	**Tonnes of produced**	**% of live weight 42kg**
Carcase Lean	222	357,636	35%	11.7	101,677	28%
Carcase fats	66	106,324	11%	4.67	40,584	11%
Abattoir fats	32	51,551	5%	2.33	20,248	6%
ECP	44	70,883	7%	2.44	21,204	6%
Offals	20	32,219	3%	7.21	62,657	17%
Edible Human *	**384**	**618,614**	**61%**	**61%**	**28.35**	**67%**
1. Petfood	13	20,943	2%	0.66	5,736	2%
2. Carcase bones	62	91,825	10%			
3. Cat 3 **	82	132,100	13%	3.15	27,375	7%
SRM ***	*79*	*127,300*	*12.5%*	0.21	1,825	0%
4. Actual SRM	43	69,272	7%	0.21	1,825	0%
5. Hide and Skin	23	37,052	4%	4.66	40,497	11%
6. Gut Content	88	141,766	14%	5.11	44,408	12%
Total of 1 to 6	249		39%			
Total Live Weight	632	1,172,788	100%	42.14	366,211	100%

Cat 3 ** includes 20kg blood and 62 kg Bones

SRM*** . In a lot of plants 20kg blood and 15kg intestinal contents also go as cat 1 . In many small abattoirs the full Omasum (bible) and jaw are still going as Cat 1 adding another includes 16kg to the SRM weight.

SRM 43 kg – Weight of head, intestines plus intestinal fat and fill, spinal cord and OTM spinal column

If all the ECP, Offals, petfood, abattoir fats & Cat 3 went as Cat 13 total =400,000 Tonnes in England or 771,540.tonnes for U.K. slaughtering figures

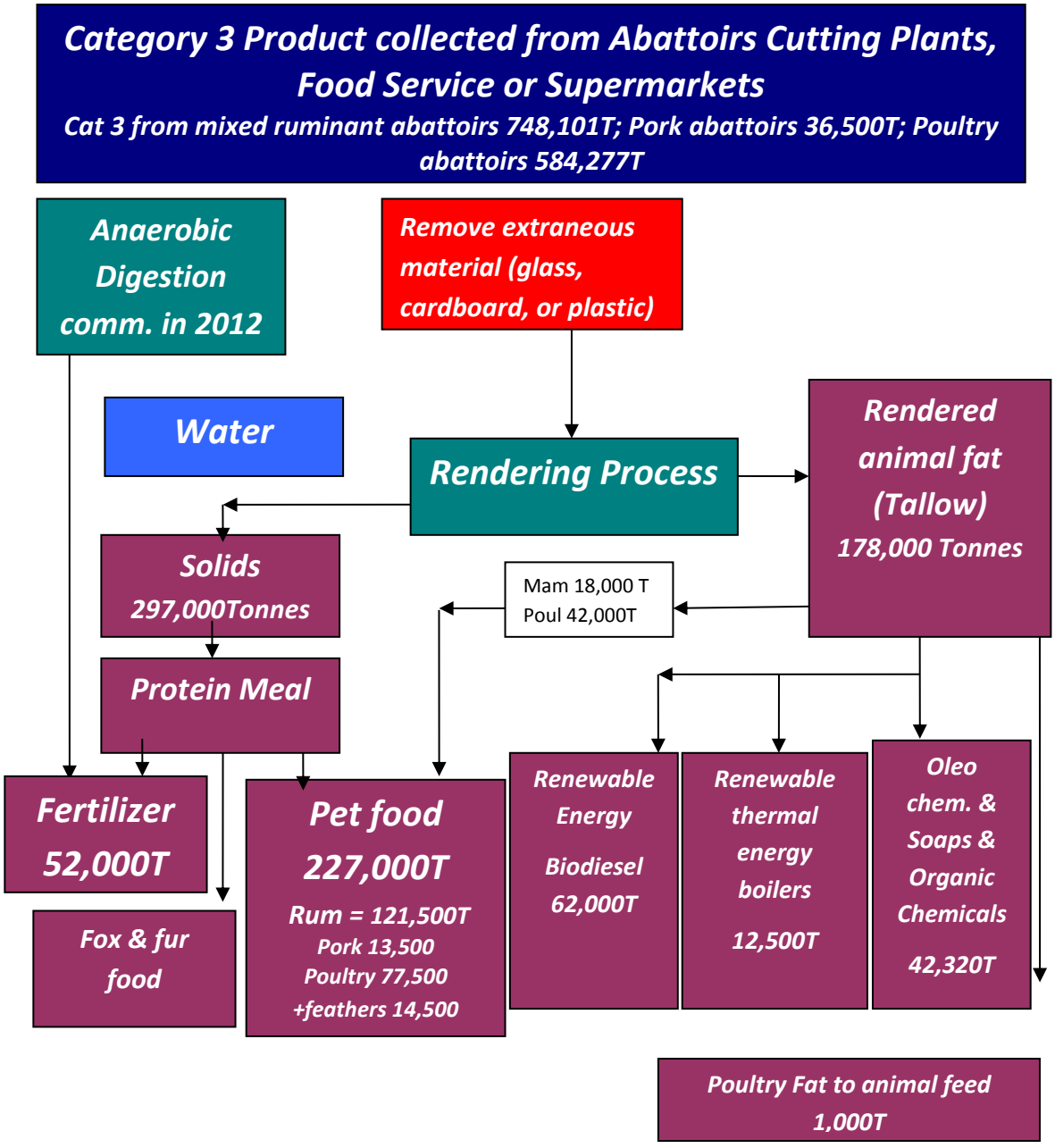
As identified in Table 5.5 currently 61% of a bovine carcase can be eaten. This could be higher if the blood and bones underwent a further process to make them edible. Currently, a few marrow bones are used to manufacture stocks and flavourings. On the continent the larger companies use them to make collagen and gelatine.

6. FIFTH QUARTER DESTINATIONS ACCORDING TO EXTERNAL RECEIPTS

6.1. RETURNS FROM THE U.K. RENDERING INDUSTRY

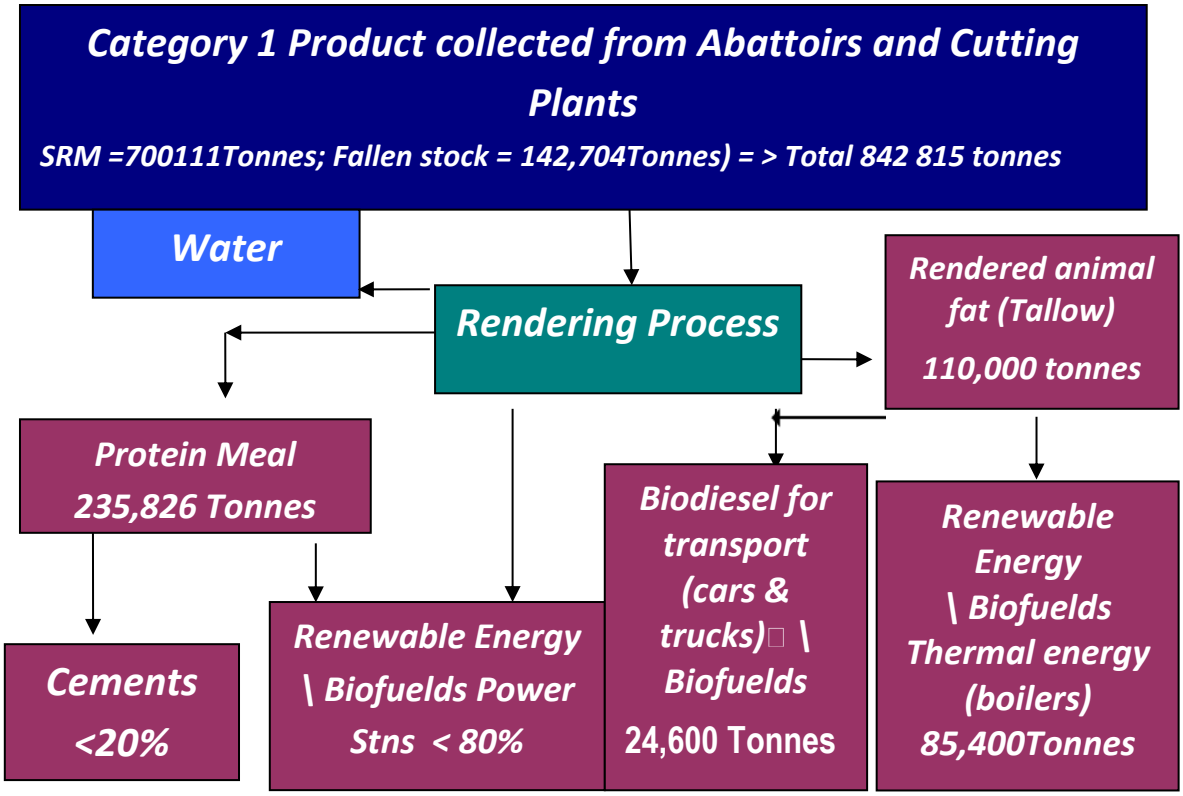
Figures 6.1 and 6.2 summarises the receipts from all rendering sites in the U.K. as declared on their European returns for cat 3 and cat 1 material. The total appears to be high when compared with the production data collected from the abattoirs. Extrapolating the previous data for all the UK abattoirs slaughtering ruminants and were to send all the offals, ECP, petfood and Cat 3, the figure would be 771,500 tonnes.

Diagram 6.1 Flow of Category 3 rendered products for the whole of the UK.



Source FABRA 2012

Diagram 6.2 A breakdown of the flow of products rendered as Cat 1 for the UK



Source FABRA 2012

Since 2006, when approximately 35% of the live weight of a beast was going as Cat 1, the industry has significantly reduced the rendering load. In 2012, the English industry estimated that 158,000 tonnes of SRM (137,000 tonnes bovine or 14% of cattle live weight; 21,000 tonnes ovine or 6% live weight) is being rendered. However, as identified in Fig 6.2, FABRA figures for the U.K. for the same period show 700,000tonnes of SRM is being rendered as Cat 1 (83% of load).

Table 6.1: Calculated estimates of product going for rendering based on abattoir information (t)

TONNES	Cat 1 load	Cat 1 from older animals	Cat 1 from rejections	Cat 3 load	Cat 3 Fat / edible
Sheep	21,000	2,400		53,000	15,000
Cattle	137,000	7,700	85,000 (170,000 X 500kg) **	141,000	57,000
Total	158,000	10,100	85,000	195,000	72,000
Renderers	700000			748,000	
% of render total	22.6%	1.4%		26%	10%

** An estimate based on FSA condemnations. This figure has been sourced from FSA information. The accompanying caveat was that it was believed to be unreliable.

Table 6.1 shows the breakdown of product going for render according to abattoir estimates against those figures declared by the renderers. Cat 1 material sent by the abattoirs forms approximately one quarter (22.6%) of what they declare they receive. Taking into account the 7,700 tonnes of Cat 1 produced from OTM vertebral column and 2,400 tonnes added from the slaughter of sheep over 1 year, this only increases the proportion of Cat 1 against renderers claim to 24%.

Additionally, this figure does not include the 85,000t (12% of Cat 1 load) of slaughter line rejections which are also consigned to Cat 1. (For example animals with bovine Tuberculosis (bTB) and other animals displaying specific diseased organs). Nor does this figure does include Cat 1 from fallen stock which accounts for a further 143,000 tonnes or 20% of the Cat 1 load. Bearing in mind that England slaughter more than half the stock slaughtered in the UK, the Cat 1 still only accounts for approximately 50% of what the renderers say they receive.

6.1.1. Reasons for the discrepancy

Extrapolating data gathered gives an estimate that is significantly lower than that declared by the renderers. The reasons for this large discrepancy are not known however anecdotally the following are potential explanations.

- The renderers may over-declare what they process.
- No known figures for number of carcases condemned and therefore consigned to the Cat 1
- An amount of rain or snow may be included with the Cat 1 product thus increasing the weight
- Abattoirs may overstate the product they harvest for human consumption. Less may be collected than expected due to lack of staff and/or inadequately trained staff.
- More product than estimated is being thrown into the Cat 1 bins in abattoirs because the FBO's are not maintaining tight controls; comparing actuals with estimates would show whether this is the case.
- Some of the abattoirs calculate the weights and quantities of offals being harvested and monitoring actual against estimate. However none of the abattoirs were doing this with the waste.
- Although abattoirs separate Cat 1 and Cat 3 some renderers will make the decision to combine the product because of the need to keep the Cat 1 process plant in operation.
- Anecdotal evidence suggests that most of the ovine and bovine blood that is collected is currently rendered as Cat 1 even though abattoirs state it leaves at Cat 3

6.1.2. Recommendations

R1. Reweigh 5th quarter product to update previous figures. In 1990, MLC used various data sets and some research to establish the average weight of a beef animal, sheep and pig and the weight of all the 5th quarter including bones, offals, blood, hide/skin, stomach contents etc. The industry including breeds, weights and conformation of animals have changed significantly in the last 20 years and updated figures would be beneficial. Other questions which could be answered include weights of bones versus age/conformation, weights of offal versus age/conformation, breed, sex etc. This would also potentially give a better carbon footprint for the U.K. livestock because the weights of animals have increased and the belief is that more meat is harvested per animal. Therefore each beast has approximately the same carbon footprint while growing but delivers more kilos of meat.

R2. Engage with abattoirs who believe that they are harvesting 55%+ of the live animal weight. Compare their weights of the three categories of ABP and pet food versus kill figures

R3. Although there is a certain amount of scepticism of the SRM tonnage declared by the renderers, there is potential to improve the accuracy of these figures. However, it does not hide the fact that there is still too much product going into Cat 1 rendering. We know that this is coming from small and medium sized abattoirs which need further support to reduce these volumes. More work needs to be done to engage, understand and develop solutions for this part of the industry

R4. Investigate the financial losses or the consequential impact on carbon footprint due to the fact that Cat 2 material is being combined with Cat 1

6.2. EXPORTS AND IMPORTS

Many companies now export offal, co-products, soft bones and tendons globally and no longer send these edible products for rendering or pet food. Exports have been encouraged and supported by EBLEX through various activities including product specifications, recipes, working with celebrity chefs and customer introductions - either by introducing potential customers to potential suppliers or invitations to foreign trade shows around the world.

The statistics, compiled by HMRC, show a 200% increase in total offal exports over the last six years to 2011. Calculating the percentage of offals exported compared with abattoir availability shows that it is equivalent to 1.9% of the total weight available or 52% of the basic offal that tends to get harvested for human consumption. Including the "more exotic" offals such as cattle feet, spleens, lungs would mean we are exporting a quarter of the offal available. However, it is known that there are currently only limited outlets for these types of products. The range of products and associated volumes being exported are detailed in Table 6.2.

Table 6.2: UK Export Statistics 2006 – 2011. Source: HMRC

Description	United Kingdom Export Quantity (tonnes) To World						% inc. '06 to '11
	2006	2007	2008	2009	2010	2011	
Fresh/ Ch edible bovine offal	826	2,651	7,373	13,812	17,724	19,354	2242%
Frozen bovine Tongues	22	5	7	74	518	44	96%
Frozen Bovine Livers	356	928	2,295	2,587	2,828	3,999	1023%
Offal Of Bovine Animals, Edible, Nesoi, Frozen	403	828	1,658	4,098	6,975	10,017	2386%
Offal Sheep, Goat, Horse, Ass, Mule/Hinny Edble Fr/Ch	1,447	1,175	1,625	2,383	2,630	2,495	73%
Froz Sheep Goats, Horses, Offal	173	296	663	1,159	1,450	1,112	543%
Fresh Or Chilled Swine Offal	10,519	8,189	15,091	9,846	13,191	14,346	36%
Frozen Livers Of Swine	591	391	574	558	517	1,045	77%
Frozen Swine Offal Exc. Livers	9,716	11,634	12,039	10,430	13,945	19,461	100%
Ed Offal, Bovine, Swine, Sheep,						71,872	199%

Goat, Horse, Etc.	24,054	26,096	41,325	44,948	59,778		

NESOI Not elsewhere specified or included

It is unknown whether these offal figures include variety meats and products derived from the carcase such as soft bone, tendons, membranes, and ligaments eg. paddywack, which are widely exported. DEFRA stated that it varied depending which customer was importing the offal.

The comparison of imports versus exports is interesting. In 2010 the UK became a net exporter of offals. The increasingly positive trend of improving export quantities is good news for the British economy's balance of payments. Comparing the imports and exports also points out further opportunities that potentially exist to satisfy the home market.

It is common knowledge that the export market is hostage to currency fluctuations. Since the lows in 2009 Sterling compared to the Euro has increased in value by nearly 20%. Of which 10% occurred in 2012. Against the dollar the fluctuations have been less, only 5% decrease, making our products marginally less in the global market. This can mean that our traders may be selling product for less than 2 years ago as a lot of these products are traded in dollars

6.2.1. Export products

The markets available for beef and lamb offal are summarised in Tables 6.3 and 6.4 below and show that good inroads are being made into utilising more of the exotic parts or variety meats of the animal which are not consumed in the UK. Chapter 8 contains an in depth review of these different products.

Table 6.3 Beef Offal defined by whether they have home or Export Markets

OFFALS WITH MARKETS (HOME AND ABROAD)	OFFALS WITH MARKETS (ABROAD)	OFFAL WITH LIMITED MARKETS (ABROAD)
Skirt	Feet	Trachea (weasand) & trim
Tongue	Pizzle	Oesophagus
Liver ***	Paddywack	Sweetbreads (thymus)
Kidneys	Tendons	Lungs
Heart	Testicles	Udder
Cheek meat & head trimmings ***	Bible Omasum	Spleen
Lips ***	Reed / Abomasum	Mask
Rumen & reticulum (tripes)***	Aorta	Snout
Tail		

*** Limited human consumption in UK

Table 6.4 Lamb Offal defined by whether they have home or Export Markets

OFFALS WITH MARKETS (HOME AND ABROAD)	OFFALS WITH MARKETS (ABROAD)	OFFAL WITH LIMITED MARKETS (ABROAD)
Intestines / runners	Brains	Oesophagus
Liver	Tail	Feet
Kidneys	Head	Trachea (weasand) & trim

Heart	Testicles	Soft bones
Lungs – for haggis	Tripes	Membranes
Sweetbreads (thymus)	Tongue	

6.2.2. Imported Product

Table 6.5 shows a 14% decrease in the quantity of offal product imported, albeit we are still importing 48,000 tonnes.

Table 6.5 United Kingdom Import Statistics From World. Source HMRC

Description	United Kingdom Import Quantity (tonnes)						% change 06-11
	2006	2007	2008	2009	2010	2011	
Offal Of Bovine Animals, Edible, Fresh Or Chilled	20,150	14,262	16,628	19,925	15,231	15,886	-21%
Tongues Of Bovine Animals, Edible, Frozen	136	41	71	5	76	252	85%
Livers Of Bovine Animals, Edible, Frozen	541	480	566	483	412	283	-48%
Offal Of Bovine Animals, Edible, Nesoi, Frozen	4,990	4,306	6,267	6,142	6,368	7,810	57%
Offal Of Swine, Edible, Fresh Or Chilled	162	267	514	749	1,648	2,467	1420%
Livers Of Swine, Edible, Frozen	680	512	602	814	1,121	717	6%
Offal Of Swine Except Livers, Edible, Frozen	17,518	15,368	17,872	17,517	8,412	9,284	-47%
Offal Sheep,Goat,Horse,Ass, Mule/Hinny Edble Fr/Ch	161	248	241	182	138	95	-41%
Offal Of Sheep, Goats, Horses Etc, Edible, Frozen	11,172	13,199	13,340	15,461	13,896	10,779	-4%
Ed Offal, Bovine, Swine, Sheep, Goat, Horse, Etc.	55,509	48,683	56,102	61,279	47,303	47,574	**-14%**

The export-import balance, Table 6.6, highlights an increasing demand for ox tongues and pork livers. It is assumed that not all the imported offal enters the human food chain but is used by pet food manufacturers. However, it is not possible to determine volumes as the pet food figures include poultry offals as well as rendered MBM.

Table 6.6 **United Kingdom HMRC Export - Import Balance**

Description	Import Balance - Quantity tonnes						Net Increase 06 -11
	2006	2007	2008	2009	2010	2011	
Offal Of Bovine Animals, Edible, Fresh Or Chilled	-19,323	11,611	- 9,255	- 6,113	2,492	3,468	22,791
Tongues Of Bovine Animals, Edible, Frozen	- 114	36	- 64	69	442	- 208	- 95
Livers Of Bovine Animals, Edible, Frozen	- 185	447	1,729	2,104	2,416	3,716	3,900

Offal Of Bovine Animals, Edible, Nesoi, Frozen	- 4,587	3,477	- 4,609	- 2,044	607	2,207	6,793
Offal Of Swine, Edible, Fresh Or Chilled	10,357	7,921	14,577	9,097	11,543	11,879	1,522
Livers Of Swine, Edible, Frozen	- 88	- 121	- 28	- 256	- 605	328	416
Offal Of Swine Except Livers, Edible, Frozen	- 7,802	- 3,735	- 5,833	- 7,087	5,533	10,176	17,979
Offal Sheep, Goat,Horse, etc Edible Fresh or Chilled	1,285	927	1,384	2,201	2,491	2,400	1,115
Offal Of Sheep, Goats, Horses Etc, Edible, Frozen	-10,999	- 12,904	- 12,677	- 14,301	- 12,446	- 9,667	1,332
Ed Offal, Bovine, Swine, Sheep, Goat, Horse, Etc.	**-31,456**	**- 22,587**	**- 14,777**	**- 16,331**	**12,474**	**24,298**	**55,754**

* NESOI - Not elsewhere specified or included

Negative figures indicate more product was imported than exported

Table 6.7 details the countries where offal is currently being exported. The destination of exports is important due to currency fluctuations. When the pound was on a parity with the Euro, our export to the Eurozone was significantly greater than recently where the Euro has dropped to about £0.85. However, the strong dollar has helped with global exports, especially to the Far East where the dollar tends to be the currency of choice. Currently over 80% of the offal exported goes to seven countries, of which 60% goes to countries within the Euro zone, and 28% is going to Asia.

Table 6.7 Export and Imported Countries for offals 2011

Destination	000 tonnes	% offal export	Imported from	000 tonnes	% offal export
World	71.87	**100%**	**World**	**47.57**	**100%**
Asia	19.99	28%	Ireland	22.93	48%
Netherlands	17.84	25%	New Zealand	8.92	19%
Ireland	10.32	14%	Netherlands	6.05	13%
France	5.84	8%	Denmark	3.66	8%
Belgium	2.14	3%	Germany	1.61	3%
Poland	2.13	3%	Australia	1.51	3%
			SIX countries account		94%
		81%			
Eurozone		**60%**			
R.O.W.		**40%**			

As can be seen in table 6.8, in 2011 the number of countries we can export to has increased by from 40 to 60 and this figure is increasing annually as the quality and safety of our meat is becoming globally recognised.. This, coupled with the increased effort to export further afield, has

impacted favourably with nearly a threefold increase by weight on the quantity of offal. The countries we import from are the same now as they were in 2006 (Table 6.8).

Table 6.8 Imports and Exports of Offal 2011 compared with 2006

	2006	2011	Change
Number of countries exported from UK	40	60	50%
(000)'s Tonnes of offal exported	24.05	71.87	199%
Number of countries import to UK	19	19	0%
(000)'s Tonnes of offal imported	55.51	47.57	-14%

6.3. PET FOOD PRODUCTION

Table 6.9 was compiled using figures from the Pet Food Manufacturers Association (PFMA). Between 2010 and 2011, UK pet food production increased by 3% with an associated increase in the weight of ABP being used in pet food, both sourced from the UK or abroad. The assumption is that the ABP includes rendered Cat 3 PAP as well as fresh offals. Prior to 2006, when the export market was closed, some abattoirs would have sold flanks, skirts, tripes etc. to pet food companies. Now that a lot of these products are being exported for human consumption' the pet food companies use alternatives such as lungs, fluked livers, udders and even spleen etc.

Table 6.9: Volumes of pet food produced in the UK. Source: PFMA.

		2010	2011
Overall production	**Volume / Million Kg**	**879**	**906**
Ingredients in production	% by weight: Animal by-products	29%	36%
	%by weight: Cereal-based products	38%	39%
	% by weight: Other	34%	25%
	Weight: Animal by-products (000 tonnes)	251	327
	Weight: Cereal-based products (000 tonnes)	333	354
	Weight: Other(000 tonnes)	295	225
Source of ingredients	% of Animal by-products bought in the U.K.	80%	78%
	% of Cereal-based products bought in the U.K.	89%	84%
	% of Other products bought in the U.K.	9%	40%
	Weight of Animal by-products bought in the UK (000 tonnes)	200	256
	Weight of Cereal-based products bought in the UK (000 tonnes)	297	298
	Weight of Other products bought in the UK (000 tonnes)	26	90
	Total amount of UK sourced material (000 tonnes)	**523**	**644**
	Weight of Animal by-products bought overseas (000 tonnes)	51	71
	Weight of Cereal-based products bought overseas (000 tonnes)	36	55
	Weight of Other products bought overseas (000 tonnes)	269	135
	Total amount of overseas sourced material (000 tonnes)	**356**	**261**

Although the percentage of ABP supplied by the U.K. has reduced, the weight of ABP has actually increased by over 25% or 56,000TPA. There has also been a 28% (20,000 tonnes p.a.) increase in imports, although it is unclear from which species this product originates, whether it is fresh or frozen and how much is the rendered PAP as no further breakdown was available. However, there

is plenty of anecdotal evidence that the pet food manufacturers are finding it increasingly difficult to obtain sufficient raw materials, especially fresh and frozen offals from abattoirs due to the increased amount being exported for human consumption and the increases in Cat 3 selling prices.

The re-classification of desinewed meat DSM in May 2012 may have substantially altered these figures as now the only markets now for desinewed beef and lamb is pet food. However, it would make more economic sense to send the meaty bones to the renderers to be converted into PAP for pet food. There is a requirement for pet food raw materials to displace those that are being imported. If the smaller abattoirs were to look to separate their ABP, there could be a market which could generate an income, as opposed to the current situation where a lot of the ABP goes into the Cat 1 bin.

6.3.1. Recommendations

R5. Work with the smaller companies to link up with pet food collectors.

7. SUMMARY

Assuming all carcase meat ends up FHCC and in the human food chain, as well as the some of the carcase fats, offals and ECP table 7.1.establishes all weights.

Table 7.1 English weights of edible products and ABP's

	Cattle		**Sheep**		**TOTAL**
Slaughter in England Tonnes of meat produced 563,840.55 *	**1,610,973 Head slaughtered** **2011**		**8,690,337** **2011**		
Total product	**Tonnes (carcase wt 350kgs)**	**% of live wt**	**Tonnes (carcase wt 20kgs)**	**% of live wt**	
Carcase Lean	462,406	42%	192,224	53%	
Carcase fats	Incl. above		Incl. above		
Abattoir fats	57,248	6%	14,884	4%	
ECP	(16,147tonnes after processing 8,000tonnes)		Incl. above		
Offals	**Incl. above** (26,363 tonnes) Incl. above		Incl. above		
Edible Human *	**519654**	**48%**	**207108**	**57%**	
Petfood	Incl. below		Incl. below		
Cat 3 **	141,293	14%	61,719	17%	203,012
Cat 1***	137,219	14%	13,014	4%	150,233

*Head x 350kg

*** Cat 1 includes 32,219 tonnes of bovine blood and 17,000 tonnes ovine blood

7.1. ESTIMATED INDUSTRY BALANCE

Table 7.2 pulls together the figures gathered from several different sources including HMRC import and export statistics, from the PFMA and from EFPRA, to produce a mass balance for the industry. The big issue is that all the comparison is between England production and U.K. consumption or export as the data is only available in a UK aggregate format. The 34,363 tonnes of offal and ECP is derived from the sum of 8,000 tonnes of ECP added to 26,363 tonnes of red offal.

Table 7.2

Summary of all figures	**Beef Wt England (Tonnes)**	**Balance All figures are UK**	**% available**	**Sheep Wt England (Tonnes)**		**% Available**	**Rendering Material UK**
Edible	388,185	**143,647** Export HMRC	**37%**	192,224	96,386 Export HMRC	50%	
Offal and ECP	**34,363**	33414 Export HMRC GB 50% England	97%	36325	3607 Export HMRC GB 50% England	10%	
		16,707			1804		
Fat/Biofuel	**57,248**			14,229			748,101 ruminant Cat3) (122,000 used in petfood) FABRA
Petfood/Cat 3	**141,293**	**256,000 tonnes** sourced from U.K. PFMA. Inc pork, poultry etc Not inc below as double counted in rendering		61,719			
Cat 1	**137,219**			**13,014**			**700,111**
Hide **	53,991						Assume only 50% produced in England
7. Cat 2 **	114,070						
Phamaceutical	624,						
**** not incl in total**		16,707			99,993		724,106

7.2. OFFAL AND ECP

Food Business Operators (FBO)s in England state they produce approximately 34,000 tonnes of bovine offal and 36,000 sheep offal FFHC. The UK exports 33,000 tonnes of bovine and 3,600 sheep offal. It is calculated that England accounts for approximately 50% of these figures which would support comments by FBOs that products have a 50:50 split between home and export markets for cattle. For sheep the offal export figures are confused as much of the offal is exported with the carcase. The other confusion arises from exactly what constitutes offal. Although tongues and livers are listed separately, skirt meat, head meat, tails, paddywack and membranes could be described as either offal or meat.

7.3. PET FOOD/CAT 3

Abattoirs estimate they send approximately 202,000 tonnes of products to be rendered or to pet food. The renderers state they receive 3.7 times this amount. Even with fats, bones, cutting plant products and other Cat 3 from the rest of the UK, this figure is difficult to balance. FABRA state they output 227,000 tonnes of ABP (from four species) to pet food while the PFMA state they source 256,000 tonnes from UK for the four species. This discrepancy could be explained by the 29,000 tonnes being derived from fresh cat 3, rather than rendered product

7.4. CAT 1

Abattoirs estimate they send approximately 150,000 tonnes (137,219 bovine + 13,014 ovine) to Cat 1, whereas the renderers state they receive 700,000 tonnes. Even if we estimate that 50% of this is not produced in England this is still only 42% of the receipts.

7.4.2. The situation in 2012

Small and medium sized abattoirs are still harvesting about a third to two fifths of the carcase for human consumption, and disposing of much of the ABP to Cat 3, while the very small are disposing a lot of their ABP as Cat 1.

The price of fat has risen substantially in the last six years. The current market price as quoted in Meat Trades Journal September was £375 per tonne. The fat is either going to manufacture biodiesel or as a food grade fat. Distinguishing the percentage that went as a fuel alternative was difficult as many of the abattoirs thought it went for food but shipped it as cat 3 meaning either pet food or biofuel.

Table 7.3 - Comparison Table 2012 versus 2006 See Appendices 4 - 7

	Cattle				Sheep			
	2006		2012		2006		2012	
Disposal Channel	Kg/Head (carcase wt 318kgs)	% of live wt	Kg/Head (carcase wt 350kgs)	% of live wt	Kg/Head (carcase wt 20kgs)	% of live wt	Kg/Head (carcase wt 20kgs)	% of live wt
Carcase Lean	192.54	32%	224.54	35%	11.7	28%	11.7	28%
Carcase fats	65.76	11%	65.76	11%	4.67	11%	4.67	11%
Abattoir fats	30.21	5%	30.21	5%	1.99	5%	2.33	6%
ECP (tripes, hooves etc)	9.28	2%	44.39	7%	1.31	3%	2.44	6%
Offals (heart, tails, kidneys, liver, tongue etc)	17.36	3%	19.51	3%	1.09	3%	7.21	17%
Edible Human *	**315.15**	**53%**	**384.41**	**61%**	**20.76**	**49%**	**28.35**	**67%**
Petfood	4.91	1%	5.07	1%	1.3	3%	0.66	2%
Cat 3 **	59.43	10%	64.45	10%	6.08	14%	3.15	7%
SRM ***	113.63	19%	79.00	13%	4.23	10%	0.21	0%
Actual SRM	62.67	10%	43.78	7%	1.78	4%	0.21	0%

Hide and Skin	42.49	7%	17.66	3%	4.66	11%	4.66	11%
Gut Content	74.45	12%	74.45	12%	5.11	12%	5.11	12%
Total Live Weight	599.98	100%	625.03	100%	42.14	100%	42.14	100%

See appendix 3 for the origin of 2006 figures

* Edible Human for sheep included 0.05 kg for Illeum

*** 2006 Cattle SRM Was 98.53 Inc. unfiltered blood, (20.13), and intestinal gut fill (15.0). Old figure of 98.53 assumed bible and reed to Cat 3 and blood was dewatered to 10% weight; never happened as no one emptied bible or reed so both went to cat 1; no one filtered blood.
2012 SRM of 79 includes intestinal contents of 15kg and 20.13 kg blood, normally leaves as cat 3 but tends to be processed as cat 1; also included is a 25% allowance for vertebral column of OTM cattle.

*** 2006 Sheep Original SRM figure was 1.76 however most sheep's blood was disposed as cat 1 and ileum was not included.

The 2006 figures were described as best case. However this case was not common
Figures highlighted thus were described as being harvested however out of the total 56.85 probably no more than 17 kg went for either human consumption; the rest generally went for cat 3 or cat 1 rendering.

8. BEEF 5TH QUARTER

8.1. SURVEY RESPONSE

As part of this project a survey was carried out with a representative sample of beef and sheep abattoirs who were interviewed to discuss the approximate percentages of 5th quarter products going to the different market. This enabled the quantity of products that are harvested for human consumption to be estimated as well as how much of the 5th quarter is being exported. It also discussed the obstacles to companies that are not harvesting product. The market for Cat 3 was more difficult as some abattoirs sold product directly for pet food while others sent it to the renderers who have different markets

Some of large abattoirs kept production records of the yields of offal and sales prices against standards. The standard weights varied considerably between abattoirs

Table 8.1 shows the amount of harvested product believed to have been consumed in 2006 compared to 2012. The large difference is attributed to the export of the 5th quarter.

Table 8.1 Summary of what is harvested FHCC

	2006	**2011**
Tails	85%	100%
Tongues	85%	100%
Thin and thick skirt	85%	100%
Liver	50%	70% (due to fluke)
Kidneys	60%	100%
Hearts	70%	95% -100%
Cheek meat	No evidence found - 0%	74%
Lips, snout,		65%
Plain & honey comb tripe	10%	60%
Bible and Reed	0%	60%
Lungs	0%	0%
Spleen,	0% Cat 1	0% Now pet food
Oesophagus, trachea, aorta,	0%	60%
Hooves	0%	18%

Although red offals have a high nutrition value containing a wide variety of vitamins, minerals, and trace elements, many of these products are unpopular with few markets for all products produced in the U.K. The skills and recipes to prepare these meats have also disappeared. There are also animal health issues (liver fluke[5], *Cysticercus bovis* (*C. bovis*) etc.) which mean a percentage of these products are downgraded and are rejected as Cat 3 and Cat 1.

8.2. LIVER

The liver weighs between 6 - 9kg per beast. Some abattoirs seemed to underestimate the weights to allow for fluke losses in management reports on yield. Fluke prevalence varied, between 10% to 50% of the beef livers being consigned to the Cat 3 or even Cat 1 bin. (One abattoir that concentrated on slaughtering dairy cows stated they had up to 80% of their livers condemned for fluke.)

[5] Livers with signs of fluke (active or inactive) are rejected by the meat inspectors as Cat 3, however some abattoirs will dispose of fluked livers as Cat 1 due to no Cat 3 collection.

Of the abattoirs that responded approximately 20- 30% of all livers are lost from the human food chain due to a variety of liver diseases including fascioliasis (liver fluke), tenuicollis tracks, abscess, peritonitis or other diseases.
Some livers only had live fluke in a localised area which meant that only a small proportion of the liver needed to be rejected. In a few abattoirs (large and small) rejected livers were going as Cat 1 when it should be classed as a Cat 3 product. Fluke does not represent a health issue to humans when the product is cooked however the appearance is distasteful. A few of the larger and smaller abattoirs declared that the markets fluctuated and they sent the product as petfood during certain times of the year

8.2.1. Reasons given for livers not going into the human food chain.

- Lack of a domestic market and no access to freezers to chill product for export
- Fluke and other diseases
- Not a desirable food stuff. There is a view that it is a ration food or a working class food

8.2.2. Reasons that the fluked livers were not going into the pet food chain

- Poor understanding by the FBO who believed that they should be Cat 1 rather than Cat 1
- No advice by meat inspectors or renderers
- No Cat 3 bin collection

8.2.3. Recommendations

R6. Help improve the home market for liver through recipe cards, celebrity chefs and the trade teams. Develop added value products from liver e.g. pates mixed meat balls etc
R7. Identify further export markets for livers.
R8. Identify where there are opportunities to bulk up and freeze/chill.
R9. Explore with agents and the renderers as to whether they could take chilled product as a human food and have central freezer
R10. If only a small amount of fluke is present communicate through FSA meat inspectors that the liver is acceptable for human consumption once the damaged area is removed and consigned to Cat 3 bin.
R11. Fluked livers are capable of being used as a raw material for pet food with no adverse affect and could either be chilled and sent fresh to pet food manufacturers or should be put in the Cat 3 bin, not in the Cat 1.

8.3. HEARTS

The bovine heart when trimmed weighs between 2 and 2.4 kg, with less than 0.5% hearts rejected for *Cysticercus bovis* (C bovis). All the large abattoirs interviewed stated that the beef hearts were going for human consumption either to manufacturing or export. Very few processed and packed hearts into retail pack. Some of the smaller abattoirs declared that the markets fluctuated and they sold it as petfood during certain times of the year.

It is estimated 95 to 98% of beef hearts went for human consumption. (50:50 split between home market and export). Pet food or Cat 3 approximately 5 to 10%, primarily coming from the smaller slaughterhouses. This could be as much as 161 tonnes per annum

8.3.1. Reasons given that hearts were not sent for human consumption:

- Lack of market
- Not enough kill numbers to make a box up
- No freezer on site
- Floor waste
- Meat inspection reject

During discussions with FBOs and also when walking the slaughter line it is still apparent that in some abattoirs there are still extra cuts, over and above requirements, being made to hearts by the meat inspectors during inspection resulting in downgrading or loss of potential markets.

8.3.2. Recommendation

R12. Potentially more value could be obtained if the hearts were inspected according to recent FSA guidelines. Explore further how this message can reach all meat inspectors

8.4. KIDNEYS, THICK SKIRT, THIN SKIRT, TAIL AND TONGUE

All the large abattoirs interviewed stated these five products were going for human consumption. However, as with other red offal, both the home and export markets fluctuate through the year. The larger abattoirs will send it to either manufacturing or export. A few of the large plants processed the tail and kidneys into retail pack. The skirts and tongues tended to go to specialist processors.

Table 8.2: Product weight ranges

	Weight range (Kg)
Kidneys	1.0 – 1.3
Thick skirt (body or heart skirt or pillar of the diaphragm located next to the sternum)	1.5 - 1.8
Thin skirt (diaphragm)	0.5
Tail	0.9 – 1.2
Tongue	1.5 – 2.5

Some abattoirs, at certain times of the year, sent a small percentage of these products to pet food or Cat 3 .This was estimated to be about 5 to 10%, which were primarily coming from the smaller slaughterhouses. Many of the smaller abattoirs are looking for alternate opportunities for these products. The reasons for these being sent to pet food or Cat 3 were the same as those given above.

8.4.1. Recommendations

R13. Improve the value of the products by increasing the export markets
R14. Work closer with some of the "consolidation agents" to understand the barriers to them collecting these products
R15. Identify and communicate to the industry export markets
R16. Refine and disseminate the export messages

8.5. LUNGS AND TRACHEA

A set of lungs weigh between 3.5 - 4kg. Most abattoirs, including nearly all the large ones, send all lungs to pet food or Cat 3. The smaller abattoirs tend to send lungs out in the Cat 1 bin. It is estimated that less than 1% of the English lungs go for edible consumption. A few trim off the trachea and fat and split these into different bins. A few of the abattoirs will export the trachea for human consumption. A similar investigation in Scotland identified that between 15% - 25% of the lungs went for human consumption, especially during the winter months (when up to 90% went for human consumption??). These would be used as the raw materials to manufacture Haggis typically

coming up to the end of January (Burns night). None of the abattoirs interviewed were exporting lung tissue for human consumption, (except small quantities to Scotland in Dec / Jan).

8.5.1. Recommendations

R17. Many of the abattoirs want help looking for alternative opportunities for lungs
R18. Identify and develop products made from lung tissue. Products such as haggis are popular across the border. Faggots used to be a made in England. Could similar products be developed and promoted in England?
R19. Work to identify other countries that eat lungs or have recipes to add value to the product
R20. Identify export and ethnic markets and communicate these to the industry

8.6. SWEETBREADS

Sweetbreads are the thymus or pancreatic glands of young milk-fed calves or lambs. However, they tends to degenerate, toughen and are replaced by fibrous tissue after the animal has matured. The thymus sweetbread is more popular. Two of the abattoirs interviewed are trialling the marketing of calves sweetbreads as a human food. They stated that between 10 to 15% of their product was going as edible accounting for probably 1 -2% of the available sweetbreads. Most of the abattoirs sent the product for Cat 3 either as a pet food or fat for tallow production.

8.6.1. Recommendations

R21. Sweetbreads are a fat rich by-product and it may be that putting them in the fat bin may be currently the best and most economical market
R22. Identify further recipes and markets for sweetbreads

8.7. HEADS

A bovine head weighs 16kg on average (see the breakdown in Table 8.3). Only the cranium, eyes, brain and tonsils are SRM, which weigh approximately 7.5 kg. There is still variation between the techniques used by the meat inspectors to inspect the cheeks. Some are still cutting into the body of the muscle and making the cheek meat only fit for manufacturing. The majority of the large and medium sized abattoirs are harvesting cheek meat, lips and snout for human consumption. This is one of the big success stories for EBLEX as up to five years ago this was very rare and most abattoirs consigned the head, minus tongue, to the Cat 1 bin. Many plants are also taking off the lower mandible to further reduce the weight in the Cat 1 bin. Out of the five smaller abattoirs interviewed, two of them harvested cheek meat but not the lips, while the other three put whole heads in the SRM bin. Those abattoirs harvesting head meat use various methods, giving different yields. The head should be completely stripped of meat.

8.7.1. Reasons for not harvesting head meat

- Labour or skill shortages
- Very small numbers
- No freezer capacity
- Lack of specialist equipment eg. Jaw breaker (although this is not required)
- Small Medium size Enterprises (SME's) believe it is not economically viable

8.7.2. Recommendations

R23. Work with FSA to further align inspection practices
R24. Develop material re papillae, mask and/or snout harvesting
R25. Develop more markets for this material
R26. Refine and disseminate export messages

R27. Undertake further work with the smaller abattoirs to harvest more head meat and explore other opportunities to reduce the amount going into the Cat 1 bin

Table 8.3: Weights of the various head components and destinations

	Weight(kg)	Human edible	Pet food/ Cat 3	Cat 1
Brain	0.56			100%
Eyes	0.06			
Tonsils	0.02			
Remainder incl skull	6.77			
Mandible	1.50			50%
Ears	1.26		50%	50%
Tongue incl trimmings	2.24	100%		0%
Head & cheek meat incl trimmings	2.12	75%		25%
Lips	1.12	45%	25%	30%
Snout (washed mask)	0.35	18%	56%	26%

8.8. AORTA

Most of the large abattoirs were saving, freezing and exporting aortas for human consumption. This is a delicacy in the Far East. The product is not consumed in the UK and approximately 40% goes as Cat 3 to the renderers.

8.8.1. Recommendations

R28. Ensure the whole industry knows of the markets for aorta

8.9. OESOPHAGUS

A few abattoirs were saving and freezing this product for export. However, it was primarily going for fresh pet food. Approximately 60% of English production was harvesting the product, the rest were consigning it to Cat 3 rendering.

8.10. PADDYWACK AND LEG TENDONS

The paddywack (*Ligamentum nuchea*) is the thick ligament linking the head and the shoulder. It weighs approximately 0.8kg per beast. The paddywack and tendons from the hooves and knee joints used to be rendered but are now being harvested and packed for export by all the larger abattoirs and many of the medium abattoirs.. They are a popular delicacy and in high demand for human consumption in the Far East. Both the paddywack and the tendons get harvested in the cutting plant. However, a better quality product is produced when harvested in the abattoir.

8.9.1 Recommendations

R29. Many of the smaller abattoirs and a few of the larger abattoirs need to be shown the best process to harvest this valuable product. Potentially once it leaves a small abattoir it can end up in a Cat 3 rendering plant

R30. Where it is not economic for the abattoir to process for human consumption a more proactive process to collect and dry for dog chews could add significant value to this product, which is currently for sale on the internet for £5 to £8/kg not including postage and packaging

8.11. BLOOD

Blood is processed by coagulation and drying or by separation of the plasma and haemoglobin fractions, followed by spray drying to produce plasma and haemoglobin powders. None of the abattoirs questioned were collecting blood for human edible, most were sending it out as Cat 3 to the renderers. Each beast produces about 20kg of blood therefore English bovine slaughter houses produced 32,000 tonnes in 2011 and 17,000 tonnes of ovine blood. Blood is collected by the renderers and processed either as a Cat 1 product or as a Cat 3 product into blood meal. The main use for the meal is as food in the fox and mink industry (for fur).
Since BSE, blood has become a big burden for this industry. Even though it is no longer a Cat 1 product, abattoirs still tend to have to pay for its disposal (up to £80 per tonne). It is an expensive product to incinerate because of its high water content, but this tends to be the main method of disposal.

Pre 2002, blood was used as a fertilizer, directly injected into the soil to contribute nitrogen and aid in humus formation to improve soil structure. It was also long used as an anti-foaming agent in fire extinguishers (it protects the surface from heat and retards the formation of vapours). However, the EU regulations 1994/2002 banned these practices. In the UK, probably the only currently used viable economic alternatives are to digest it either aerobically or anaerobically (after it has been pasteurised) creating a biogas and/or fertilizer. A few of the renderers are installing digesters for this purpose. Currently no statistics exist on the yields of these products.

Blood is good source of a variety of proteins, plasma, haemoglobin and other products which could be used in the food and /or pharmaceutical industry. However few abattoirs have the equipment to collect and store the blood hygienically. Albeit some of the larger abattoirs are investigating the financials of going down this route.

8.11.2. Recommendations

Within the meat industry, especially the ruminant sector, there is reluctance to develop alternative products due to the perceived huge risks to invest in advanced scientific innovation. There are potentially hundreds of bioactive peptides which can be manufactured from blood, however, only a few of these are capable of delivering health benefits such as preventing hypertension, antioxidants or opioid activity. Many different pharmaceutical products produced from blood are currently being researched; including some that will lower and raise blood pressure. If you look at the increase in functional food products such as Benecol® and Yacult® you can see the dairy industry has been researching these functional foods for many years with some success.

R31. Investigate the potential research opportunities to develop a suite of functional foods that move the industry further up the value added chain

R32. Explore opportunities to extend research to develop other innovative products from blood and its constituents. Products such as fibrinogen and the enzyme thrombin are used under the trade mark fibrimex as a binder for meat processing to manufacture meat products

R33. Composting blood with paunch contents and lairage waste to generate biogas and produce a natural sustainable fertiliser and soil improver is currently possible but not widely practiced

R34. Blood proteins, especially those found in the plasma fraction, can be used to manufacture gelling anti foaming or emulsifying agents which could be added to food ingredients

R35. Blood could also be used to enrich certain foods with high grade proteins e.g. pasta

R36. Blood used to produce a blood meal high in protein could be used as a raw material for pet food manufacture. However, up to recently pet food manufacturers dismissed this idea as it

made the colour of the pet food very dark and unattractive. However these attitudes may change as the raw materials become more scarce.

9. OVINE OFFALS

9.1. RED OFFAL INCLUDING LIVER, KIDNEYS AND HEART

The market for sheep offal is more established than for cattle offal. There is a tendency for abattoirs that are slaughtering lamb for export to send the red offal with the carcase. This reduces the quantity available in the UK, it also seems to be more popular with the UK market so less overall goes either to pet food or for export. It is difficult to link the quantity of product that abattoirs say they harvest with the quantities on sale in the UK or exported. The understanding is that pluck and kidneys tend to go with the carcase and may not be counted separately.

9.2. HEADS AND FEET

None of the abattoirs interviewed for this report were processing sheep heads or feet for human consumption. However, the author is aware of at least two abattoirs which are processing these products for export and the home ethnic market. One or two more are known to skin a few heads to meet regular customers small weekly demand.

The majority of the large abattoirs send feet out as Cat 3, with about 50% known to go as pet food. Other large abattoirs send the heads and feet as Cat 1. Heads from sheep over 1 year of age at slaughter have to go as Cat 1. In 2010 this was approximately 2,400 tonnes.

9.2.1 Reasons for not harvesting heads and feet for human consumption

- The processing of both products demand specialist knowledge, skills and equipment
- Both products are subject to post mortem inspections by the FSA which adds a significant cost that some abattoirs believe do not make the finished product economically viable
- Other abattoirs were unable to process sheep feet correctly to get the correct quality demanded by the customer
- Poor returns on investment

9.2.2 Recommendations

R37. Improve the markets for heads and feet to ensure that there is sufficient demand for this product

R38. Further investigation and trial work to understand the cost benefit analysis

10. CATTLE & SHEEP EDIBLE CO-PRODUCTS

10.1. CASINGS

Cattle intestines are classified as SRM and are sent to Cat 1 rendering plants. Sheep casings have always been in demand especially recently during the economic downturn where their price has increased by over 50%. Sheep (and pig) intestines are washed and salted for collection.

The companies involved in casing production may deal with one or more of the following processes:-

Production: Harvesting of the intestines and production of runners
Cleaning: Transforming the runners into salted casings
Sorting: Selection of the casings by quality, length and calibre (diameter)
Distribution: Sale and distribution of sorted casings either using UK or imported products

Due to the increase in price of casings it is now economical even for the smallest abattoirs to empty the intestines, bundle into sheaths of 50 and put into a barrel of salted water. They keep for several days like this and can be collected when a few barrels have been stored.
In 2012, sheep casings were worth between £1.10 and £1.50 (2013 prices are up to £2) per runner depending on quality, quantity and location of abattoir. Only a few small abattoirs were not harvesting the sheep intestines. These were the very small companies where there was a lack of knowledge about the current price paid for runners. During discussions it was apparent that the FBOs were exceedingly interested once they knew that there was a demand and good prices for sheep casings

10.2. TRIPES

The processing of cattle stomachs into tripe is, in part, due to the work done by EBLEX. In 2006 none of the abattoirs visited in England were processing cattle or sheep tripes. In the best instances these were going to a third party who processed them into tripe such as Heys or Scraggs. Other companies would collect rinsed and dried rumen and reticulum free of charge and process into pet food. Certainly all omasums and abomasums (bibles and reeds) and in a few cases (smaller abattoirs) unopened rumen and reticulum were sent out unemptied as Cat 1, adding significant weight to the Cat 1 bins. An anecdotal estimate of maybe 5% of the cattle kill would have the tripes harvested for human consumption.

In 2012, most of the large abattoirs, run by companies that have multiple sites, were doing the following:- washing, polishing, cooling and packing the rumen and reticulum for human consumption (normally exported). Not every abattoir was processing the omasum (bible) due to the amount of contamination and load it put on the effluent treatment plant. Even less companies processed the abomasum (reed) (approximately 30%) for human consumption. However, in a few cases it was going into the fat bin, otherwise it was consigned as Cat 3.

Surprisingly not all of the large abattoirs process tripe. Some of the largest abattoirs still sell the product to pet food manufacturers.

10.2.1. Reasons for not harvesting tripe for human consumption

- Expensive and demanding to process; space, manning, hot water, effluent treatment
- Inadequate space or effluent capacity
- Cost received for product as a fresh pet food ingredient has improved due to much of the product now going to human consumption

- Fluctuating and seasonal market with many risks, especially if using grey routes to China.

10.2.2. Recommendations

R39. Further work is required to continue to increase the markets to which we can export. A greater number of markets gives the industry the flexibility to reduce risks caused by seasonality and political vagaries.

R40. Currently dried tripe is on sale on the internet for between £5 to £20/kg. This is a dried and packed product which has only had a rough wash and marketed as a pet food. For small abattoirs that service one or more butchers' shops, the possibility is not available. Butchers shops are not allowed sell pet food as they cannot have human edible and pet food in the same facility. In addition, the butchers shop would need to be licensed under the ABP regulations as either a collection centre or distribution centre. Butchers get round a lot of the regulation by selling the product as FFHC.

10.3. HOOVES

Recently more abattoirs have started to process hooves in England for export. They have been processed on the continent and in Ireland for many years. In the past we imported small quantities from Ireland primarily for the ethnic markets. However recently a few of the larger abattoirs have made the significant investment required to process hooves for human consumption.
Currently approximately only 10% (3 of the largest abattoirs) of the kill in England harvest hooves. However this should increase in the future.

10.3.1. Reasons for more abattoirs not processing hooves to go into the human food chain.

- There is still a perception among many of the abattoirs that there is a risk of over-supply in the market which would cause the price to drop
- The cost of the equipment and the space needed for processing deter some of the more restricted businesses and all of the small and medium sized abattoirs
- The amount and temperature of hot water necessitate steam boilers. There is also a significant amount of very dirty water to treat and dispose.
- Many abattoirs believe that the returns do not justify the investment costs, especially when the pet food companies are paying a good price for these products
- The larger abattoirs benefit from harvesting the Achilles tendons and spoon tendons from the hooves and legs and believe that there is a similar cost recovery without the upfront investment and extra load on the effluent by processing the hooves in this manner

10.3.2 Recommendations

R41. Harvesting the tendons is significantly easier than processing the entire hoof. Not only are the tendons easier to pack, store/freeze and ship but they also attract a good price. Certainly it would be more beneficial for the smaller abattoirs to carry out this operation. However, the markets may be limited to China and surrounding countries

R42. Opening up more markets will increase the demand and diminish the risks due to oversupply. Certainly there are large opportunities in Africa for hooves. However, there are also issues with the exchange rates and the ability of companies to pay.

R43. Opportunities may exist to look at combining several abattoir outputs and process on the one site. The chill chain rules may need some amending if this was to be practical.

11. FATS - HUMAN EDIBLE OR CAT 3

Harvesting fat is lucrative and is primarily controlled by local economics. There are two types of fat processing activity:

- The production of fats and proteins (greaves) for human consumption which is in accordance with Hygiene Regulation (EC) No 853/2004.
- The processing of Cat 3 ABP, also derived from animals FFHC.

Most plants sell the fat collected in the abattoir. A few large abattoirs render it themselves as either Cat 3 for bio-fuel or as a food grade fat. The renderers were paying between £300 and £390 per tonne for fat, unlike pet food which currently makes between £20 and £100 per tonne. An estimate of 30kg of fat per beast is recovered in the abattoir while another 15 kg can be recovered in the boning hall has which equates to about £14 per beast.

Fats from different parts of the body have differing qualities. In the past the slaughterhouses harvested a percentage as best fat or first quality fat which came from animals that have been passed as fit for human consumption and sold for a higher price. The best quality tallow such as lard (pork fat) and beef dripping is obtained from melting fat tissues derived from sites such as the KKCF or suet (kidney) or cod fat (inguinal fat from male animals). Oils and fats produced by fat melters are used in the food industry, e.g. in baking and food processing; frying and margarine production. This tallow can be used in all applications including human food, animal feeds, soaps, cosmetics and pharmaceuticals. Second quality is the cutting fat which is boned out in the cutting plant, which is used by butchers to wrap roast before retail packing the product. The omental and other fat such as that harvested in the cutting plants tended to be rendered as ABP Cat 3. Of this product about half the tallow and animal fats produced were used by the oleochemical industries as raw materials for a wide variety of chemicals, which are then used in soaps, cosmetics, pharmaceuticals, detergents and a large range of industrial products, e.g. from paint to car tyres or the pet-food industry.

At the beginning of the project abattoirs split their fat between food grade and Cat 3. As the project went on prices altered and the trend seemed to be that more abattoirs were sending the fat to be rendered as a bio-fuel. As there was more value as fuel alternative than a cooking oil or baking aid (pastry and bread). Estimations were that 90% goes to Cat 3 biodiesel production or a fuel alternative and 10 % is used in human edible or pet food. Discussions with the renderers supported this and showed that the majority of fat was collected as Cat 3 and rendered to tallow which currently tends to go to the bio-fuel markets due to the increased prices for bio-fuels. Because a lot of fat is going for biodiesel technically it doesn't matter whether it is Cat 1 or Cat 3. Renderers in most cases are still charging for Cat 1. This seems to be incongruous as there are large amounts of fat present on the intestines. The other factor driving these markets is the receipt of carbon credits for using the fat (if sent out as Cat1) as a biofuel could be considered to be part of the credit scheme.

A few large abattoirs have the ability to render their fat however, the economic situation and global oil price and their license dictate which product are produced. During the 2011/12 only two rendered to produce a food grade fat for the human edible market, while the others rendered to produce a Cat 3 tallow for a biofuel. The rendering of fat produces water with fat present and greaves. As there is no human edible market for greaves even though it is food grade it tends to go out as Cat 3 as a raw material for pet food.

11.1 RECOMMENDATIONS

No recommendations are made due to the economic forces currently driving this part of the market including the global crude oil industry, food shortages etc. Having a co-located rendering facility is

beneficial for the abattoirs as it enables them render their fat quickly, reducing degradation which improves the quality of the finished product.

12. HIDES AND SKINS

Hides and skins are important to the meat supply chain because:

- They weigh 7% of the carcase
- The leather industry believes that as they are a by-product they attract none of the pre-slaughterhouse carbon footprint. It could be argued that, they have an economic value and are in demand, they should carry some of the Carbon footprint
- 40% of a hide could end up as human edible by being used to generate collagen
- The process dictates whether a product can actually enter the human food chain although maintaining the chill chain is not as important as maintaining freshness
- The majority of the hides and skins produced in the UK are exported
- During certain periods the sheep skins are not considered worth processing and some will go for rendering

After hides/skins are flayed from the carcase, slaughterhouses can collect and save them and make the decision as to whether the product will be kept in the human food chain as an edible co-product or whether it will leave the plant as ABP Cat 3. The hide is a highly putrescible material and the abattoir will adopt a specific process for storage, despatch and processing depending on the end market

- Hides that are to remain in the human food chain (as a raw material for harvesting collagen or gelatin) will need to have good chill chain control and despatch is normally required to be carried out within 24 hours. Hides are iced to reduce the temperature to below 3^{o}C and must be transported on food grade refrigerated lorries to food grade premises and not through hide merchants whilst maintaining their chill chain. Chilling and refrigerating the hides will allow the delay of processing for up to one week. This makes it difficult for the small and medium sized companies to supply.
- Despatch fresh immediately after slaughter, this normally means daily collections in refrigerated containers if they are not going to be processed within 8 to 12 hours. However, these hides and skins tend to be non-food grade products
- Salt the hides. This enables the abattoirs to play the global markets as well as sort and grade the hides and hold them to get a good price either in the UK or export markets. Salting hides allows them to be kept for up to six months without jeopardising the quality of leather produced.

Cattle hides are processed into three main products: leather including suede, gelatin used in a variety of products and collagen which can be used to manufacture reformed collagen sausage casings.

12.1. LEATHER

Leather is used in the fashion, automotive and furniture industry with different markets requiring different leather sizes and grades. Most markets require the leather to be damage free (caused by injections, barbed wire, infections, knife damage in the abattoir, putrescence). By tightening up the supply chain an abattoir may be able to guarantee a higher value product which could potentially guarantee better price.

R1. Working with abattoirs, hide merchants and producers to improve the grades of hide by improving communications up and down the chain, relaying issues such as injection marks or barb wire damage, parasite damage as well as flay damage in the abattoir

12.2. DROP SPLITS AND COLLAGEN PRODUCTION

Collagen is an intermediate product in the process to manufacture gelatin. Recently this intermediate product has grown in popularity as more new and innovative products have been developed with properties that have got benefits for consumption and cosmetic purposes. It has the property of being an edible digestible protein that adds few calories to a diet. Therefore in these times of growing appetites and obesity it makes a good filler food providing satiety without many calories. It has the potential to become far more popular than it is currently for both human and pet food diets. Collagen is largely derived from the collagen rich corium layer of cattle hides which is harvested when the hides are split. It is the drop split that is sent to the collagen manufacturer. However cattle hides do not yield a large percentage of collagen (5%) when compared with cattle bones 25% and pig-skins 37% it is still considered and efficient use of the drop splits.

Only hides that have been chilled can go for human consumption which tends to limit production to the large companies with a good hide treatment facilities and high turnover to supply the market. These hides are used for the manufacture of collagen or gelatin. These hides are processed to remove any dirt and contamination during a rather aggressive primary washing process. All hides whether salted or chilled could be used to generate collagen as long as they are processed fairly quickly (within a week) and little degradation taken place. Therefore icing hides and keeping them cool has to be done according to regulations but adds costs for no reason. (APPENDIX 8)

Reformed casings are one of these products made of collagen. They are ready to use and are not salted nor need refrigeration, with a shelf life of about two years if kept in a cool, clean and dry environment. A visit was made to two tanneries for the purpose of this report and the raw material for collagen production was seen. A visit to the collagen production company was not possible.

12.2.1. Recommendation

R44. Investigate what sort of benefits could be gained by further research into the collagen industry. What beneficial products could be derived from gelatin and collagen

13. THE VALUE TO THE INDUSTRY

Table 13.1 was compiled in October 2012 using figures given by few agents and sales figures from some of the abattoirs. Sales figures are often difficult to access but AHDB market intelligence team are interested in collating prices for the 5th quarter in order to report them and aid transparency and marketing decisions within the industry.

Table 13.1: Sales prices as at October 2012.

Product	Sales Price per beast	Cumulative total per beast	Presentation
Hide.	£47.00	£47.00	Dependent on size, quality
Hooves. Per set	£5.00	£52.00	Washed, no hair/toenails, singed & packed.
Tripe plain	£7.00	£59.00	
Bible	£0.80	£59.80	Washed, trimmed polished & packed.
Honeycomb	£1.30	£61.10	
Paddywack.	£0.65	£61.75	Packed
Tendons.	£0.60	£62.35	Packed
Oesophagus	£0.20	£64.85	Pet food
Trachea	£0.60	£68.85	
Heart.	£2.50	£69.85	Packed
Liver.	£4.00	£75.85	Packed
KIdney.	£1.00	£84.35	Packed
Cheeks.	£6.00	£87.35	Packed
Tongue.	£8.50	£91.15	Packed
Tail.	£3.00	£91.30	Packed
Thick skirt	£3.80	£92.30	Packed
Thin skirt	£0.15	£93.30	Packed
Lips	£1.00	£93.60	Packed
Pizzle	£1.00	£94.30	Packed
Testicles	£0.30	£94.50	Packed
Snouts	£0.70	£94.70	Packed
Muzzle	£0.20	£100.70	Packed
Neck Trim	£0.20	£100.90	Pet food
30 kg fat @ £200/tonne	£6.00	£100.90	

Average prices dependent on quantity, quality, location of abattoir, presentation, current market forces. Prices also fluctuate throughout the year and according to exchange rates.

13.1. VARIABILITY WITHIN THE INDUSTRY

There are vast differences between what each company earns from its 5th quarter. The figures above are based on anecdotal evidence and the knowledge of the value of each depending on the particular market. For each bovine animal companies could be earning as little as £62 and paying the renderers £2.40 to dispose of stock which would attract as much as £3.00 if it was sold as pet food. i.e the earnings of 5th quarter £59.60.

The companies that are focused on adding value to their 5th quarter could be earning as much as £125 per beast on packed product sold for human consumption with a further £2.50 per beast for

pet food sales. They would also be avoiding Cat 1 disposals costs. This implies a positive financial benefit of £127.50 per beast, a difference of £67.90 per beast over those not taking advantage of these opportunities. It should probably only be the very small abattoirs with only Cat 1 collection that falls into the first category. However, there are 86 abattoirs in this type slaughtering (2% of the kill).

In truth most abattoirs are somewhere in between, with only a few earning over £100 per carcase. The largest abattoirs have management systems that not only measure how much they are earning daily but also the yields per day and even sometimes per head.

The abattoirs also earned different monies from the renderers for their ABP and hide or skin merchants. It is believed that one of the reasons is the quality of the ABP. Renderers say they will pay more if the ABP is not degraded but will yield a good quality tallow and protein meal.

14. THE IMPACT ON CARBON FOOTPRINT

The carbon footprint for cattle and sheep meat is based on 1kg of meat. However this 1 kg is carcase meat with no consideration for offal or other 5th quarter products included in the calculations.

Assuming that only carcase meat is used in the calculation:

> If a beast weighs 600kg liveweight, the carcase weighs 318kg and the meat weighs 192 kg or 32% of the live weight. In 2006 another 36 kg of offals and fat were also eaten 228kg or 38% of the liveweight of the animal was eaten.
>
> In 2012 the weights of fats, offals, and 5th quarter going for human consumption need to be added to the 192kg, which increases the percentage to 48%. This is a 26% increase on the weight eaten.
>
> Or looking at it another way ; the carbon footprint for 1kg meat has reduced by one quarter.

However if the value of 38% is used (included fats and offals); there has still been a 26% increase in the amount of meat eaten per animal therefore the carbon foot print has been cut by 21% for 1kg of meat.

This simplistic approach does not consider the extra processing carbon inputs for the extra hot water and chilling or freezing required to transport the product to the far eastern markets. Nor does it include the carbon credits gained when using the rendered fat and MBM to provide thermal energy and power.

15. RECOMMENDATIONS

Recommending changes to legislation is difficult in an industry that although has many excellent companies with good management systems has a few which are still working to improve their management controls. In the past animal proteins were added to animal feed and fed to ruminants (natural vegetarians). The current legislation was introduced because of BSE and FMD and has been effective at regenerating the English beef and sheep industry to far higher quality meat production system. The quality of the carcases and the health and welfare of the animals and the safey of our meat has improved. The U.K. is due to become a negliable BSE risk country in 2017 (currently controlled BSE risk). However, the practices are also adding considerable costs to the industry both financially and environmentally. Regulations are required but some of the current ones are too stringent and could be re-assessed in specific areas, based on a realistic and proportionate level of acceptable risk in comparison to other components of the food chain. Therefore, the recommendations in some instances are not innovative practice and not new but returning to the systems that were in place before BSE.

15.1. STRATEGIC RECOMMENDATIONS

15.1.1. Move the industry to reducing SRM/Cat 1 practice

In 2012, the FSA have eliminated the requirement for BSE tests on all healthy animals. However, abattoirs still have to remove the spine for OTM animals and consign it to the Cat 1 bin as it is a SRM.
As detailed earlier in the report, all bovine and ovine animals have certain parts that must be consigned to Cat 1. This makes little sense when compared with practices in other parts of the world where cattle brains (brawn), cattle mesentery fat and intestines are widely used for human consumption. OTM Cattle also must have their spinal column removed as SRM. One has to ask how the pre and post thirty month age category can be an effective measure of risk.

Furthermore no links have been made between scrapie and vCJD, yet all lambs and sheep have their illeum and spleen and those over 1 year old have brains consigned to Cat 1 and the sheep require splitting to remove the spinal cord. There is also a requirement for the lamb heads to be inspected if they are going for human consumption. This adds considerable cost to the processing of the sheep carcases and by-products as a lot of the small and medium abattoirs are still not efficient doing this process.

15.1.2. Updating the SRM list

To reflect the UK's controlled risk status for BSE, the SRM list should be reviewed and, subject to a thorough risk assessment the following products be re-categorised:

1. Remove mesentery fat and cattle intestines from the SRM register. They have been the subject of significant research and are considered to have the same amounts of risk as a sirloin steak [6]
2. Remove the vertebral column (VC) of OTM cattle from the risk register. Currently UTM cattle are believed not to present a risk. Routine testing for BSE has stopped and the UK has the status of controlled risk for BSE for the last few years. Raising the date limit of VC removal should be introduced as soon as possible
3. Remove the SRM classification from all parts of a sheep including those over 1 year.
4. Eliminate the necessity to remove the spinal cord and splitting a sheep carcase over 1 year.

[6] A quote from Joris Winkler

15.1.3. Desinewed meat (DSM)

Due to the re-evaluation and renaming of DSM as Mechanically recovered Meat (MRM) in May 2012, this product has been consigned to pet food. Research has recognised differences between low pressure recovery (Baader process) of meat from bones compared to high pressure recovery. The structure of the meat product has been shown to be different and that difference can be measured. Low pressure production produces a product similar to mincemeat with little calcium and haemoglobin content, whereas the high pressure method produces a less textured product similar to a meat paste, with a higher calcium content.

15.1.4. Blood

The belief is that the BSE prion agent is not present in blood. Bovine and ovine blood is an expensive burden to the industry. Blood is an excellent source of soil nutrients and in the past was injected into the soils as a fertilizer. Review the risk of this practice with a view to its reintroduction even without pasteurisation. Certain conditions need to be stipulated for safety such as it must be injected into the subsoil as to prevent access by birds and vermin. Soil to be left free from animals for a specified period etc

15.1.5. Use of Cat 3 product for animal feed

In 2013/14 it is likely that porcine and poultry PAP will be reintroduced into the animal feed subject to strict controls (only cross species feed and subject to DNA tests) The anomaly is that humans and pets are currently allowed eat animal proteins but other omnivores such as pigs, poultry and fish (up to 2013) are prohibited from eating bovine and ovine proteins as an animal feed. Subject to Cat 3 being suitable for pet food and being considered to be prion free i.e. separate facilities for Cat 1 and Cat 3 rendering. A consideration should be given to feeding bovine and ovine rendered material to poultry, fish and pigs.

15.1.6. Salting vs chilling for hides

Work with collagen processors to understand what the minimum transport specifications for hides that can go into the human food chain so that it is not necessary to chill all hides.

15.1.7. ABP Regulations

ABP regulations prevent companies that are processing ECP to take another companies ECP. A large retailer will tend to process tripes and sometimes hooves on site. However regulations prevent them from taking product from neighbouring abattoirs. The risks and repercussions should be investigated to understand the consequences if this practice were to be relaxed.

Another angle to this recommendation is the ability of butcher shops to sell product to pet owners. Packed green tripe, paddywack etc is currently prohibited to be sold as petfood from an establishment without an ABP license. Allowing a safe and well packaged product to be sold from a separate counter or fridge would help the SME abattoirs.

15.2. TECHNICAL RECOMMENDATIONS

In previous reports a recommendation for an indepth technical research has been suggested into Anaerobic digestion AD and Filtration however both of these options are probably more about composting and liquid removal rather than adding value. AD has provoked a flurry of activity and sponsorship from government projects and will not be covered in this report.

- Research what are the financial losses or the consequential carbon footprint due to the fact that Cat 2 material is being combined with Cat 1.

- Reweigh 5th quarter product to update previous figures. This is useful to ensure that the figures used to calculate 5th quarter as well as yields of by-products are up to date and accurate. This would also improve the accuracy of other academic research.

15.2.1. Rendering yields

Further work could be done with the renderers to understand the factors that influence different yields of products. Develop a better understanding on how collection timings from abattoirs to renderers and the process parameters to improve these yields.

Understanding the factors (e.g. chilling by-products, enclosed containers, protected from the elements) that affect the protein recovery, the presence of free fatty acids and yields and developing process and collection parameters to maximise the above could deliver higher financial benefits. Collecting and feeding back information to the abattoirs on yields and values of their Cat 1 and Cat 3 products could help to deliver benefits for the abattoirs and the renderers including a reduced disposal costs and better value finished product.
By understanding what the effects putting fatty meats in the fat bin would improve understanding as to whether it is better to render the likes of sweetbreads and Abomasum (reed or rudd)

15.2.2. Hides

An amount of technical / supply chain work could be done to improve the value of U.K. hides. It is well known what actions in the tannery will improve the quality of leather however having proper traceability up and down the chain to allow feedback to producers on issues with the hides and enabling the producers use this information could benefit the whole industry. By producing animals with a premium hide (no barbed wire, injection or parasitic marks) capable of yielding the whole area will improve the value. By increasing our understanding as to whether certain factors e.g. production systems, breeds, sex or age of an animal effect the final product, information could be given to farmers that could increase the value of the hide which may attract a premium in their carcase payment.

15.2.3. Fats.

The price paid for fat is volatile during the course of this research prices quoted ranged from £200 to £375. The differences seemed to be whether it was going for human edible or biodiesel. The main point here is the yield. Work could be done with the renderers to understand the factors that will yield the most and highest quality product.

15.2.4. Blood and Collagen

Further research is required with both these by-products, for 2 different reasons.
Blood is currently a wasted protein which in an era of growing populations and shrinking animal proteins makes no sense. It is currently not allowed as an animal feed although we are able to use it as a pet food.

- Concerns should be dispelled for using cattle blood as a protein additive in poultry, pig and fish food.
- Collagen has a huge potential in the health food industry. By exploiting products manufactured from collagen could increase the value of bones and hair.
- Research to evaluate the technical attributes of blood raw or as a meal for use as a fertilizer.

15.3. MARKET DEVELOPMENT

A variety of activity is recommended to be undertaken to develop both UK markets and export.

15.3.1. Focus on small and medium sized companies

Provide support and assistance to enable the SMEs to add value to the by-products by selling them as human food

All companies can add further value by finding the best market for all products that are not SRM. There are many different companies that purchase offals and ECP for the export market. They all have different customers, specifications and prices.

There are three types of companies in the English market

1) Big companies that are selling with their own people.
2) Small companies that take product from big companies and export it to the best market.
3) Consolidators which are small companies that work with small and medium sized abattoirs. Most small abattoirs when looking to expand into the offal export markets do not have the skills, resources, space and processes to pack and box the product to go for the human market By using consolidators who will take mixed pallets of boxed product and feed back the correct packing and production specifications to obtain the best price.

Potentially the gap is for small companies that are not slaughtering sufficient quantities to merit the investment in equipment.
Carry on the work to detail the technical processing specifications of particular products e.g tripe hooves and runners. Customers especially of the 5th quarter product complain about quality of the packing labelling, colour and presentation.

15.3.2. "Where to Export Product" App

Similar to the Eblex meat purchasing guide "app". An app could be developed for 5th quarter to highlight to abattoirs where the best current markets are for the variety meats. This will be more useful when there is access to the Chinese, Russian and African markets as well as those of the EU.

15.3.3. Increase the value of the Animal By-products

A lot of renderers now pay the abattoirs for Cat 3 products. However there are further opportunities to increase the value of the Cat 3 by ensuring the product is stored and despatched well to maximise the value. After technical research is done provide messages to SMEs

15.3.4. Reduce Cat 1 rendering load.

The renderers state 700,000 tonnes of Cat 1 for the U.K. Interpolating this figure to estimate what is purely English would be approximately 350,000tonnes. This is significantly higher than the abattoirs state they produce (152,000). The true figure probably lies somewhere in the middle. This is still very high for the industry and means that many of the companies are putting too much product into the SRM bins.

Only 7% of a beast (skull, brains and tonsils, spinal chord and intestines) and less than 1% of a lamb is SRM and needs to be sent to a Cat 1 renderer.

Table 15.1: Weight of Bovine SRM

Cat 1	UTM	OTM
1 beast	43 kg max Head – mandible & meat **= 8.67kg** (+1.26 ears not SRM) Intestines & intestinal fat = **30kg** (not inc. 25kg contents) Spinal cord = **0.2kg** **Other waste not necessarily SRM = 4kg**	62 kg Includes 19 kg spinal column
100 beasts	4.3 tonne	
200 beasts	8.6 tonne	
1000 beasts	43 tonne	

Companies should:

1. Record and monitor Cat 1 weights as a percentage of the kill and develop protocols with their staff to minimise the weights
2. Empty cattle intestines – this would reduce the Cat 1 load by between 15kg – 25kg and increase the yield of by-products for the renderer which could attract a better price
3. Empty the bible. The bible contains approximately 8 kg of undigested grass. By not emptying it the product has to go out as Cat 1 although it contains no SRM. (During the investigation some companies were putting full bibles in the Cat 3 bin. Perhaps when the renderer receives this product they render it as Cat 1 and this pushes up the Cat 1 figures)
4. Ensure heads are completely deboned and all meat harvested
5. Work with the renderers to help them identify better systems that no longer make it cheaper to put all ABP in the Cat 1 bin.
6. Ensure lamb heads are put in Cat 3 and not Cat 1

16. CONCLUSION

During the writing and publication of this report the situation has continued to change. More sheep heads and feet are going for human consumption; fat is once again worth more as an edible fat then a biodiesel.

The industry is constantly evolving and trying to improve. Most people who work in the meat industry are entrepreneurs that want to sell more and to find new customers. The good thing is that the better companies are continually looking to expand their product portfolio.

The transformation that large abattoirs have undergone has benefited the industry environmentally and financially. This is encouraging the SMEs to follow in their footsteps or benefit because the petfood companies have raw material shortages. These changes need to be introduced in to the medium and smaller companies. These companies need more assistance and support as they normally are short on the necessary resources (cash, people, skills and space) to harvest, process, pack, chill and ship these products. The support needs to be tailored in its delivery so it is relevant to each company.

They are faced with increasingly tight margins as well as tight supplies. There is a need to improve the operations/production management especially in the SME abattoirs to train abattoir staff to harvest more products in a manner that the customers want. By increasing the amount of an

animal that goes for human consumption is not only good for the abattoir, by exporting this 5th quarter it is good for the economy and for our carbon footprint.

An on-going assessment of how the industry is doing should be carried out annually. There is no mechanism to do this currently; however, by capturing the quantities of product from a representative sample of companies will illustrate the continual improvement and reduction in carbon footprint.

Appendix 1. **List of previous reports evaluating the use of offals and 5th quarter materials**

1993 By-products of animal origin and animal waste - Michael Fogden

1996/7 Feasibility study on alternative uses for Animal By-products. S. L. Woodgate

1997 Animal by-products industry in France Denmark and Germany Ireland, Italy and the Netherlands. Alan Lawrence commissioned by MLC

1997 An audit of bovine and ovine slaughter and by-products sector (ruminant products audit). MLC and Leatherhead Food RA "

2005/2006 A review of the Red Meat Offal and By-Products Industry - MLC industry consulting commissioned by EBLEX.

2007/8 Utilisation of Waste Materials (covered all by-products from the red meat, dairy and poultry sectors). A separate review was conducted for Defra in called the

2009 Fresh Meat Resource Maps IGD and MLCSL commissioned by WRAP (waste resource action programme)

2010 Adding value to the fifth quarter for Scotland MLCSL commissioned by QMS

Appendix 2. **Regulations and Legislation**

Recent years have seen large changes, challenges and new opportunities for the animal by-products industries for both raw materials and the markets they serve. In 2001 E.U. regulations classified materials with possible links to Transmissible Spongiform Encephalopathy TSE as specified risk materials (SRM) and have put onerous processing specifications on this material to ensure all prions are destroyed and no possible route exists for this material to enter any food chain. Since 2001 the E.U. have carried out risk assessments on these materials and have been updating the list of SRM's when the risk is no longer thought to be present.

New animal by-products regulations come into force on 4 March 2011. They are:

1. Regulation (EC) No. 1069/2009 which lays down health rules as regards animal by-products not intended for human consumption. This regulation supersedes Animal By-products *EC Regulation 1774/2002. It is owned by Defra and is designed to protect animal health*
2. Regulation (EC) No. 142/2011 which implements Regulation (EC) No. 1069/2009

The regulation EC 1069/2009 allows for some relaxing of the legislation especially when considering its use as a fuel alternative. In EC 1774/2002 certain interpretations of the regulation banned the use of tallow as a fuel alternative which were widely regarded as being nonsensical. The revised regulation has taken a more sensible interpretation as detailed here:-

The disposal of all animal by-products is not a realistic option, as it would lead to unsustainable costs and risks for the environment. Conversely, there is a clear interest for all citizens that, provided the health risks are minimised, a wide range of animal by-products are safely used for various applications in a sustainable manner. A wide range of animal by-products are indeed commonly used in important productive sectors, such as the pharmaceutical, feed and leather industries.

New technologies have widened the possible use of animal by-products or derived products to a large number of productive sectors, in particular for the generation of energy. However, the use of those new technologies might pose health risks that must also be minimised.

Regulation (EC) No. 1069/2009

However the use of processed animal proteins PAP[7] as an animal feed is prohibited. Some pressure has been raised to try and convince the authorities to introduce inter species feeding i.e. porcine PAP to poultry and vice versa. Opposition arose as there was no belief that the renderers could produce "clean poultry" PAP with no porcine proteins, and clean porcine PAP, with no poultry proteins. It looks likely that if the rendering industry can solve this problem the regulations will be changed in 2013. Initially poultry and porcine PAP will be allowed in Aquaculture (fish food). The Aquaculture industry in the UK and the EU is seen as a growth industry. It is predicted to grow globally by 6%p.a. for the next few years. The U.K. industry is concentrated in Scotland while Norway is the big player in Europe however the US and Far East dominates the markets.

Subject to discreet species PAP processing and discreet species DNA testing being made available by 2013 the use as a feed for poultry (with porcine PAP) and pigs with poultry PAP may be allowed after 2013. It is believed that porcine DNA tests should be available mid 2013 while poultry DNA tests will not be available till 2014.
This relaxation should bring considerable financial benefits to the industry as these products have high feed value. They should also help with the excessive and escalating feed costs in the pig and poultry industries.

[7] See glossary in front of report for the difference between PAP and MBM

Section 4

Categorisation

Article 7

Categorisation of animal by-products and derived products

1) Animal by-products shall be categorised into specific categories which reflect the level of risk to public and animal health arising from those animal by-products, in accordance with the lists laid down in Articles 8, 9 and 10.
2) Derived products shall be subject to the rules for the specific category of animal by-products from which they have been derived, unless otherwise specified in this Regulation, or provided for in measures for the implementation of this Regulation which may specify the conditions under which derived products are not subject to those rules adopted by the Commission.
3) Articles 8, 9 and 10 may be amended in order to take into account scientific progress as regards the assessment of the level of risk, provided such progress can be identified on the basis of a risk assessment carried out by the appropriate scientific institution. However, no animal by-products listed in those Articles may be removed from those lists, only changes of categorisation or additions may be made.
4) The measures referred to in paragraphs 2 and 3, designed to amend non-essential elements of this Regulation, inter alia, by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 52(4).

Article 8

Category 1 material

Category 1 material shall comprise the following animal by-products:

(a) entire bodies and all body parts, including hides and skins, of the following animals:
  (i) animals suspected of being infected by a TSE in accordance with Regulation (EC) No 999/2001 or in which the presence of a TSE has been officially confirmed;
  (ii) animals killed in the context of TSE eradication measures;
  (iii) animals other than farmed and wild animals, including in particular pet animals, zoo animals and circus animals;
  (iv) animals used for experiments as defined by Article 2(d) of Directive 86/609/EEC without prejudice to Article 3(2) of Regulation (EC) No 1831/2003;
  (v) wild animals, when suspected of being infected with diseases communicable to humans or animals;
(b) the following material:
  (i) specified risk material;
  (ii) entire bodies or parts of dead animals containing specified risk material at the time of disposal;
(c) animal by-products derived from animals which have been submitted to illegal treatment as defined in Article 1(2)(d) of Directive 96/22/EC or Article 2(b) of Directive 96/23/EC;
(d) animal by-products containing residues of other substances and environmental contaminants listed in Group B(3) of Annex I to Directive 96/23/EC, if such residues exceed the permitted level laid down by Community legislation or, in the absence thereof, by national legislation;
(e) animal by-products collected during the treatment of waste water required by implementing rules adopted under point (c) of the first paragraph of Article 27:
  (i) from establishments or plants processing Category 1 material; or
  (ii) from other establishments or plants where specified risk material is being removed;
(f) catering waste from means of transport operating internationally;
(g) mixtures of Category 1 material with either Category 2

Category 2 material

Category 2 material shall comprise the following animal by-products:

a) manure, non-mineralised guano and digestive tract content;
b) animal by-products collected during the treatment of waste water required by implementing rules adopted under point (c) of the first paragraph of Article 27:
  i) from establishments or plants processing Category 2 material; or
  ii) from slaughterhouses other than those covered by Article 8(e);
c) animal by-products containing residues of authorised substances or contaminants exceeding the permitted levels as referred to in Article 15(3) of Directive 96/23/EC;
d) products of animal origin which have been declared unfit for human consumption due to the presence of foreign bodies in those products;
e) products of animal origin, other than Category 1 material, that are:
  i) imported or introduced from a third country and fail to comply with Community veterinary legislation for their import or introduction into the Community except where Community legislation allows their import or introduction subject to specific restrictions or their return to the third country; or
  ii) dispatched to another Member State and fail to comply with requirements laid down or authorised by Community legislation except where they are returned with the authorisation of the competent authority of the Member State of origin;
f) animals and parts of animals, other than those referred to in Article 8 or Article 10,
  i) that died other than by being slaughtered or killed for human consumption, including animals killed for disease control purposes;
  ii) foetuses;
  iii) oocytes, embryos and semen which are not destined for breeding purposes; and
  iv) dead-in-shell poultry;
g) mixtures of Category 2 material with Category 3 material;
h) animal by-products other than Category 1 material or Category 3 material.

Article 10

Category 3 material

Category 3 material shall comprise the following animal by-products:

(a) carcases and parts of animals slaughtered or, in the case of game, bodies or parts of animals killed, and which are fit for human consumption in accordance with Community legislation, but are not intended for human consumption for commercial reasons;
(b) carcases and the following parts originating either from animals that have been slaughtered in a slaughterhouse and were considered fit for slaughter for human consumption following an ante-mortem inspection or bodies and the following parts of animals from game killed for human consumption in accordance with Community legislation:
  (i) carcases or bodies and parts of animals which are rejected as unfit for human consumption in accordance with Community legislation, but which did not show any signs of disease communicable to humans or animals;
  (ii) heads of poultry;

material or Category 3 material or both. *Article 9*	(iii) hides and skins, including trimmings and splitting thereof, horns and feet, including the phalanges and the carpus and metacarpus bones, tarsus and metatarsus bones, of: — animals, other than ruminants requiring TSE testing, and — ruminants which have been tested with a negative result in accordance with Article 6(1) of Regulation (EC) No 999/2001; iv) pig bristles; v) feathers; animal by-products from poultry and lagomorphs slaughtered on the farm as referred to in Article 1(3)(d) of Regulation (EC) No 853/2004, which did not show any signs of disease communicable to humans or animals;
d) blood of animals which did not show any signs of disease communicable through blood to humans or animals obtained from the following animals that have been slaughtered in a slaughterhouse after having been considered fit for slaughter for human consumption following an ante-mortem inspection in accordance with Community legislation: ii) animals other than ruminants requiring TSE testing; and iii) ruminants which have been tested with a negative result in accordance with Article 6(1) of Regulation (EC) No 999/2001; e) animal by-products arising from the production of products intended for human consumption, including degreased bones, greaves and centrifuge or separator sludge from milk processing; f) products of animal origin, or foodstuffs containing products of animal origin, which are no longer intended for human consumption for commercial reasons or due to problems of manufacturing or packaging defects or other defects from which no risk to public or animal health arise; g) petfood and feedingstuffs of animal origin, or feedingstuffs containing animal by-products or derived products, which are no longer intended for feeding for commercial reasons or due to problems of manufacturing or packaging defects or other defects from which no risk to public or animal health arises; h) blood, placenta, wool, feathers, hair, horns, hoof cuts and raw milk originating from live animals that did not show any signs of disease communicable through that product to humans or animals; i) aquatic animals, and parts of such animals, except sea mammals, which did not show any signs of disease communicable to humans or animals;	j) animal by-products from aquatic animals originating from establishments or plants manufacturing products for human consumption; k) the following material originating from animals which did not show any signs of disease communicable through that material to humans or animals: i) shells from shellfish with soft tissue or flesh; ii) the following originating from terrestrial animals: — hatchery by-products, — eggs, — egg by-products, including egg shells, (iii) day-old chicks killed for commercial reasons; l) aquatic and terrestrial invertebrates other than species pathogenic to humans or animals; m) animals and parts thereof of the zoological orders of Rodentia and Lagomorpha, except Category 1 material as referred to in Article 8(a)(iii), (iv) and (v) and Category 2 material as referred to in Article 9(a) to (g); n) hides and skins, hooves, feathers, wool, horns, hair and fur originating from dead animals that did not show any signs of disease communicable through that product to humans or animals, other than those referred to in point (b) of this Article; o) adipose tissue from animals which did not show any signs of disease communicable through that material to humans or animals, which were slaughtered in a slaughterhouse and which were considered fit for slaughter for human consumption following an ante-mortem inspection in accordance with Community legislation; p) catering waste other than as referred to in Article 8(f).

Animal by-products must be processed in accordance with the following processing standards.

(a) Processing method 1 must be applied to:

(i) Category 2 material (other than manure, digestive tract content separated from the digestive tract, milk and colostrum), destined for biogas or composting plants or intended to be used as organic fertilisers or soil improvers, and

(ii) Category 1 and Category 2 material destined for landfill.

(b) Any of processing methods 1 to 5 must be applied to:

(i) Category 2 material from which the resulting protein is destined for incineration or co-incineration,

(ii) Category 2 material from which the rendered fat is destined for a Category 2 oleochemical plant, and

(iii) Category 1 or Category 2 material destined for incineration or co- the distil ileum and in animals over 12 months the head including the brain, eyes, spinal chord and tonsils. incineration.

C. *Processed products*

8. Processed products derived from Cat 1 or 2 materials, with the exception of liquid products destined for biogas or composting plants, must be permanently marked, where technically possible with smell, using a system approved by the competent authority. Detailed rules for such marking may be laid down under the procedure referred to in Article 33

9. Samples of processed products destined for biogas or composting plants or landfill, taken directly after heat treatment, must be free from heat resistant pathogenic bacteria spores (*Clostridium perfringens* absent in 1 g of the products).

Food Hygiene Regulations

The food hygiene regulations came into force on 1 January 2006 and include the hygienic production of meat.

These are:

Regulation 852/2004 which sets out the hygiene requirements for food production generally

Regulation 853/2004 which sets out the specific hygiene requirements for production of products of animal origin

Regulation 854/2004 which sets out the official control requirements for products of animal origin intended for human consumption for enforcement authorities

The regulations were based on Hazard Analysis Critical Control Point (HACCP) principles and applied to all premises producing meat.

Appendix 3. **Example of disposal routes in 2006**

Table 1: Example Of Disposal Of By-Products From Slaughtering:

Disposal channel:	Cattle Kg/Head (Carcase wt 318 kgs)	Sheep Kg/Head (Carcase wt 20 kgs)	Pigs Kg/Head (Carcase wt 76 kgs)
Carcase lean	192.54	11.70	41.08
Edible Human *	122.61	9.11	33.86 (Inc 4.11 blood)
Petfood	4.91	1.30	1.37
Rendering **	64.46	8.50 (Inc 1.93 blood)	14.89
SRM	98.52 Inc unfiltered blood, (20.13), and intestinal gut fill (15.00)	1.76	
Hide and skin	42.49	4.66	
Gut content	74.45	5.11	10.15
total live weight	599.98	42.14	101.35

Source: MLC – see Appendix 6 of this report.

Note:

**Although these are potentially edible for human consumption (as individual items or in processed products) a proportion would be used for pet food.*

*** Amount left after good separation practice, see Section 7.*

Appendix 4. **Percentage breakdown of bovine fifth quarter for England utilisation (based on processor interviews)**

	CATTLE Carcase Breakdown in Percentages	Product wt (kg)	Edible	FAT/ biofuel	Pet food	Cat 1
Carcase Meat	Lean	192.54	100%	0%	0%	0%
	Subcutaneous fat	24.39	74%	26%	0%	0%
	Intermuscular fat	41.37	74%	26%	0%	0%
	Paddywack	0.8	74%	0%	0%	26%
	Tendons	0.5	74%	0%	0%	26%
	Bone & trim waste	37.03	0%	0%	85%	15%
	Vertebral Column	18	0%	0%	74%	26%
	Spinal cord	0.18	0%	0%	0%	100%
Fats	Cod fat	4.49	74%	26%	0%	0%
	KKCF	11.18	74%	26%	0%	0%
	Caul fat	14.54	18%	81%	0%	0%
	Lung fat	1.57	18%	81%	0%	0%
	Intestines	16.77	0%	0%	0%	100%
	Intestinal fat	13.42	0%	0%	0%	100%
Tripes	Stomachs Rumen & reticulum (tripes)	9.28	60%	0%	40%	0%
	Omasum (bible)	3	60%	0%	26%	14%
	Abomasum (reed)	2.03	18%	42%	40%	0%
	Rennet	1.12	18%	56%	26%	0%
Red Offal	Kidneys	1.12	100%	0%	0%	0%
	Heart	2	100%	0%	0%	0%
	Aorta	0.23	60%	14%	26%	0%
	Lungs	3.58	0%	0%	85%	15%
	Liver	7.85	70%	0%	24%	5%
	Trachea (weasand) & trim	1.11	60%	0%	25%	15%
	Oesophagus	0.22	60%	0%	40%	0%
	Sweetbreads (thymus)	0.34	0%	0%	100%	0%
	Skirt	1.23	100%	0%	0%	0%
	Tail	1.12	100%	0%	0%	0%
	Feet - hooves	11.18	18%	0%	67%	15%
	Pizzle	0.4	56%	0%	0%	26%
Head	Head remainder incl, brain, eyes, tonsils, skull	7.41	0%	0%	0%	100%
	Tongue incl trimmings	2.24	100%	0%	0%	0%
	Cheek meat	2.12	74%	0%	0%	26%
	Lips	1.12	18%	0%	56%	26%
	Ears	1.26	1%	0%	73%	26%
	Mandible	1.5			50%	50%

	CATTLE	Product wt (kg)	Edible	FAT/ biofuel	Pet food	Cat 1	Hide	Cat 2	Pharm
	Blood	20.13	0%	0%	100%	0%	0%	0%	0%
Hide	**Hide**	17.66	1%	0%	0%	0%	100%	0%	0%
	Split	18.9	16%	0%	0%	0%	84%	0%	0%
	Hair	5.93	0%	0%	0%	0%	0%	100%	0%
Grass	**Stomach contents**	65	0%	0%	0%	0%	0%	100%	0%
	Intestinal fill	25	0%	0%	0%	0%	0%	100%	0%
Unpopular offals	**Gall bladder**	0.07	0%	0%	44%	0%	0%	0%	56%
	Gall	0.47	0%	0%	0%	0%	0%	0%	74%
	Pancreas	0.38	0%	0%	100%	0%	0%	0%	0%
	Spleen	0.89	0%	0%	100%	0%	0%	0%	0%
	Udder	0.97	0%	0%	100%	0%	0%	0%	0%
	Residual material, incl, reproductive organs,udder & other waste	0.9	0%	0%	100%	0%	0%	0%	0%
	Waste	7.27	0%	0%	0%	100%	0%	0%	0%

Carcase Breakdown by weight in kg

Appendix 5. **Tonnages of Bovine fifth quarter for England utilisation (based on the processor interviews)**

	Cattle Breakdown weight (tonnes)	**Product wt (kg)**	% live weight	**Edible**	**FAT/ biofuel**	**Petfood / Cat3**	**Cat 1**
Carcase Meat	Lean *	**192.54**	32%	309,644	-	-	-
	Subcutaneous fat *	**24.39**	4%	29,130	10,094	-	-
	Intermuscular fat *	**41.37**	7%	49,411	17,121	-	-
	Paddywack *	**0.8**	0%	955	-	-	331
	Tendons *	**0.5**	0%	597	-	-	207
	Bone & trim waste *	**37.03**	6%	-	-	50,629	8,923
	Vertebral Column	**18**	3%	-	-	21,498	7,449
	Spinal cord	**0.18**	0%	-	-	-	289
Fats	Cod fat	**4.49**	1%	536	1,858	-	-
	KKCF	**11.18**	2%	13,353	4,627	-	-
	Caul fat	**14.54**	2%	4,315	19,068	-	-
	Lung fat	**1.57**	0%	466	2,059	-	-
	Intestines	**16.77**	3%	-	-	-	26,970
	Intestinal fat	**13.42**	2%	-	-	-	21,582
Tripes	Stomachs Rumen & reticulum (tripes)	**9.28**	2%	8,989	-	5,936	-
	Omasum (bible)	**3**	0%	2,906	-	1,242	677
	Abomasum (reed)	**2.03**	0%	602	1,364	1,298	-
	Rennet	**1.12**	0%	332	1,005	464	-
Red Offal	Kidneys	**1.12**	0%	2,091	-	-	-
	Heart	**2**	0%	3,096	-	120	-
	Aorta	**0.23**	0%	156	-	214	-
	Lungs	**3.58**	1%	-	-	4,895	863
	Liver	**7.85**	1%	8,908	-	3,055	662
	Trachea (weasand) & trim	**1.11**	0%	1,075	-	443	267
	Oesophagus	**0.22**	0%	213	-	141	-
	Sweetbreads (thymus)	**0.34**	0%	-	-	547	-
	Skirt	**1.23**	0%	1,978	-	-	-
	Tail	**1.12**	0%	1,801	-	-	-
	Feet	**11.18**	2%	3,318	-	11,968	2,694
	Pizzle	**0.4**	0%	360	-	-	166

Carcase Breakdown by weight in kg

Appendix 5 cont

		Product wt (kg)	% live weight	Edible	FAT/ biofuel	Petfood /Cat3	Cat 1	Hide	Cat 2	Pharm
Head	Head remainder incl, brain, eyes, tonsils, skull	**7.41**	1.23%	-	-	-	12,380	-	-	-
	Tongue incl trimmings	**2.24**	0%	3,602	-	-	-	-	-	-
	Head & cheek meat incl trimmings	**2.12**	0%	2,532	-	-	877	-	-	-
	Lips	**1.12**	0%	332	-	1,005	464	-	-	-
	Ears	**1.26**	0%	30	-	1,475	521	-	-	-
	Mandible	**1.5**	0%			1,949				
	Blood	**20.13**	3%	-	-	32,373	-	-	-	-
Hide	Hide	**17.66**	3%	-	-	-	-	28,450	-	-
	Split	**18.9**	3%	4,805	-	-	-	25,591	-	-
	Hair	**5.93**	1%	-	-	-	-	-	9,537	-
Grass	Stomach contents	**65**	11%	-	-	-	-	-	104,533	-
	Intestinal fill	**25**	4%	-	-	-	402,051	-		-
Unpopular offals	Gall bladder	**0.07**	0%	-	-	50	-	-	-	63
	Gall	**0.47**	0%	-	-	195	-	-	-	56
	Pancreas	**0.38**	0%	-	-	611	-	-	-	-
	Spleen	**0.89**	0%	-	-	1,431	-	-	-	-
	Udder	**0.97**	0%	-	-	1,560	-	-	-	-
	Residual material, incl, reproductive organs,udder & other waste	**0.9**	0%	1	-	1,447	-	-	-	-
	Waste	**7.27**	1%	-	-	-	11,692	-	-	-
Wt of live animals Kg		**600.51**								
Carcase weight		**314.63**								
Total weight of carcases			506,860	453,982	57,196	144,454	498,528	54,040	114,070	119
Number of animals	Red Offals 26,363 Tonnes of product	1610973		0%	0%	0%	0%	0%	0%	0%

Appendix 6. **Percentage Utilization of Ovine 5th quarter for England (based on Interview)**

Carcase Breakdown by weight in kg

	SHEEP	Product wt (kg)	% Live weight	Main Edible Tonnes	Edible co-products Tonnes	Cat 3 / Petfood Tonnes	Cat 1 Tonnes	FAT/ biofuel Tonnes
Carcase Meat	**Meat**	16.37	39%	142,261	-	-	-	-
	Bone & waste	3.58	8%	20,723	-	10,388	-	-
	Spinal cord	0.05	0%	-	-	-	435	-
Tripes	**Intestines**	1.31	3%	-	11,096	-	288	-
	Intestinal fat	0.57	1%	-	594	1,036	-	3,324
	Rumen & reticulum (tripes)	0.68	2%	-	2,183	3,577	150	-
	Omasum & abomasum	0.34	1%	-	354	2,526	75	-
Cat 1 offals	**Illeum**	0.05	0%	-	-	-	435	-
	Spleen	0.11	0%	-	-	-	956	-
Fats	**Caul fat**	0.74	2%	771	-	-	-	5,660
	Lung fat	0.34	1%	-	354	1,245	75	1,280
	KKCF	0.68	2%	708	-	1,236	-	3,965
Red Offal	**Kidneys**	0.11	0%	956	-	-	-	-
	Heart	0.23	1%	1,999	-	-	-	-
	Liver	0.7	2%	4,954	-	1,052	77	-
	Sweetbreads (thymus)	0.06	0%	521	-	-	-	-
	Skirt	0.23	1%	1,999	-	-	-	-
	Tail	0.3	1%	2,244	-	320	44	-
	Trachea (weasand) & trim	0.06	0%	63	-	446	13	-
Unpopular offals	**Lungs**	0.45	1%	469	-	3,343	99	-
	Feet	0.82	2%	-	2,632	4,313	180	-
	Oesophagus	0.11	0%	517	-	438	-	-
	Gall bladder	0.02	0%	-	-	169	4	-
	Gall	0.02	0%	-	-	169	4	-
	Pancreas	0.11	0%	-	-	932	24	-

Appendiz 6 cont

	SHEEP	Product wt (kg)	% Live weight	Main Edible Tonnes	Edible co-products Tonnes	Cat 3 / Petfood Tonnes	Cat 1 (T)	FAT/ biofuel (T)	Skins Tonnes	Cat 2 Tonnes
Head	Head		0%	-	-	-	-	-	-	-
	Tongue	0.14	0%	153		816	254		-	-
	Head & Cheek meat	0.3	1%	313		1,749	545		-	-
	Brain	0.11	0%	115		641	200		-	-
	Eyes	0.02	0%	-		137	36		-	-
	Remainder incl skull	1.14	3%	-	-	6,647	3,260	-	-	-
	Blood	1.93	5%	-	-	16,348	425	-	-	-
Hide	Reproductive organs	0.7	2%	3,329	-	2,600	154	-	-	-
	Fleece and pelt	3.69	9%	-	-	-	-	-	32,067	-
	Wool	0.97	2%	-	-	-	-	-	8,430	-
Grass	Gut contents	5.11	12%	-	-	-	-	-	-	44,408
		42.15		182,094	17,214	60,130	7,734	14,229	40,497	44,408

Main Edible Tonnes	Edible co-products Tonnes	Cat 3 / Petfood Tonnes	Cat 1 Tonnes	FAT/ biofuel Tonnes	Skins Tonnes	Cat 2 Tonnes

Appendix 7. **Carcase Breakdown by percentage of live weight**

SHEEP		Product wt (kg)	Main Edible	Edible co-products	Cat 3 / Petfood	Cat 1	FAT/ biofuel
Carcase Meat	**Meat**	16.37	100.0%	0.0%	0.0%	0.0%	0.0%
	Bone & waste	3.58	66.6%	0.0%	33.4%	0.0%	0.0%
	Spinal cord	0.05	0.0%	0.0%	0.0%	100.0%	0.0%
Tripes	**Intestines**	1.31	0.0%	97.5%	0.0%	2.5%	0.0%
	Intestinal fat	0.57	0.0%	12.0%	20.9%	0.0%	67.1%
	Rumen & reticulum (tripes)	0.68	0.0%	36.9%	60.5%	2.5%	0.0%
	Omasum & abomasum	0.34	0.0%	12.5%	85.0%	2.5%	0.0%
Cat 1 offals	**Illeum**	0.05	0.0%	0.0%	0.0%	100.0%	0.0%
	Spleen	0.11	0.0%	0.0%	0.0%	100.0%	0.0%
Fats	**Caul fat**	0.74	12.0%	0.0%	0.0%	0.0%	88.0%
	Lung fat	0.34	0.0%	12.0%	42.1%	2.5%	43.3%
	KKCF	0.68	12.0%	0.0%	20.9%	0.0%	67.1%
Red Offal	**Kidneys**	0.11	100%	0.0%	0.0%	0.0%	0.0%
	Heart	0.23	100.0%	0.0%	0.0%	0.0%	0.0%
	Liver	0.7	86.7%	0.0%	12.0%	1.3%	0.0%
	Sweetbreads (thymus)	0.06	100.0%	0.0%	0.0%	0.0%	0.0%
	Skirt	0.23	100.0%	0.0%	0.0%	0.0%	0.0%
	Tail	0.3	86.1%	0.0%	12.3%	1.7%	0.0%
	Trachea (weasand) & trim	0.06	12.0%	0.0%	85.5%	2.5%	0.0%
Unpopular offals	**Lungs**	0.45	30.4%	0.0%	67.1%	2.5%	0.0%
	Feet	0.82	0.0%	36.9%	60.5%	2.5%	0.0%
	Oesophagus	0.11	54.1%	0.0%	45.9%	0.0%	0.0%
	Gall bladder	0.02	0.0%	0.0%	97.5%	2.5%	0.0%
	Gall	0.02	0.0%	0.0%	97.5%	2.5%	0.0%
	Pancreas	0.11	0.0%	0.0%	97.5%	2.5%	0.0%
Head	**Head**						
	Tongue	0.14	12.6%	0.0%	67.1%	20.3%	0.0%
	Head & Cheek meat	0.3	12.0%	0.0%	67.1%	20.9%	0.0%
	Brain	0.11	12.0%	0.0%	67.1%	20.9%	0.0%
	Eyes	0.02	0.0%	0.0%	79.1%	20.9%	0.0%
	Remainder incl skull	1.14	0.0%	0.0%	25%	75%	0.0%

Appendix 7 cont..

	SHEEP	Product wt (kg)	Main Edible	Edible co-products	Cat 3 / Petfood	Cat 1	FAT/ biofuel	Skins	Cat 2
	Blood	1.93	0.0%	0.0%	54.0%	46.09%	0.0%	0.0%	0.0%
Hide	**Reproductive organs**	0.7	54.7%	0.0%	42.7%	2.5%	0.0%	0.0%	0.0%
	Fleece and pelt	3.69	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
	Wool	0.97	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
	Gut contents	5.11	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Appendix 8. **Commercial Companies dealing with 5th quarter products**

Main non abattoir companies involved in collecting and treating edible offal and animal by-products in the UK

OFFALS and ECP for EXPORT					
Company Name	Location		**Type**	**Specialise In**	**Part of which group**
Ashfield Foods	Ipswich	ECP		Export	
Elmgrove	Dungannon NI	ECP			Dunbia
GPS	Essex	Offal and ECP		Export	
Heys		Offal and ECP		Green tripe collected and processed at home site.	
Irish Casings		Offal and ECP			
Robin Pearson	Paisley			Wholesaler – deals in edible offal	
RUNNERS					
Asco		ECP		runners	
De Weijd		ECP		runners	
Devro		ECP		Artificial casings from collagen	
Irish Casings	S Ireland	ECP		runners	
Harder Bros	Leeds	ECP		runners	
Oris	Sunderland	ECP		runners	Van Hessen
Weschenfelder		ECP		runners	
Iman Casings	S Ireland	ECP		runners	
PETFOOD					
Company Name	Location	ABP	**Type**	**Specialise In**	**Part of which group**
Alba Proteins	Dumfries	Cat 3	Intermediate Plant	Alba Proteins specialise in the processing of cat 3 material from abattoirs	Part of Leo Group Ltd. collect and processes animal by-products into meals, oils and petfood ingredients.
Perimax/PDM	Arbroath, Angus	MRM	Processa chicken & pork bones	Meat ingredients for food industry; reformed meats, meatballs, mincemeat, meat emulsions,	Part of PDM
Tony Fear				Offal collection for pet food	
PDM				Offal collection for pet food	
Stafford By products				Offal collection for pet food	
Asco				Offal collection for pet food	
Oakley				Offal collection for pet food	
Anglia Canners				Offal collection for pet food	
Durham Animal Feeds				Offal collection for pet food	
Mildland Meats				Offal collection for pet food	
JK Petfoods					
C & D Pet foods			Dried		Part of ABP
HIDES AND SKINS					
A Hayden (By-products) Ltd	Inverness IV1 1SU	Cat 3	Intermediate Plant	Collects hide and skins	
Sandyford Hide and Skins	PA3 4HP Paisley	Cat 3	Intermediate Plant		
WJ & W Lang	Paisley			Lang Wet blue hides supply Major wet blue supplier to sister companies	Part of Scottish Leather Group Ltd. Incl. Bridge of Weir Leather Company and Andrew Muirhead & Son Ltd.
Roger Smith				Hides agent	
Bradford H&S				Hides and skins	
Marshall Farmer	8 depots	Cat 3		Hides and skins	
FAT MELTING MBM & PAP RENDERER					
Caledonian Proteins purchased by Dundas in 2008	Motherwell	Cat 3	Fat & PAP	Renderer	
	Dumfries	Cat 1	Fat & MBM		

A Hughes and Sons	Lincoln	Cat 1	Fat & MBM		
Omega	Bradford	Cat 1	Fat & MBM	Renderer	Part of Leo Group Ltd.
	Penrith	Cat 3	Fat & PAP		
Oran				Renderer	
Saria bought PDM & APC in 2012	Doncaster, Widnes Nuneaton Nottingham	Cat 3 Cat 1		Renderer	Saria own 49% of co.
Nortech	Leeds	Edible		Fat melter,	
Pointons	Stafford	Cat 1	Fat & MBM	Renderer	Cat 3
		Cat 3	Fat & PAP		
Duncrue Food Processors	NI			Fat melter	
Scot Proteins	Inverurie	Cat 1			
Foyle Proteins					
Lynergy used to be Dengannon proteins	Dungannon NI				
JG Pears	Market Harboroug h	Cat 3		Fat & derivatives	
J Knight	London	Cat 3		PAP and Fat	
BLOOD TREATMENT					
APC	Doncaster			Blood treatment	Part of PDM/Saria
Regal	NI			Blood treatment	Part of PDM/Saria
J Knight	London	Cat 3		PAP and Fat	

In addition there are a small number of abattoirs that have on site cat 3 rendering or fat melting operations