

# The role of fat processing and rendering in the European Union animal production industry

Stephen Woodgate, Johan van der Veen

European Fat Processors and Renderers Association (EFPRA). Standing technical group. Greenleigh, Kelmarsh Rd. UK-LE 16 9RX Leicestershire (United Kingdom). E-mail : stephen@beaconresearch.co.uk

This paper describes fat processing and rendering systems as it relates to the activities of the European Fat Processors and Renderers Association (EFPRA). The paper is laid out in sections. Firstly a general section deals with all common aspects relating to the activities of EFPRA members. Secondly, specific issues are discussed with regard to a) fat processing, b) animal by-products not intended for human consumption. Finally, a summary is given, which concludes that given the state of science today ; a) the activities of EFPRA members are vital to the sustainable operation of the animal livestock-food chain and to the environment ; b) the products from the industry may be regarded as safe if the following standards are applied – safe sourcing, safe processing, safe use ; c) the application of these principles will allow the re-entry of certain products manufactured by EFPRA members into the food chain.

**Keywords.** Food and feed industry, fat processing, rendering, animal by-products.

## 1. COMMON ASPECTS

### 1.1. Introduction

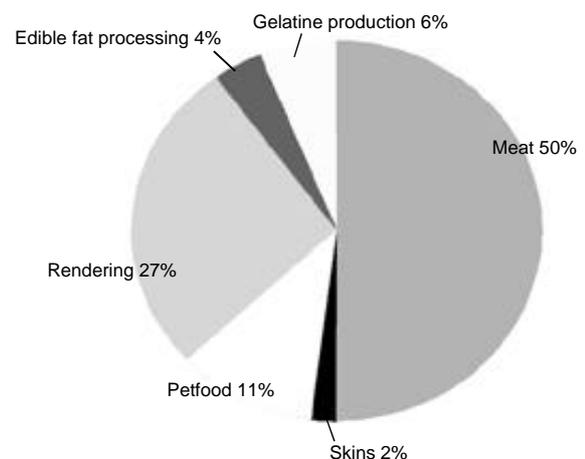
When animals are slaughtered to produce meat for human consumption approximately 50% of the animal is turned into animal byproducts (**Figure 1**). In the EU, approximately 17 million tonnes of slaughter by-products are produced by the meat industry every year. Over 14.5 million metric tonnes of this total comes from animals declared fit for human consumption. The rendering and fat processing industry provides the vital outlet for these materials by transforming them into a wide variety of products. From this raw material, over 1.5 million metric tonnes of fat and three million metric tonnes of protein are produced by this industry annually.

A variety of by-products have made a contribution to the value of the animal, by finding their way into a wide variety of applications either before or after further processing. Traditional uses for the protein rich solids include use in foods, pet foods, livestock feeds, and fertilizers. Fats have been transformed into soaps and oleochemicals (fatty acid derivatives) in addition to being used in food, pet foods and feed applications.

However, many of these traditional applications have been lost or severely curtailed as a result of BSE, and newer alternative uses as energy/fuel sources have been developed over the past five years. From 2000, certain outlets for products have been restricted and new outlets have needed to be found. These include

using protein meals and animal fats as energy sources in combustion units for the generation of steam or renewable electricity.

Nonetheless, animal by-products contain high levels of water and have a very suitable biological and microbiological composition which, if not stabilised, can lead to decomposition and environmental pollution. The most conventional way of stabilising raw material is to process the raw material with heat. This serves to both evaporate the water content and sterilise at the same time: this process is known as “Rendering”.



**Figure 1.** Estimated utilization of slaughtered animal (by % weight).

In light of the events during the last ten years or so, much of the value to the livestock industry has been lost because the by-products could not be used in traditional applications. This fact has highlighted the potential for “added value” from the activities of EFPPRA members, and has also served to promote the future re-application of animal by-products through efficient and safe processes.

## 1.2. Processing

The word “Rendering” is an old word which can mean different things to different people. In its simplest form, Rendering means “to Render open” (or split) – by heat processing – raw material into a solid (protein meal) and a liquid (fat is a liquid at elevated temperatures). While in theory this would cover all aspects of animal by-product processing, the practical word Rendering has in many cases become synonymous with the processing of inedible animal by-products.

However Rendering also describes the processing of edible grade by-products and in these circumstances Edible Rendering should be clearly stated, although many still prefer to use the term “fat processing”.

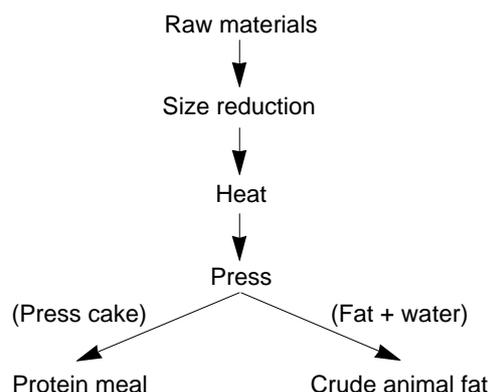
There are two main systems of rendering, described as either wet or dry systems, with the latter being further divided into natural fat and added fat systems. However, this is still rather an over simplification and in reality many types of processes are in existence through the world, and many have been altered and adapted in accordance with technical advances and legislative changes over the years.

In general, most rendering processes refer to the processing of high fat raw materials. A simplified generic process description for rendering of high fat raw material is shown in **figure 2**.

For wet melting, (shown in brackets) the heat applied is only enough to melt the fat, and both the “Meal” and “Fat” still contain water after decanting. The water is evaporated or separated in subsequent steps with the final products being protein meal and crude animal fat. More detailed schematic diagrams are shown in **figure 3A** (Wet processing) and **3B** (Dry processing).

Animal by-product processors may also process low fat materials: for example, feathers are hydrolysed and dried, to produce Hydrolysed Feather Protein (HFP). 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.

There are many types of process used in the industry and these can be most simply described in terms of system type, fat level and process condition. The possible options and/or combinations can be described in **table 1**.



**Figure 2.** Simplified generic process description.

It is difficult to generalize about the main systems in use in the EU. However, it is now realistic to say that continuous systems are now most prevalent, while all of the fat levels are commonly used. In terms of process, atmospheric and pressure systems are the most common, with stand alone vacuum systems now being obsolete.

## 1.3. Legislation and controls (HACCP, traceability and codes of practice)

The legislation regulating the two sectors are the “Meat products directive” 77/99/EEC (EU, 1977; 1992) for the fat processing sector and the “Animal by-products regulation” ABPR 1774/2002/EC (EU, 2002) for the rendering sector. A schematic description of the two sectors are shown in **figure 4**.

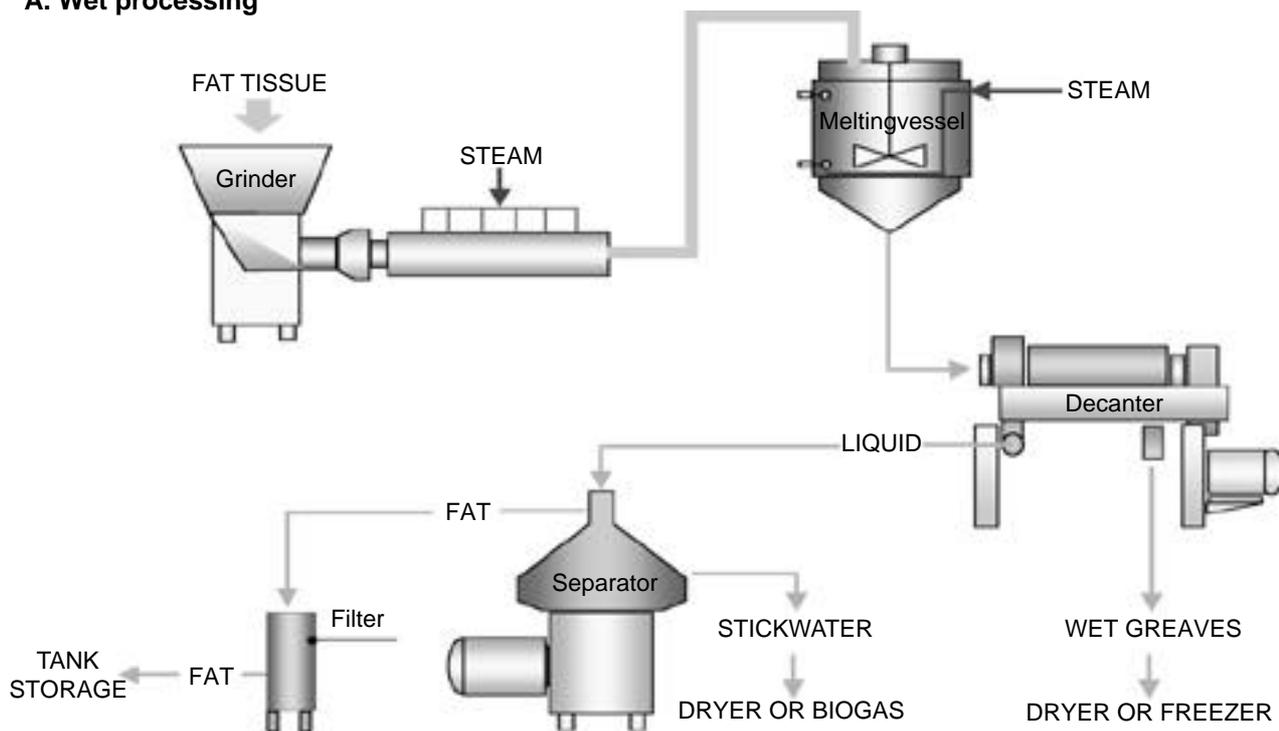
HACCP food safety principles apply to all aspects of both regulations, including the slaughterhouse, on to the processing plant and finally to the destination of the products. Movement documentation, combined with HACCP systems at the various processing locations ensures that a fully traceable system is in place from farm to fork. In addition, codes of practice have been developed and adopted by various sectors in the industry, as retail pressures have added to the legislative requirements. EFPPRA STG are currently developing codes of practice to international standards (for example, to the Codex standard), together with allied industries and potential users such as the animal feed associations FEFAC and Copac/Cocega

**Table 1.** Overview of processing techniques.

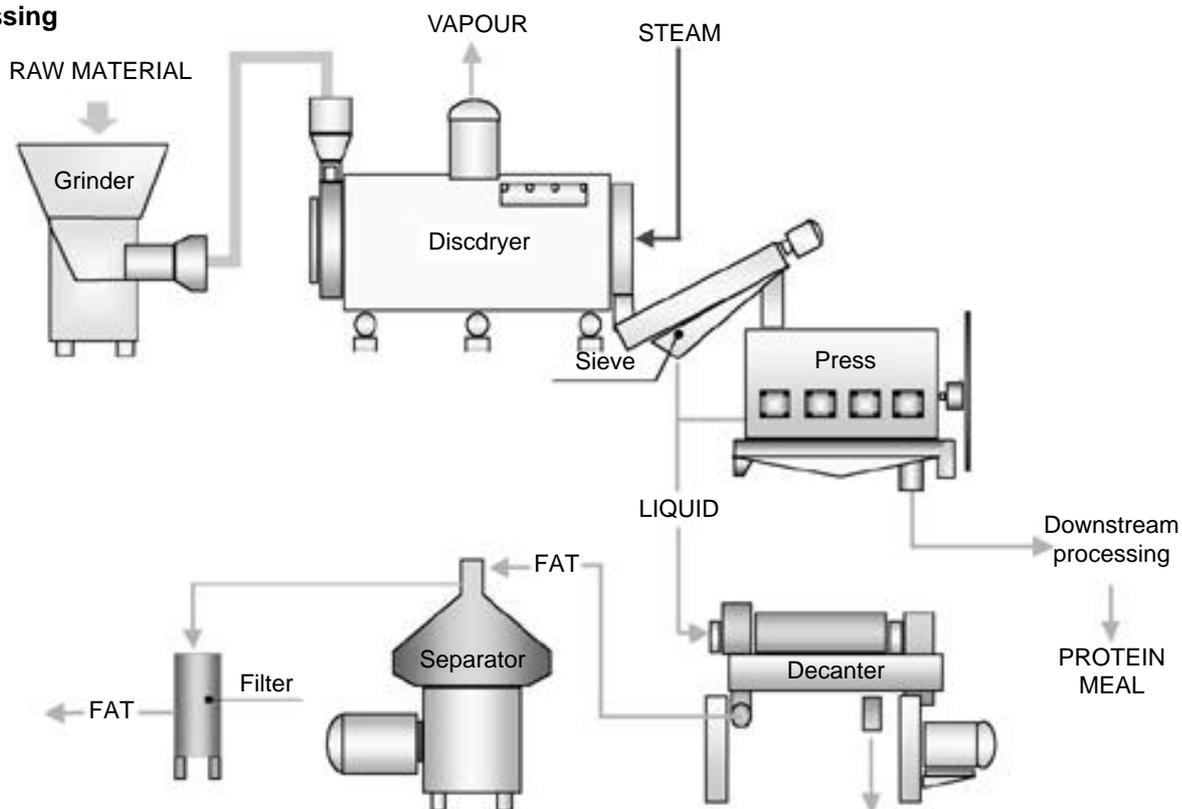
### Rendering — Fat processing

System: batch or continuous  
 Fat level: natural fat or added fat or de-fatted  
 Process: atmospheric or vacuum or pressure

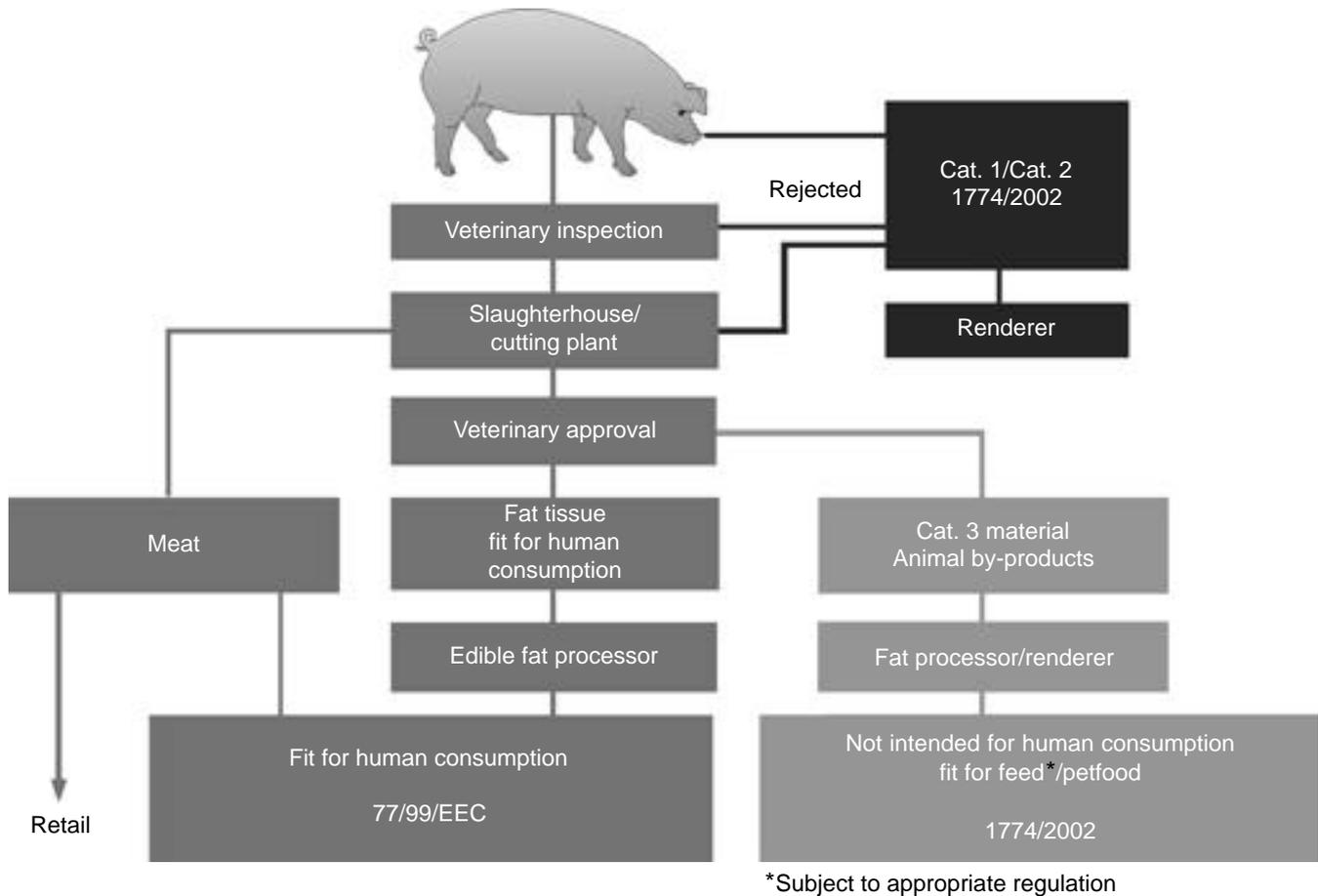
**A. Wet processing**



**B. Dry processing**



**Figure 3.** Schematic diagrams of two rendering processes.



**Figure 4.** Schematic diagram of animal by products and appropriate regulatory regimes.

## 2. SPECIFIC ASPECTS

### 2.1. “Edible” fat processing

**Introduction.** Lipids are of vital importance. Without lipids there is no life, we can't think, and we experience no sense. The main categories of lipids are the triglycerides or fats. Fats are major components in daily foodstuff and provide for a significant part of our energy needs. Apart from that fats are a sustainable energy source they have many other biological functions, as storage of fat soluble vitamins (vitamin A, D, E, and K), supply of essential fatty acids and protection of organs. Body fats can easily be oxidised to provide energy for metabolic processes or increasing the body temperature. Triglycerides are composed of glycerol and three fatty acids. Every triglyceride has its own combination of fatty acids determining the functional properties of the fat or oil, like for example a lower melting point for unsaturated fatty acids containing double bonds. Fatty acids are in dietary foods of fundamental importance as part of the synthesis of polar lipids like phospholipids and glycolipids for the production of lipid bilayers of cell

membranes and intracellular messengers. Additionally fatty acids regulate enzyme activity and the expression of genes related to the lipid metabolism (Rossell, 2001). In spite of all these positive biological functions animal fats have a negative reputation concerning obesity and increasing “bad” LDL-cholesterol with concerns developing coronary heart disease (CHD). So far there is however no conclusive proof delivered that a high consumption of animal fat is the cause of these diseases. Even the contribution of saturated fats in relation to CHD has led to extensive scientific disagreement (Gurr, 1999). Research has conducted that the ratio of different fatty acids plays a part in the development of CHD, but even this can not be disconnected from the other ingredients in dietary food. In general a balanced ratio of saturated, mono-unsaturated and polyunsaturated fatty acids is suggested for dietary foods (1:1:1). In the recent publication of Mensink on the effects of dietary fatty acids and carbohydrates on the HDL cholesterol ratio was observed that the consumption of trans fatty acids is the most harmful macro-ingredient in the terms of risk on CAD (coronary artery disease) (Mensink *et al.*,

2003). In this meta-analysis of 60 trials was estimated that trans fatty acids, arising from partly hydrogenated vegetable fats, have with a factor of 7.3 more adverse effect on CAD compared to saturated fats. It is suggested that changes in food, for example the high sugar consumption connected to the quick transformation of sugar into body fat reserves, go much faster than alterations in genetic material as the possible cause of most of the prosperity diseases. An optimal and balanced ratio between the different food ingredients related to age and exercise is the key to improve health and body weight.

**Animal fats.** For animal fats a number of characteristics are of importance to determine the quality of food and feed. The odour is not easy to measure, but is significant for acceptance as food or feed. A low percentage of free fatty acids (FFA) in combination with a low peroxide value (POV) is explained as a fresh product. The peroxide value is a size for the oxidation of fatty acids. Adding anti-oxidants can slow down the oxidation process in fats. Furthermore moisture and insoluble impurities (II) should be as low as possible in animal fats. Typically freshly melted edible animal fats have the following commercial specification; FFA < 0.50%, POV < 4%, moisture < 0.20% and II < 0.02% (typical value < 0.01%, not detectable). The commercial specifications of animal fats derived by fat processors, destined for e.g. calf milk replacers and pet foods, are traditionally much stricter than the legal specifications. For instance, insoluble impurities have not been acceptable for a long time for the production of calf milk replacers as in practice they block the nozzles of spray dryers.

**Fat processing industry.** Fat processing is a serious business activity to create added value in the animal chain. The European association of fat processors (Unega) is in 2001 merged with the European association of renderers (Eura) into a new organisation EFPPA (European Fat Processors and Renderers Association) to inform the public about the industrial application of animal slaughter by-products. Fat processors and renderers have the aim to be transparent in the animal chain and to act as responsible entrepreneurs to create added value. The business of fat processors is historically determined by the processing of animal slaughter by-products exclusively from approved animals for human consumption. The fat processing activity is divided into the production of animal fats and proteins fit for human consumption in accordance with directive 77/99/EEC (EU, 1977) and the processing of category 3 material (former low risk material) from approved animals for human consumption in conformance with

regulation ABPR 1774/2002/EC (EU, 2002). Fat processing is historically associated with species specific processing and the production of high-grade animal fats for specific markets like the bakery industry, calfmilk replacers and petfood. Within the framework of species specific processing the production of bovine fat, lard and poultry fat can be distinguished. Fat processors also supply animal fats to the oleochemical industry for the production of detergents, cosmetics and technical products. The produced animal proteins are wet frozen or dried and respectively used for production of foodstuffs e.g. meat products or as an ingredient for petfood. The applied processes in fat processing are wet melting, dry rendering or hybrid systems of the former. Fat processing is characterised by its fresh raw material, fat tissues, and relative mild processing conditions in order to preserve the product properties, which are essential for the applications. The quality and source of the raw material is an important aspect of fat processing. Fat tissues are freshly collected from slaughterhouses and the fat tissues (internal) from animals slaughtered today are melted at the same evening. The principle of quality control is focussed on the animal chain and based on the food safety system HACCP. The raw materials for fat processors are subject of the same quality and food safety inspections and monitoring program on environmental contaminants, growth hormones and veterinary drugs as is compulsory for meat. Fat processors are able to pay for slaughter by-products, therefore creating an added value for slaughterhouses. Recently the difference between renderers and fat processors is partly disappearing by the introduction of the animal by-product regulation ABPR 1774/2002/EC (EU, 2002). This regulation has also induced specific category 3 and species dedicated processing in the rendering business. The introduction of the animal by-product regulation in Europe has given the animal by-product industry an important impulse to make strategic choices for the processing for the food/petfood chain or for alternative uses. However harmonisation of European legislation remains a subject for attention. A few member states are still going further than the European rules, which has lead to serious disruption of the European market and complications of regulations. The most imaging example is the European acceptance of the use of animal fats in feed, where Germany has one-sided prohibited the use of all animal fat in feed, including pig fat, poultry fat and fish oil fit for human consumption. A stricter national legislation as additional safeguard for food safety is totally ineffective to protect consumers, because imported meat products are produced according to the valid European rules. In Europe we have to listen to the

opinion of European Food Safety Authority (EFSA) and harmonise the European regulations between the member States.

**Animal fats in food.** Animal fats play an important role in a balanced diet and in the manufacture of food products contributing to texture and palatability. They are a valuable source of concentrated energy and essential fatty acids needed for growth and development. In fact, lard has been suggested as an excellent alternative to cows milk fat in infant formulae due to its closer fatty acids profile to breast milk (Brooke, 1985) and lard is easily absorbed and digested (Beenion *et al.*, 1966). That all animal fats are very high in saturated fats is also a misconception, in fact for example lard contains only 40% saturated fats compared to 90% for coconut oil and 70% for butter fat. The flavour enhancing properties of lard and tallow is the reason of its application as frying agent (SFA, 1990; Rodgers, 1989). Lard is used, for hundreds of years, as a major fat for cooking. Traditionally lard is used in bread making to assist the leavening process and to soften the crumb. The soft consistency and crystalline character make lard the most suitable shortening for pastry. At the usual lower mixing temperatures of pastry, lard retains his plastic properties, while other fats become too hard. The use of lard in the bakery industry is praised in terms of colour, flakiness, flavour and tenderness (LFRA, 1993).

**Animal fats in feed.** The fatty acid composition and the melting point of fat for feed applications are important features for the production of a high quality feed pellet and a good consistency of meat. The alternative use of vegetable fats with lower melting point results into the so-called “weak” meat, which is not acceptable for consumers. For animal fats the good nutritional aspects (e.g. linoleic acid), digestibility and high energy density are playing an important part to draw up a feed composition. Feeding animal fats have especially a positive influence on the meat quality and taste. Feed producers prefer animal fats on account of the positive effect on the crystallisation characteristics for calfmilk replacers and the formation of a firm pellet for compound feeds. A firm pellet leads to higher production capacities (up to 15%) and a higher feed performance. Better economics are also relevant in the case of feeding animal fats, i.e. lower feed costs, higher feed performance and higher return on animal by-products. The fatty acid composition of the fat used for feeding monogastric animals is of direct influence on the composition of the fat stored by the animal. Fats are especially stored under the skin and around specific organs, like kidneys. But also muscular tissue contains fat, inducing more tendered and tasteful meat (Petz, 2003).

**Tallow and TSE risk.** In general tallow is accepted as being safe towards TSE transmission, when it is sourced from healthy animals and treated with an appropriate purification process (SSC, 1998; 2001; 2002; 2003a). The numbers of empirical publications concerning the significance of tallow in the transmission of BSE are limited. Experimental challenge infecting cattle via dietary tallow has never been attempted. Taylor observed in his empirical study with brain injection of mice, that industrial produced tallow, even using the lowest time-temperature combination and the source was highly infective, was free from detectable TSE infectivity (Taylor *et al.*, 1995; 1997; MAFF *et al.*, 1997). Besides tallow, animal protein was also subject of the research project from Taylor. The experiments from Taylor were based on industrial related processes and the results for animal protein were translated into the current well-known inactivation conditions of 133°/20/3 bars as put down in EU-directive 96/449/EC (EU, 1996) [currently regulation ABPR 1774/2002/EC (EU, 2002)]. Schreuder confirmed in 1998 the efficacy of pressure cooking in inactivating BSE in his study related to the rendering procedures (Schreuder *et al.*, 1998). It is still striking that the inactivation results for animal proteins from the Taylor study were readily translated into legislation and the results regarding tallow from the same study are still contested. Especially in Germany and Denmark have been speculations on the possible significance of tallow in TSE transmission. Inquiries on the variation in incidence of BSE have indicated that the BSE incidence is not consistent with the use of tallow in feed (Wilesmith *et al.*, 1988; AID, 2002; Japan, 2003a; 2003b). The Japanese and Dutch BSE inquiries have cleared tallow as possible route for transmission. The Dutch research team of the AID concluded that the calf milk replacers hypothesis was not confirmed by facts. The change that BSE contamination of Dutch bovine animals via this route has taken place was considered on the basis of the research results practically out of the question. In 20% of the Dutch BSE cases were the calves only fed with own cow-milk. Appel *et al.* (2001) dedicated their study on tallow to the use in oleochemical processes on the heat stability of prions in water, lipid and lipid-water mixtures. There were some questions formulated about the efficiency of prion inactivation in a hydrophobic environment with very low water activity. This resulted in a second on going research project by Riesner together with APAG (not yet published) on the efficiency of inactivation under complete oleochemical processing conditions. The Scientific Steering Committee (SSC) has in several scientific opinions established that tallow in feed is safe to use under certain conditions (max 0.15%

insoluble impurities, SRM removal, food/feed grade). To silence the discussion on the use of tallow the commission asked EFSA to carry out a quantitative risk assessment of the residual BSE risk in bovine derived product concerning tallow, gelatin and dicalcium phosphate. This assessment is expected to be published in the second half of 2004. Furthermore the SSC has reported that there is no evidence of natural occurrence of TSE in non ruminant farmed animal producing food, such as pigs and poultry (SSC, 1999; 2000; 2003b; EU, 2003a). An oral challenge of pigs with BSE contaminated material (Wells *et al.*, 2002) has not resulted in a clinical case after seven years of exposure.

As for distribution, there is no TSE discussion on the use of pig fats and poultry fats, there is no scientific basis for banning pig or poultry products from feed for farmed animals.

## 2.2. "Rendering": animal by-products not intended for human consumption

**Introduction.** A large number of different rendering processes have been used over the years. Since 1994, and now confirmed in the ABPR 1774/2002/EC (EU, 2002) are the five generic methods approved by the regulation. A summary of the five methods is shown in **table 2** with more details given in **figure 5** and **table 3**.

All mammalian processed animal proteins must be submitted to method 1 (pressure cooking), as either as a pre- or post-process (pet foods applications excepted). This overview indicates that method 1 can be used either as continuous or batch systems, however methods 3, 4 and 5 are nearly always continuous systems.

**Regulatory controls.** The ABPR 1774/2002/EC (EU, 2002) came into force on 1<sup>st</sup> May 2003 and introduced the requirement for many specific controls, many with regard to Processed Animal Proteins, (PAP). The regulation lays down key points in the handling,

processing and marketing of animal by-products not intended for human consumption. The precautionary principle is paramount in this regulation and therefore the highest risk group of animals and their by-products (Category 1) are required to be destroyed.

A second category of materials (Category 2) includes dead animals (without SRM), and these should be processed separately and only used for specific non-feed applications.

The third category (Category 3) includes materials from animals "slaughtered fit for human consumption". These materials, when processed to proscribed standards, can be used in a range of applications – including animal feeds. These categories are briefly summarised in **table 4**.

Any co-mixing of animal by-products of different categories always results in the down grading of all of the mixture to the lower category, so considerable care has to be taken at all positions in the collection and processing systems to ensure complete segregation.

In theory, a range of processing options is now available for the processing of animal by-products (**Table 5**). However, while Category 3 ABP may be processed by any processing, Category 1 and 2 ABP's have limited disposal or application opportunities.

**Disposal/Energy recovery.** The current regulation controlling what is prohibited and what is allowed in animal feed, is the TSE Regulation 999/2001 (EU, 2001), amended by Commission Regulation 1234/2003 (EU, 2003a). This latter regulation effectively replaces the "temporary" feed ban (2000/766/EC).

The complete prohibition of animal proteins, which included many protein sources not directly related to TSE's, was a result of the European Commission realising that there were no effective controls for the high risk protein sources such as ruminant or mammalian meat and bone meal.

Since the ban was put in place in December 2000, all producers of animal by-products have been economically disadvantaged as alternative, mainly costly, disposal methods have required to be used.

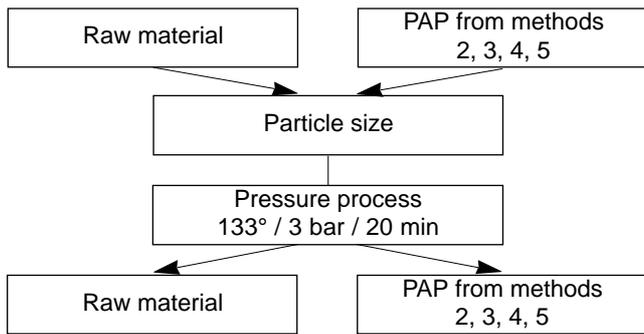
Although, new systems have been developed since 2000, and the costs of disposal have reduced where energy recovery has been effected in co-incineration systems.

The use of composting and anaerobic digestion (bio-gas) for some categories of animal by-products has become more common since the advent of the ABPR 1774/2002/EC (EU, 2002). However, the main problem with these technologies is that they have uncertain end sales values and thus the cost of processing and thus the value of animal by-product is unclear.

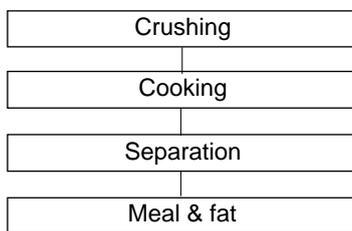
**Animal feeding opportunities.** The hierarchy of value of animal by-products to the animal agriculture

**Table 2.** EU rendering process overview.

ABPR/1774 Process Method	General Description	Continuous (C) or Batch (B)	Pre or Post Method 1
1	133°C/3 bar/20 min	C or B	Not applicable
2	Atmospheric Natural fat	B	Pre & Post
3	Atmospheric Natural fat	C (B)	Pre & Post
4	Atmospheric Added fat	C (B)	Pre & Post
5	Atmospheric De-fatted	C (B)	Post

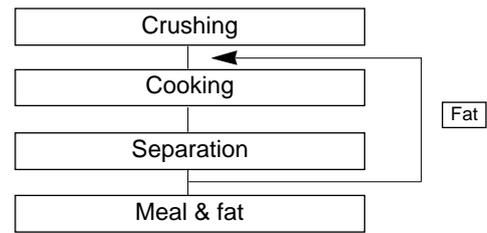


**Method 1.** Pressure/batch or continuous. Applied to mammalian material either as a “pre” pressure process (raw material) before entering any one of methods 2–5 or it is applied as a “post” pressure process after completion of any one of the methods 2–5.

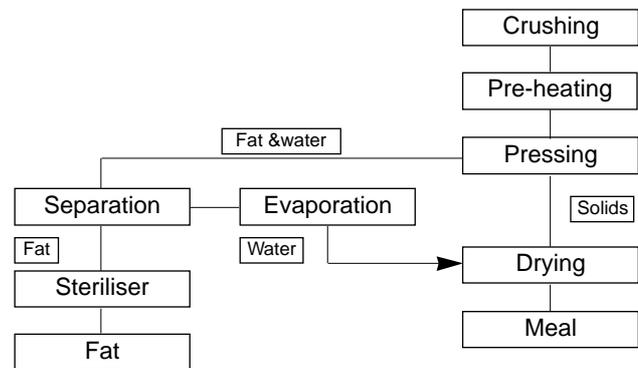


**Method 2.** Atmospheric/natural fat/batch. Where necessary, the material is reduced in size by crushing. It is then heated in a steam-jacket vessel (often with a steam-heated rotor) to remove the inherent moisture. The moisture is driven off as water vapour at atmospheric pressure. After drying/cooking, the material is then separated into its liquid/tallow and solid/protein fraction, normally by mechanical means before being made into animal protein meal by milling.

**Method 3.** Atmospheric/natural fat/batch or continuous. Where necessary, the material is reduced in size by crushing. The material then passes into a steam-heated vessel where the inherent moisture is driven off as water vapour at atmospheric pressure. Progress of the material through the vessel is controlled by means of displacement and mechanical restrictions to ensure that the final product, when discharged from the cooking/drying operation, has achieved the necessary time and temperature. After drying/cooking the material is separated into its liquid/tallow and solid/protein fraction, normally by mechanical means, before being made into animal protein meal by milling.



**Method 4.** Atmospheric/added fat/batch or continuous. Where necessary, the material is reduced in size. The material then passes into a steam-heated vessel where a constant level of hot liquid fat/tallow is maintained. The principles of deep fat frying takes place with the passage of the raw material through the vessel and is controlled by means of displacement and mechanical restrictions to ensure that the cooked / dried material is discharged with all of its residual moisture removed at atmospheric pressure as water vapour. On discharge, any surplus fat not required to maintain the cooker/drier working level is removed, normally by draining and mechanical means and the solid fraction protein is made into protein meal by milling.



**Method 5.** Atmospheric/de-fatted/batch or continuous. Where necessary the raw material is reduced in size. It is then heated to a temperature at which coagulation of the material takes place. Then, by mechanical forces (normally by pressing) the inherent liquid phase of fat and water are removed from the solids. The solids then pass to a drying/cooking system, to remove inherent moisture and produce a solid fraction of protein which are made into protein meal by milling. The liquid phase is further treated to separate and recover the fat/tallow by centrifugation before final heat sterilisation. The water phase is normally evaporated before final drying with the solid protein fraction.

**Figure 5.** Description of approved processing systems ABPR 1774/2002/EC (EU, 2002).

industry dictates that every effort must be made to focus on the processing systems, such as fat processing or rendering, that can yield in valorized saleable products. Here the main efforts are concentrated upon the maximum use of animal proteins and fats in animal feeding.

To facilitate the production of animal proteins and fats that meet the specific requirements of ABPR 1774/2002/EC (EU, 2002), means that production facilities for “Category 3 Feed grade products” are dedicated to only the processing of Category 3 animal by-products from animals fit for human consumption.

**Table 3.** Notes and definitions.

**Natural fat** The naturally occurring fat present in most raw materials. There may be a small amount of recycled processed tallow to assist drying, but minimal effects on the residence time of particles through the system must be maintained.

**Added fat** Substantial amounts of tallow that are added to raw materials prior to the sterilising phase. Ratios of tallow : raw materials of 0.5 : 1 up to 5 : 1 are in common use. Variations in the ratios of fat recycled can affect raw material residence time and the parameters set.

**De-fatted** Raw material is made suitable for de-fatting by heat coagulation followed by mechanical pressing. The low-fat protein residue is subsequently dried and sterilised.

**Separation** The initial separation or pre-separation of the fat from the dried and sterilised materials. This can be effected by either draining or centrifuging.

**Meal production** This generally includes pressing of the separated material to produce a press cake, except for pre-pressing systems. Subsequently the press cake or meal is ground to produce a meal suitable for distribution.

In addition, facilities will most likely be specific to species in order to meet the requirement of the intra-species PAP feeding ban.

The new regulation brings the opportunity to open the animal feed market to a significant portion of animal by-products. However, there will be very strict controls on the use of such materials, including registration of all premises (from farm, abattoir, production/rendering, feed mill and farm again).

Spot checks on cross contamination, and the prohibition of intra-species recycling will ensure that controls and policing will be required at member state and EU official levels. In practice, protein meals will need to be made as species pure i.e. porcine, bovine, avian and fed to species other than themselves. For example, poultry meal may be used in pig, and aquaculture feeds but not in poultry feed.

**Control tools.** Controls are the key to unlocking the door to allowing some specific animal proteins back into farmed animal feeds, and there are two specific control areas that the European Commission is specifically highlighting: markers for banned materials, and species identification for banned and approved proteins.

Work on both aspects have been supported by EFPRASTG and research in both marker and species identification projects have been, in the main, conducted between JRC /DG SANCO and the EFRA STG.

**Table 4.** Categories of raw material in ABPR 1774/2002/EC (EU, 2002).

<b>C1</b>	Highest risk	Destroy
<b>C2</b>	Medium Risk	Process/limited use
<b>C3</b>	Low Risk	Process/feed

**Table 5.** Processing alternatives in ABPR 1774/2002/EC (EU, 2002).

Incineration	Disposal
Co-Incineration	Energy / Products
Landfill	After processing to specific standards
Composting & anaerobic digestion	Compost and biogas
Technical Applications	Oleochemical and biofuels
Pet Foods	Raw and processed (fresh/frozen)
<b>Processing ie "Fat process/Render"</b>	Saleable products

**Markers.** Markers are required both in respect of the ABPR 1774/2002/EC (EU, 2002) for Category 1 and 2 raw materials and products. It is vital to the feed industry that both Category 1 and 2 materials are adequately stained with an inedible dye and possibly with a second "invisible" (chemical) marker to avoid the possible incorporation of banned products into feed. It is expected that at least one of the markers can be detected after a heat processing step such as rendering, in both protein products and rendered fat. Following the introduction of these marker systems, it is hoped that the Commission will feel confident that Category 1 or 2 materials cannot find their way into feeds for farmed animals.

**Species identification.** As a consequence of ABPR 1774/2002/EC (EU, 2002) and the TSE regulations there are two reasons to be able to identify the species of animal that was used to produce a processed animal protein. The EC established a project to investigate and develop species identification methods (STRATFEED) and the EFRA STG have been prominent in working as part of this project (Gizzi *et al.*, 2003).

With the advent of animal proteins being allowed back into feed in a step wise progression, it is likely that some feeds may contain animal proteins which are approved, whilst others remain prohibited. It is

therefore essential that a feed can be tested and if animal protein is present a method is able to determine if it is of avian or bovine/ovine/porcine origin (for example). The current (and only) approved method for detecting animal protein is a microscopy method (EU, 2003b) which is sensitive to rather low levels (~ 0.1%) but is unable to discriminate between different land animal species. The microscopy method can discriminate fish from land animals but not discriminate between avian, porcine, bovine, ovine, so there are limitations.

It is rather disappointing to report that no other method has yet proven to be reproducible and reliable in terms of validation tests with reference materials. Difficulties with reaching the detection limits suggested by DG SANCO are compounded by the problems that arise from dealing with heat and pressure processed animal proteins. This latter fact makes techniques that rely upon some aspect of protein configuration, i.e. antibody/Elisa systems or even PCR (using DNA) rather temperamental to say the least.

Further work is needed in this area and more is being planned by members of EFPRASTG and several of the analytical research groups that have been attempting to find reproducible, reliable and hopefully inexpensive method(s). Although the STRATFEED project is officially completed it is hoped that more EC research will be initiated if required.

**Future steps.** EFPPRA considers that, given the positive control aspects of the animal by-products regulations, on for example, the separation and marking of raw materials and processing plants, consideration should be given to the re-introduction of certain approved products into animal feeds without the requirement for fully validated species identification methods.

In this context, the re-introduction of appropriate poultry and porcine based products into feeds for allowed farm animals should be approved if strict channeling can be guaranteed. This approach may be considered in the light of both the high demand for approved (derogated) animal proteins and the fact that difficulties continue with identification of these species as they are not detectable by the microscopy method.

Dedicated aquaculture species and poultry feed mills (in addition to the already approved pet food manufacturing plants) would give the possibility of ensuring that dedication from process through to use can be approved and regulated by the competent authorities.

Further relaxations of the current animal feeding ban could be considered in the light of future developments of the species identification methods.

### 3. CONCLUSIONS

The activities of the European Fat Processors and Renderers Association [EFPPRA] are described in relation to generation of animal by-products from animals raised for the production of human food in Europe. The general processing techniques used by the fat processing and rendering sectors are also shown and the common aspects are considered.

Special considerations for each aspect of “Fat processing”, “Rendering” (Animal by-products not intended for human consumption) and “TSE risk” as it relates to both sectors, are discussed.

Conclusions that relate to the current state of science are possible. It is clear that the activities of EFPPRA members are vital to the sustainable operation of the animal livestock-food chain and even if products are not utilised as before, the connection is still essential. At the current time it also can be concluded that animal fats have a higher valorization compared to processed animal proteins. In addition, the current move away from feeding proteins to animals farmed for human consumption has emphasised the role of EFPPRA members in their enhancement of the environment. Production of natural and clean fuels for energy generation is an example of how EFPPRA members have met the challenge of keeping the livestock cycle operational.

However, when considering the economic hierarchy for slaughter by-products, the re-entry of certain products back into the food chain either directly as human food or *via* animal feed is recognised as being essential to the long term effectiveness of the European livestock industry.

The key elements of safety may be summarised as

- safe sourcing,
- safe processing,
- safe use.

Application of the state of science today and in the future (including TSE science, but not excluding other aspects such as health and welfare) can ensure that these elements are met. Thereafter, the application of these principles will allow the re-entry of certain products manufactured by EFPPRA members into the food chain in a stepped progression. Under current circumstances, some products that are verifiably channelled from source to use may be approved immediately, while others may require more progress to be made with the development of control tools, and in particular species identification tools. EFPPRA STG commits itself to the continued research and development required to meet the objectives set by the European Commission and the European Parliament to allow the re-entry of approved products back into the food chain.

**Glossary of terms and abbreviations***Regulations (and short reference number)*

ABPR: Animal by-product regulation (1774/2002/EC)  
 TSE Reg: Transmissible Spongiform Encephalopathy regulation (999/2001/EC)

*Terms or abbreviations*

Edible fat: Fat removed from animals slaughtered fit for human consumption

ABP: Animal by-product (unprocessed) not intended for human consumption

TSE's: Transmissible Spongiform Encephalopathies (BSE and scrapie)

Animal feed: Feed for animals farmed or fattened for food

PAP: Processed Animal Protein

RAF: Rendered Animal Fat

HFP: Hydrolysed Feather Protein

HACCP: Hazard Analysis Critical Control Point

SSC: Scientific Steering Committee

*Government /Authorities*

DG SANCO: Directorate-General; Health and Consumer Protection

EFSA: European Food Standards Authority

JRC: Joint Research Centre (of EU)

Code: Codex Alimentarius (Joint foods standards programme of FAO/WHO)

FAO: Food and Agriculture Organization of the United Nations

WHO: World Health Organization

*Trade Associations*

EFPPRA: European Fat Processors and Renderers Association

EFPRASTG: EFPPRA Standing Technical Group

FEFAC: European Feed Manufacturers Association

Copac/Cocega: European Cooperative for Farmers

**Bibliography**

AID (2002). Algemene Inspectiedienst of the Dutch Ministry of Agriculture, Nature and Food Quality. *Bovine Spongiform Encephalopathie: second opinion, 18 Oktober 2002*. [online] [18/10/04], 20 p. Available <[http://www9.minlnv.nl/servlet/page?\\_pageid=112&\\_dad=portal30&\\_schema=PORTAL30&p\\_item\\_id=78278](http://www9.minlnv.nl/servlet/page?_pageid=112&_dad=portal30&_schema=PORTAL30&p_item_id=78278)>

Appel TR., Wolff M., von Rheinbaben F., Heinzl M., Riesner D. (2001). Heat stability of prion rods and recombinant prion protein in water, lipid and water-lipid mixtures. *J. Gen. Virol.* **82**, p. 465–473.

Beenion E., Stewart J., Bamford GST. (1966). Baking fats in cake making. London: Leonard Hill Books, p. 48–49.

Brooke OG. (1985). Absorption of lard by infants. *Hum. Nutr.: Appl. Nutr.* **39A**, p. 221–223.

EU (1977). Council Directive 77/99/EEC of 21 December 1976 amended and updated into council directive 92/5 EEC of February 10, 1992 on health problems affecting intra-Community trade in meat products. *Off. J. L026*, 31/01/1977, p. 85–100.

EU (1992). Council Directive 92/5/EEC of 10 February 1992 amending and updating Directive 77/99/EEC on health problems affecting intra-Community trade in meat products and amending Directive 64/433/EEC. *Off. J. L057*, 02/03/1992, p. 1–26.

EU (1996). Commission Decision 96/449/EC of 18 July 1996 on the approval of alternative heat treatment systems for processing animal waste with a view to the inactivation of spongiform encephalopathy agents. *Off. J. L184*, 24/07/1996, p. 43–46.

EU (2000). Council Decision 2000/766/EC of 4 December 2000 concerning certain protection measures with regard to transmissible spongiform encephalopathies and the feeding of animal protein. *Off. J. L306*, 07/12/2000, p. 32–33. [online] [13/10/04], 2 p. Available <[http://europa.eu.int/eur-lex/pri/en/oj/dat/2000/l\\_306/l\\_30620001207en00320033.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2000/l_306/l_30620001207en00320033.pdf)>.

EU (2001). Regulation (EC) No 999/2001 of the European Parliament and of the Council of 22 May 2001 laying down rules for the prevention, control and eradication of certain transmissible spongiform encephalopathies. *Off. J. L147*, 31/05/2001, p. 1–40. [online] [13/10/04], 40 p. Available <[http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l\\_147/l\\_14720010531en00010040.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_147/l_14720010531en00010040.pdf)>.

EU (2002). Regulation (EC) No 1774/2002 of the European Parliament and of the Council of 3 October 2002 laying down health rules concerning animal by-products not intended for human consumption. *Off. J. L273*, 10/10/2002, p. 1–95. [online] [13/10/04], 95 p. Available <[http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l\\_273/l\\_27320021010en00010095.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l_273/l_27320021010en00010095.pdf)>.

EU (2003a). Commission Regulation (EC) No 1234/2003 of 10 July 2003, amending Annexes I, IV and XI of regulation (EC) No 999/2001 of the European Parliament and of the council and regulation (EC) No 1326/2001 as regards transmissible spongiform encephalopathies and animal feeding. *Off. J. L173*, 11/07/2003, p. 6–13. [online] [13/10/04], 8 p. Available <[http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l\\_173/l\\_17320030711en00060013.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_173/l_17320030711en00060013.pdf)>.

EU (2003b). Council Directive No 2003/126/EC of 23 December 2003 on the analytical method for the detection of constituents of animal origin for the official control of feedingstuffs. *Off. J. L339*, 24/12/2003, p. 78–84. [online] [13/10/04], 7 p. Available <[http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l\\_339/l\\_33920031224en00780084.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_339/l_33920031224en00780084.pdf)>.

Gizzi G., van Raamsdonk LWD., Baeten V., Murray I., Berben G., Brambilla G., von Holst C. (2003). An overview of tests for animal tissues in feeds applied in response to public health concerns regarding bovine

- encephalopathy. *Rev. Sci. Tech. Off. Int. Epizoot.* **22** (1), p. 311–331.
- Gurr MI. (1999). *Lipids in nutrition and health: a reappraisal*. Bridgwater, United Kingdom: Oily Press.
- Japan (2003a). Japanese press communication, Contaminated feed caused BSE outbreak. *The Japanese Times*, 28 August 2003. [online] [18/10/04]. Available <<http://www.japantimes.co.jp/cgi-bin/getarticle.p15?nn20030828a3.htm>>.
- Japan (2003b). *Japanese BSE investigation report, unofficial translated passages from the official report. Concerning the investigation into the source and route of BSE infection – report on the results of the epidemiological analysis by the BSE epidemiological investigation team*. Unofficial English Translation, Dutch Ministry of Agriculture, The Hague. September 2003.
- LFRA(1993). *Focus on lard, the facts and the fiction in the interest of better eating*. Survey of research literature undertaken by Leatherhead Food Research Association, on behalf of the Lard association (available at EFPRA).
- MAFF (Ministry of Agriculture and Fisheries UK), IAH (Institute of Animal Health), De Mulder P., CNEVA (France) (1997). *Inactivation of the BSE and scrapie agent during the rendering process*. Final report of the study contract No 8001 CT90 0033, MAFF, London.
- Mensink RP., Zock PL., Kester ADM., Katan MB. (2003). Effects of dietary fatty acids and carbohydrates on the ratio of serum total to HDL cholesterol and on serum lipids and apolipoproteins: a meta-analysis of 60 controlled trials. *Am. J. Clin. Nutr.* **77**, p. 1146–1155.
- Petz E., Dutch Meat Board (2003). Der inhalt des Futtertroges ist entscheidend. *Pro Fleisch* **18**, p. 6–7.
- Rodgers T. (1989). *Problems and opportunities of small fryers*, *Food RA Symposium Proceedings*, 35, March, p. 91–108.
- Rossell B. (2001). *Oils and fats volume 2: animal carcass fats*. ISBN n° 905748743, Leatherhead Publishing, Leatherhead (UK).
- Schreuder BEC., Geertsma RE., van Keulen LJM., Van Asten AAM., Enthoven P., Oberthür RC., de Koeijer AA., Osterhaus ADME. (1998). Studies on the efficacy of hyperbaric rendering procedures in inactivating bovine spongiform encephalopathy (BSE) and scrapie agents. *Vet. Rec.* **142**, p. 474–480.
- SFA (1990). *Edible Oils Manual*. Alexandria (Virginia, USA) Snack Food Association, p. 5–17.
- SSC (1998). *The safety of tallow derived from ruminant tissues. Adopted opinion at the scientific steering committee meeting of 26-27 March 1998 following a public consultation on the preliminary opinion adopted on 19–20 February 98*. [online] [13/10/04], 16p. Available <[http://europa.eu.int/comm/food/fs/sc/ssc/out11\\_en.pdf](http://europa.eu.int/comm/food/fs/sc/ssc/out11_en.pdf)>.
- SSC (1999). *Intra-Species Recycling: the risk born by recycling animal by-products as feed with regard to propagating TSE in non-ruminant farmed animals. Adopted opinion by the scientific steering committee at its meeting of 17 September 1999*. [online] [13/10/04]. Available <[http://europa.eu.int/comm/food/fs/sc/ssc/out60\\_en.html](http://europa.eu.int/comm/food/fs/sc/ssc/out60_en.html)>.
- SSC (2000). *The scientific basis for banning animal protein from the feed for all farmed animals, including pig, poultry, fish and pet animals. - Adopted opinion by the scientific steering committee at its meeting of 27-28 November 2000*. [online] [13/10/04], 17 p. Available <[http://europa.eu.int/comm/food/fs/sc/ssc/out150\\_en.pdf](http://europa.eu.int/comm/food/fs/sc/ssc/out150_en.pdf)>.
- SSC (2001). *The safety of tallow obtained from ruminant slaughter by products. Revised opinion and report adopted by the scientific steering committee at its meeting of 28-29 June 2001, editorial clarifications introduced at the SSC meeting of 6-7 September 2001*. [online] [13/10/04], 28 p. Available <[http://europa.eu.int/comm/food/fs/sc/ssc/out228\\_en.pdf](http://europa.eu.int/comm/food/fs/sc/ssc/out228_en.pdf)>.
- SSC (2002). *Update of the opinion on TSE infectivity distribution in ruminant tissues. Adopted opinion by the scientific steering committee at its meeting of 10–11 January 2002 and amended at its meeting of 7–8 November 2002*, [online] [13/10/04], 53 p. Available <[http://europa.eu.int/comm/food/fs/sc/ssc/out296\\_en.pdf](http://europa.eu.int/comm/food/fs/sc/ssc/out296_en.pdf)>.
- SSC (2003a). *The safety of tallow derivatives from cattle tallow. Adopted opinion by the scientific steering committee on 10-11 April 2003*. [online] [13/10/04], 3 p. Available <[http://europa.eu.int/comm/food/fs/sc/ssc/out359\\_en.pdf](http://europa.eu.int/comm/food/fs/sc/ssc/out359_en.pdf)>.
- SSC (2003b). *The potential requirement for designation of specified risk materials in pigs. Adopted opinion by the scientific steering committee at its meeting of 6-7 March 2003*. [online] [13/10/04], 16 p. Available <[http://europa.eu.int/comm/food/fs/sc/ssc/out319\\_en.pdf](http://europa.eu.int/comm/food/fs/sc/ssc/out319_en.pdf)>.
- Taylor DM., Woodgate SL., Atkinson MJ. (1995). Inactivation of the BSE agent by rendering procedures, *Vet. Rec.* **137**, S. 605–610.
- Taylor DM., Woodgate SL., Fleetwood AJ., Cawthorne RJG. (1997). The effect of rendering procedures on scrapie agent. *Vet. Rec.* **141**, S. 643–649.
- Wells GAH., Hawkins SAC., Austin AR., Ryder SJ., Done SH., Green RB., Dexter I., Dawson M., Kimberlin RH. (2002). Studies of the transmissibility of the agent BSE to pigs. *J. Gen. Virol.* **84**, p. 1021–1031.
- Wilesmith JW., Wells GAJ., Cranwell MP., Ryan JBM. (1988). Bovine spongiform encephalopathy: epidemiological studies. *Vet. Rec.* **123**, p. 638–644.