6. Rendering

Introduction

6.1 The rendering industry processed the waste from the carcasses of cattle and other farm animals. The process involved crushing the raw material followed by the indirect application of heat. This evaporated the moisture and enabled the fat, known as ‘tallow’, to be separated from the high-protein solids, known as ‘greaves’. In its purest form, tallow is a creamy-white substance. Annex A to this chapter describes how it is further processed. The greaves were pressed, centrifuged or subjected to a process of solvent extraction to remove more tallow, before being ground into meat and bone meal (MBM). In the 1980s, both tallow and MBM had a good commercial value, although it was the tallow which was the primary product of rendering.

6.2 Slaughterhouses use renderers to fulfil their statutory obligation to dispose of animal by-products within 48 hours of slaughter and, before the emergence of BSE, were paid by them for material that might otherwise have been considered useless waste. Epidemiological work carried out in 1988 by Mr John Wilesmith of the CVL suggested that compound animal feed containing infective MBM was the primary mechanism by which BSE spread throughout the UK. Thus the industry plays a central role in the BSE story. Mr Wilesmith subsequently concluded that changes to rendering processes in the early 1980s might have led to the emergence of the disease (see vol. 3: The Early Years, 1986–88).

6.3 It has become a widely held belief that BSE was allowed to emerge as a result of the relaxation by the Government of controls over the rendering process, coupled with a lowering of standards by renderers. The evidence received by the Inquiry does not support either conclusion, as is discussed more fully below.

6.4 This chapter looks first at some of the main features of the industry. It then goes on to describe the various processes in rendering as at 1986, and examines some issues relevant to the role of the industry in the emergence and spread of BSE. Finally it shows how the industry adapted to changes during the period covered by the BSE story, including changes in the handling of the offal designated as Specified Bovine Offal (SBO).

Some features of the industry

6.5 Some form of rendering industry has been in existence for centuries, producing tallow for candles and soap, and edible fat. During the Second World War, it was in the national interest that as much animal waste as possible should be processed and recycled in order to reduce food, feed and other imports. As noted in Chapter 7 under the heading ‘The reason for widespread use of MBM in cattle diets’, animal feedstuffs for young stock were required to include a minimum of 5 per cent by
weight of animal-protein-rich substances such as MBM. The rendering industry was thus organised to produce this protein from slaughterhouse waste, and continued to do so after wartime restrictions were lifted in 1953.

6.6 From the 1960s, more efficient, high-volume ‘continuous rendering’ systems became available, gradually replacing many of the older-style ‘batch processing’ systems. The change took place over a number of years, continuing until the mid-1980s. Technological advances, stricter controls on effluent and odours, and higher energy costs all favoured larger, more efficient plant, as did the concentration of supply of slaughterhouse waste which resulted from the post-war restructuring of the slaughtering industry. About the only advantage of batch rendering systems over continuous rendering systems was their ability to process small amounts of waste economically. The other major change in the process was the phasing out of solvent extraction, which fell out of favour in the mid- to late 1970s. Continuous and batch processing and solvent extraction are described in more detail below, and in Annex B to this chapter.

6.7 By 1985, roughly half of the approximately 1.3 million tonnes or so of raw material processed annually was being dealt with in the 10 per cent of plants that had a normal weekly capacity in excess of 1,000 tonnes. The new, larger continuous rendering plants outpaced local supplies of raw materials. They had to look further afield, thus competing with other, less efficient renderers, not only for customers but also for this raw material. The number of rendering plants fell from about 120 in the 1960s, to around 100 in 1979 and roughly 70 in 1986. Many firms closed, merged or were taken over.

6.8 By 1985 a single firm, Prosper De Mulder (PDM), and its subsidiaries, processed around 44 per cent of animal waste in Great Britain. PDM had grown by taking over other firms. A report by the Monopolies and Mergers Commission (MMC) on the position in 1985 concluded that, although there was a monopoly in favour of PDM, this did not operate against the public interest. Nor did the MMC expect it to in future, because PDM performed an essential service effectively and reliably; it did so without undue pollution of the environment; and it was economically efficient. The report did, however, recommend that an undertaking be obtained from PDM in relation to the pricing of certain future contracts to ensure that there was no exploitation of its monopoly position.

6.9 The concentration of the industry continued with further mergers taking place. By 1991 PDM’s share of the market had grown to 55 per cent in Great Britain and 60 per cent in England and Wales. A second MMC report in that year concluded that a merger with Croda, which would add a further 5 per cent to PDM’s market share in England and Wales, nonetheless did not operate against the public interest. By 1992 PDM was processing about 64 per cent of the red meat waste in England and Wales and 80 per cent of the poultry waste. At the same time, in Scotland, William Forrest and Son (Paisley) Ltd had about 71 per cent of the red meat waste supply. A third MMC report found that each had a monopoly and that there were

355 L3 tab 1B
356 Animal Waste: A report on the supply of animal waste in Great Britain, p. 34 (M4 tab 1)
357 S33 Rogers para. 16
358 Animal Waste: A report on the supply of animal waste in Great Britain, April 1985, CM 9470 (M4 tab 1), pp. 88–100
some effects adverse to the public interest.\textsuperscript{362} It recognised that animal waste collection and rendering ‘constitutes a vital public service as well as a commercial activity’, but made some recommendations intended to remedy the effect on competition of these firms’ pricing policies.

6.10 In Northern Ireland there were two principal renderers: Lisburn Proteins, which used a batch cooker system, supplemented from 1984 by a wet rendering Atlas process, to deal with about 50,000 tonnes of raw material a year and Ulster Farm By-Products, which used a batch cooker system until 1983 and thereafter a continuous system (modified from dry to wet in 1984) to process about 38,000 tonnes a year. A third renderer Duncrue Food Processors, began processing in 1981 and used a batch cooker system.\textsuperscript{363}

Geography of UK rendering plants, their suppliers and customers

Location of rendering plants

6.11 Figure 6.1 shows the locations of the major rendering plants in Great Britain in 1993, indicating which were batch systems and which continuous.\textsuperscript{364}

\textsuperscript{362} M4 tab 3 pp. 121–2
\textsuperscript{363} M12 tab 4
\textsuperscript{364} Animal Waste: A report on the supply of animal waste in England and Wales and in Scotland, (M4 tab 3)
Sources of supply

6.12 Figure 6.2 shows for each of the twelve largest rendering plants in England and Wales what proportion of its animal waste supplies were obtained from within certain distance bands in 1993, excluding supplies delivered by independent contractors. Between them, these twelve slaughterhouses held approximately 91 per cent of the market in England and Wales at that time. Figure 6.3 shows similar statistics for all three renderers operating in Scotland in 1993. The Inquiry was unable to obtain equivalent figures for Northern Ireland.
6.13 In addition, the slaughterhouses supplying the renderers could sometimes take in animals from a wide area. For example, sheep regularly went from the South West of England to Scotland for slaughter. Thus it cannot be assumed that the MBM or tallow produced by a rendering plant necessarily came from local animals.

Figure 6.2: Sources of raw material for renderers in England and Wales, 1993

Sales of MBM

6.14 Renderers sold most of their MBM to feed compounders, which were located throughout the UK. Smaller plants would sell more locally, but still up to a 200-mile radius.

6.15 Renderers also sold MBM to brokers and merchants. Brokers acted as middlemen, arranging purchases between renderers and buyers, without actually purchasing the MBM in their own right. Merchants, on the other hand, bought MBM on their own account and sold it on to their customers. Brokers and merchants
sold mostly to animal feed manufacturers, but also to larger farms and distributors. The renderer was unlikely to know the final destination of the MBM, which could be some distance from the plant.  

6.16 Renderers sold only a very small proportion of total MBM directly to farmers, usually within 30 miles of the plant. Thus, generally, neither the cattle killed in a slaughterhouse supplying a renderer nor the customers of that renderer were necessarily located close to the rendering plant.

**Processes involved in rendering in 1986**

6.17 Rendering involves crushing animal by-products (eg, fat, bones and internal organs), heating them to drive off the water content (which can be as high as 65 per cent by weight) and then separating the residue into fat (generally called ‘tallow’) and solids (known as ‘greaves’).

6.18 There are different grades of tallow, the grading depending on the concentration of ‘free fatty acid (ffa), colour, and general appearance, moisture and dirt content’. The single most important factor in determining grading is colour. Tallow of the highest calibre or ‘good colour’ tallow is used for soap manufacture and for human consumption, while the lower grades are used for animal feeds and fatty chemicals. The greaves were used in fertiliser or animal feed, or were processed further by pressing, centrifugation or solvent extraction to remove more tallow. After this further processing, the residue could be ground to produce MBM, which was used largely in animal feed, including pet food.

6.19 This section looks first at the types of raw material that were used by the rendering industry, and from where and how they were delivered to the rendering plant. Next, it describes the two main types of rendering, batch and continuous, and the solvent extraction process, which are important because of the interest in how these processes might have affected the BSE agent.

**Raw materials for rendering**

6.20 Renderers deal exclusively either with red meat material such as cattle, sheep and pig, or with poultry material. The term ‘MBM’ refers to meal produced from red meat animals, not poultry, so the renderers referred to in this chapter are only those processing non-poultry material.

6.21 In 1986, the material processed by renderers mostly came from slaughterhouses, and consisted of the parts of animals that were unsuitable for food or that people in the UK chose not to eat, such as:

- offal that did not have any more valuable use, such as the bladder, diaphragm and udder, as well as some intestines, kidneys, spleen, blood, stomach, heart, liver and lungs, which were only occasionally used for other purposes;

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365 T19 p. 60–3  
366 T19 p. 60–3  
367 YB92/06.00/9.3  
368 M12A lab 1 p. 17; YB89/06.06/7.3
• the head, hooves, bones and tails;
• edible fat; and
• carcasses condemned as unfit.\textsuperscript{369}

6.22 Material from other sources accounted for 10 per cent or less of the raw materials used by renderers.\textsuperscript{370} This included:

• whole carcasses of fallen stock from farms, kennels, veterinary sources (pets), and zoo animals such as antelope or giraffe; and
• waste from knacker’s yards, and from other animal by-product trades such as hunt kennels, maggot bait farms, tripe dressers and tanneries.

6.23 In addition, renderers received waste fat and bones from butcher’s shops, from food factories, and from boning-out and pre-packing operations supplying supermarkets.

6.24 Renderers could be categorised depending on the types and grades of animal material they processed. Therefore, this material was often sorted at the slaughterhouse before collection. The four main categories were as follows:

\textit{Technical rendering}

The principal ingredient in technical rendering is low grade (green) offal and condemned material obtained from slaughterhouses, and other low grade material which may contain fallen stock (or parts thereof) from knackers and hunt kennels. The tallow is used for industrial purposes, including lubricants, and some in animal feed. The meat and bone meal produced by renderers is used in animal feed rations and pet food.

\textit{Rendering to produce high grade tallows}

The raw material is the fresh fat and bones obtained from slaughterhouses, cutting plants and butcher’s shops. The tallow may be used for high quality toilet soap, for further refining, bleaching and deodorising for use in food manufacture, catering etc. Animal protein [MBM] is used in animal feed.

\textit{Edible rendering}

There are a number of plants which utilise fresh kidney suet and channel (opening) fats for direct human consumption. The raw materials are usually processed at lower temperatures to produce beef dripping for frying and ‘premier jus’ for packet suet and food manufacture. The greaves may be used in the manufacture of pet foods.

\textsuperscript{369} Journal of the Society of Leather Technologists and Chemists, vol. 88, p. 71; S33 Rogers para. 17, S37 Foxcroft paras 43, 44
\textsuperscript{370} S37 Foxcroft para. 43; S33 Rogers para. 17
Specialist plants

There are a small number of plants which specialise in processing blood, feathers and poultry material. The products are used in animal feed and pet food.\(^{371}\)

6.25 A description of the further processing of tallow can be found in Annex A to this chapter.

6.26 Some renderers would therefore arrange with the slaughterhouse or gut room contractor to separate out certain material from the rest.\(^{372}\) Other renderers operated gut rooms themselves. Any material not separated for renderers with specialised requirements would be thrown into a common skip to go to a renderer of low-grade, cheaper material. However, even among this low-grade material, the inclusion of stomach and intestine contents was discouraged by renderers:

> The presence of stomach contents in intestines is much discouraged by renderers and always has been because of – I was going to say low-yield, non-yield, from such material, and because of its effect upon the colour of tallow produced.\(^{373}\)

> This operation was all done in the in-house gut rooms. It was how well they operated as to whether there was any, or any stomach contents got into the rendering skip. But yes, we actively discouraged it.\(^{374}\)

Unfit meat and offal

6.27 Slaughterhouses sent most carcass parts that were unfit for human consumption to a renderer, in accordance with the Meat (Sterilisation and Staining) Regulations 1982.\(^{375}\) The rendering process could be expected to ensure this material was ‘sterilised’ in the sense understood by these Regulations. For the reasons given in Chapter 1, such sterilisation was not capable of destroying the BSE agent.

6.28 Knackers sent carcass parts to renderers. Material from knackers was by definition unfit for human consumption, and therefore renderers of edible material did not accept knackery material. Certain classes of unfit material and knackery material were required to be stained before they could go to renderers, to prevent them from entering the human food chain. In practice, however, the majority of unfit material received by renderers was unstained.\(^{376}\) Some renderers of inedible material refused to accept unfit material. However, those that did accept it did not have to handle it any differently from fit material, because their products were not for human consumption.\(^{377}\)

\(^{371}\) IBD1 tab 11, para. 2.4.4
\(^{372}\) T20 p. 78
\(^{373}\) T19 p. 91 – Mr Brian Rogers, Chairman of the UK Renderers’ Association (UKRA)
\(^{374}\) T19 p. 92 – Mr Bill Bacon, UKRA
\(^{375}\) L17 tab 15
\(^{376}\) T60 p. 89 – Mr Paul Foxcroft, Prosper De Mulder
\(^{377}\) T19 pp. 77, 79
Transport

6.29 Most rendering companies collected the material from slaughterhouses in their own vehicles. Some renderers, however, engaged contractors to do this. These contracting collectors mostly removed waste from butcher’s shops and small slaughterhouses, often consolidating small collections of similar materials. Material was transported either directly to the rendering plant, or to a renderer’s collection centre for consolidation and onward transport to the plant.378

Arrival at rendering plant

6.30 Upon arrival at the rendering plant, the raw material would be weighed on a weighbridge, then either stored in the container in which it arrived, dumped into reception pits, or simply unloaded onto the floor in open bays.

6.31 As noted above, the raw material from slaughterhouses was sorted before it left the slaughterhouse. Hence material could usually be rendered as a batch on arrival at the plant, although there might be some rough redistribution to preserve a desired balance in the material being used for a batch. In reference to the undesirable inclusion of stomach contents in a load of material, Mr Bill Bacon of the UK Renderers’ Association (UKRA) said: ‘If a load arrived and you had stomach contents in it, you could not or you did not turn it away. You made a great noise about it the following day.’379 A renderer specialising in edible tallow would only process a limited range of raw materials, and so would be more concerned about the content of a load than would one processing low-quality material into inedible tallow.

Manufacturing processes

6.32 The different rendering processes are described in Annex B to this chapter, as are the variations in processing time and temperature. All can be classified as either batch systems or continuous systems. As the names imply, in the former, material is cooked a batch at a time, while in the latter, raw material is fed in continuously at one end of the cooker and the finished product ejected at the other.

6.33 Batch rendering systems were used exclusively until the 1970s, when the first continuous rendering systems were introduced in the UK. As can be seen from Figure 6.4, the popularity of the various types of continuous system grew rapidly until the mid-1980s, by which time they were being used to produce at least 75 per cent of MBM in the UK. It has been suggested that the reduction in the use of batch rendering in favour of continuous rendering could have caused or contributed to the emergence of the BSE epidemic. This suggestion was made because the first identified cases of BSE were thought to have resulted from exposure to the disease in 1981/82, shortly after the time that continuous rendering became the primary method of rendering in the UK.380 This issue is considered below under the heading ‘Rendering, and inactivation of BSE’ (paragraphs 6.45ff).

378 Animal Waste: A report on the supply of animal waste in England and Wales and in Scotland, paras 2.31–2.33, (M4 tab 3)
379 T19 pp. 91–3
6.34 In both batch and continuous rendering systems, once most of the tallow and the moisture had been removed, the greaves could be further processed to extract more tallow. For instance, in a continuous rendering system, the greaves could be automatically dropped into a press after finishing the cooking process.

**Solvent extraction**

6.35 From the 1950s until the 1970s, the preferred method of extracting the tallow from greaves was solvent extraction. This extracted more tallow than other processes, so the resulting MBM had less fat in it. At that time the animal feed industry wanted MBM with fat content of only 1 to 5 per cent. Moreover, tallow fetched a much higher price than MBM. The difference more than paid for the extra cost of solvent extraction. (A description of the process is in Annex B to this chapter.)

6.36 Solvent extraction fell out of favour in the mid- to late 1970s, for the following reasons:

- the energy crisis in the 1970s dramatically raised the price of solvents;
- the price of tallow fell relative to MBM in the late 1970s, reducing the profit in producing more tallow and less MBM;
- animal feed manufacturers began to produce higher-fat feeds, with about 10 to 12 per cent of fat, and no longer required the low-fat MBM produced by solvent extraction preferring higher-fat MBM instead; and
- the use of solvents entailed a risk of fire and explosion. 381

6.37 The proportion of MBM produced in the UK that was subjected to the solvent extraction method is not clear, as there are no authoritative statistics on this point. Mr John Wilesmith collated figures for Great Britain from the mid-1960s to the mid-1980s, which are set out in Figure 6.5. Witnesses from the rendering industry, however, said that the use of solvent extraction was never particularly widespread and that at no time was more than 50 per cent of MBM produced and used in the UK solvent-extracted. 382

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381 S35 Bacon para. 17
382 S35 Bacon para. 17 and S33A Rogers para. 3 (4)
6.38 According to MAFF figures, a number of plants stopped using solvent extraction during the 1970s, and two large plants (together producing 26 per cent of rendered material) stopped in 1980/81. However, at least 27 per cent of plants carried on using the solvent extraction process after that time, and at least one plant, in Scotland, was still using the process in 1992.

Figure 6.5: Proportion of MBM produced using solvent extraction, 1964–88

6.39 With the decline of solvent extraction, the secondary extraction of tallow from the solid greaves is now usually done with a press, producing MBM with a fat content in the order of 10 to 14 per cent.

6.40 As with the shift from batch to continuous processing, the decline in the use of solvent extraction in the late 1970s has been suggested as a contributing factor in the emergence of the BSE epidemic. This is also considered below in the section on ‘Rendering and inactivation of BSE’.

Purchase of greaves for further processing

6.41 When solvent extraction was common, small rendering plants often concentrated on the production of tallow, selling their greaves to other processors for further processing and grinding. The Inquiry did not receive comprehensive statistics on the size of this trade. By 1970 about half of the greaves being solvent-extracted by PDM were said to have been purchased from other renderers. The greaves were bought from both inside and outside the UK. A ‘very high proportion’ of William Forrest & Son’s greaves was imported from Northern Ireland. When the expensive solvent extractors were later phased out in favour of the more affordable presses, smaller renderers could afford to undertake the secondary processing of greaves themselves. After the early 1980s, PDM’s purchases of greaves from renderers outside its group were described as ‘sporadic’. Nevertheless, the practice continued.
6.42 A renderer purchasing greaves from another renderer could not be absolutely certain of either the nature of its source material or the processing standards of the vendor.

**Comparison of the UK rendering process with that of other countries**

6.43 A comparison of rendering processes is set out in Annex C to this chapter. This is of interest when considering why BSE emerged in this country but not elsewhere. Unfortunately, information on processes used in different plants and details of the timing, temperatures and pressure used in other countries are difficult to obtain. The information we have gathered is therefore not comprehensive, and it is difficult to make exact comparisons.

6.44 However, similar changes to those experienced in the UK, both in the structure of the rendering industry and in the processes used, were seen throughout Europe and the United States. In particular, a movement away from solvent extraction seems to have been a common factor worldwide, and certainly the main equipment manufacturers sold their models throughout the world.390

**Rendering and inactivation of BSE**

6.45 A critical question in relation to the emergence of BSE is whether or not the widespread change from batch processing to continuous processing, or the decline in the use of solvent extraction, could have resulted in the BSE agent surviving the rendering process for the first time, and therefore being allowed to enter the animal food chain.

6.46 This is considered further in vol. 2: *Science*. As explained there, the timing of the phasing out of the more traditional processes casts doubt on the connection. In addition, laboratory experiments that attempted to replicate the conditions to which scrapie-infected material would be subjected during each of these processes were inconclusive. Essentially, the results indicated that the more heat-resistant strains of scrapie were not completely inactivated by conditions less rigorous than 133°C for a minimum of 20 minutes, or by the use of solvent extraction at 100°C for 30 minutes, although all rendering processes investigated resulted in some degree of inactivation.

6.47 This suggests that, in most cases, neither the older-style batch atmospheric systems nor the newer continuous systems, nor solvent extraction, were or are capable of completely destroying either the scrapie or BSE agents. The results of the experiments do not lend themselves, either, to a definitive conclusion on whether the change to continuous systems produced a significant change in deactivation. Of the 11 experiments used to replicate different continuous systems, all produced MBM that tested positive for scrapie infectivity, but levels of infectivity were calculated for only six of these. For these six, the levels of infectivity were slightly lower than that of the MBM produced by the experiment designed to replicate batch atmospheric processing. Therefore, it cannot be concluded from the results that either the change from batch to continuous

390 S37 Foxcroft para. 31
processing, or the decline in the use of solvent processing, was to blame for the origin of the BSE epidemic, or for a significant increase in infectivity of rendered material.

**Homogeneity of MBM**

6.48 One of the more puzzling aspects of the BSE story is why as few as one or two cattle in a herd might become infected with BSE, when the whole herd was fed the same compound feed. This gave rise to the ‘packet theory’ of infectivity, discussed in vol. 2: Science. The theory was that the rendering process might produce MBM that was not perfectly mixed and homogeneous: a small amount of BSE-infective material might end up confined to a packet or clump of MBM consumed by one or two cows, having not been broken down sufficiently during the rendering process to cause the BSE agent to spread evenly throughout the batch. Thus one cow might receive an infective dose while the remainder would not.

6.49 Mr Stephen Woodgate of PDM told the Inquiry that, in order to maintain the homogeneity and consistency demanded by its customers, PDM was careful to keep its raw material at a consistent ratio of bone and offal. Before entering the heating phase of rendering, the raw material would be crushed into particles ranging in size from 10 mm to 50 mm in diameter (the diameter in continuous systems typically being 10 mm to 30 mm). There would be a reasonable amount of mixing by turbulence in the heating medium (usually fat) particularly in systems where extra fat was added as part of the heating process. Added fat might produce more turbulence. In natural or low-fat systems (that is, those with no added fat) the material might have moved through the system in clumps, more so than in other systems. Upon leaving the heating phase, the greaves were pressed, cooled and ground into a powder or meal with a maximum particle size of 2 or 3 mm. This would be mixed during the process of storage and packaging of the MBM. In the opinion of Mr Woodgate, the MBM would be homogeneous both in terms of the mix of protein, fat and ash, and in terms of its original ingredients. However, he did agree that a 1 gram packet (about the size of a pea) might be conveyed from the raw material to the end consumer intact.391

6.50 The UK Agricultural Supply Trade Association (UKASTA) likewise provided the Inquiry with an explanation of the mixing process involved in compound feed production, and concurred with Mr Woodgate’s comment that MBM delivered to feed mills was ‘a reasonably homogeneous mixture’. UKASTA noted that assessments of the performance of feedstuffs manufacturers occurred at six-monthly intervals, and typical results showed ‘that a homogeneous distribution of trace ingredients . . . is achieved by conventional feed milling plant and equipment’.392

**Regulation of the rendering industry before 1986**

6.51 Before 1981 the rendering industry was virtually unregulated in terms of quality control and production methods. The only control was the commercial necessity to produce tallow and MBM that was acceptable to the market, although

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391 S39C Woodgate; T60, pp. 33–6
392 S24F Reed para. 9
at least one renderer considered it commercially prudent to monitor the microbiological cleanliness of its MBM voluntarily. However, the production of MBM and tallow required that the raw materials be subjected to robust processing at high temperatures for a significant period of time.

6.52 The primary piece of pre-1986 legislation regulating the rendering industry was the Diseases of Animals (Protein Processing) Order 1981, although it was geared towards the result rather than the process. It specified that processed protein must meet the ‘required biological standard’ of being salmonella-free. (Salmonella functioned as a benchmark, since any process that was vigorous enough to destroy it would also destroy most other common micro-organisms.) How the standard was met was at the discretion of the renderer. This legislation and other Regulations affecting the rendering industry before 1986 are examined in greater detail in vol. 14: Responsibilities for Human and Animal Health.

Legislative changes and developments in the process post-BSE

**Bovine Spongiform Encephalopathy Order 1988 (the ruminant feed ban)**

6.53 This Order made illegal the use of MBM derived from ruminant animals in ruminant feed. The ban was imposed initially for a limited period, but was later extended, first for another year and then indefinitely. All renderers accepted a mixture of both ruminant and non-ruminant material for rendering. Attempts to produce MBM derived only from non-ruminant material were unsuccessful, as renderers could not guarantee the exclusion of ruminant material. The renderers’ markets for MBM therefore were narrowed. However, only 15 per cent of MBM sold as a feed ingredient was used in ruminant feed. Much of the rest went into pig and poultry feed, and this was allowed until the Bovine Spongiform Encephalopathy (Amendment) Order 1996 banned this practice. Therefore, there was a minor impact on the size of renderers’ markets, but no effect on their processes.

**Bovine Offal (Prohibition) Regulations 1989 (the 1989 SBO Regulations)**

6.54 Under the 1989 SBO Regulations, which banned the use of SBO in human food, SBO could still legally be used in the production of animal feed, and animal feed manufacturers were the major buyers of MBM.

6.55 Once received by a renderer, SBO could not be sent elsewhere, unless handled in the prescribed manner. Effectively, this meant that renderers were obliged to process any SBO that they received, which is what they were doing anyway. Renderers who made products which were not for the human food market – that is,
the majority of the industry – could continue to process and sell SBO along with the rest of the raw material which they received.

6.56 Tallow produced from organs designated as SBO was usually of very low grade and so, in theory, would have been excluded from the raw material sent to renderers producing edible products for humans, even before the SBO ban. However, Mr John Baker of Midland Meat Packers said in oral evidence that, in the slaughterhouse, spinal cord might have gone in with the edible fat to be sent for rendering into human food.397 Renderers of edible material would therefore have had to beware of SBO arriving in the raw material.

Voluntary animal SBO ban

6.57 The ban on the use of SBO in human food led to UKASTA calling upon its members in November 1989 to use only MBM that was ‘substantially free [of SBO] on a best efforts basis’ in their production of animal feed. In turn, UKRA called upon its members to insist on separation of SBO from other material at the slaughterhouse, and to exclude it from MBM made for use in animal feed.398

6.58 Most animal feed manufacturers followed UKASTA’s recommendation and insisted on SBO-free MBM for their feed. Likewise most, but not all, renderers undertook the voluntary measures recommended by UKRA.399 The renderers said that they did their best to ensure that no SBO was included in material that was meant to be SBO-free, but without statutory backing they were reliant on the cooperation of the slaughterhouses. The willingness of slaughterhouse owners and managers to adhere strictly to the requirements varied.400

6.59 Because there was now little demand for SBO, its price fell and it provided a cheaper raw material for conversion into MBM than non-SBO material did. Therefore a two-tier pricing system developed for SBO-free MBM and for MBM derived from SBO, so long as there were still customers who did not insist on its being SBO-free.401

Bovine Spongiform Encephalopathy (No. 2) Amendment Order 1990 (the 1990 BSE Order)

6.60 This Order, implementing the animal SBO ban, came into force on 25 September 1990.402 It prohibited the sale and supply of SBO, and protein derived from SBO, for feeding to animals.

6.61 As seen above, many renderers had already changed their practices because of the voluntary animal SBO ban. The remainder now had to do so, and the two-tier pricing structure ended. Renderers were not in the business of selling or supplying animal feed themselves, and so there were no direct obligations on them under the Order. However, the renderers’ main customers, the animal feed manufacturers, were covered by the prohibition; so, for commercial reasons, renderers were forced to keep non-SBO material separate from SBO. No comprehensive guidance was

397 T58 p. 114
398 T60 p. 104 – Mr Brian Rogers, UKRA
399 T60 pp. 99–100; YB90/4.03/2.1–2.3; YB90/2.13/5.1
400 T60 pp. 102–3
401 T60 p. 101 – Mr Paul Foxcroft
402 L2 tab 5 article 8
provided to renderers until July 1992, when MAFF published its Code of Practice on ‘The Handling of Specified Bovine Offals (SBO) at Rendering Plants’, which is discussed below.

6.62 SBO constituted only a small proportion of the raw material received by renderers. The difficulties of ensuring that it was separated from the other material are discussed in vol. 5: *Animal Health, 1989–96*. PDM’s response to the animal SBO ban was to direct all of its SBO raw material and any raw material that contained SBO to one plant, thereby ensuring that all of its other plants were free of SBO. This increased the company’s transport costs.

**Purchase of greaves for further processing**

6.63 This practice created potential quality assurance problems for the purchaser and uncertainty about SBO content. These problems are of particular concern in the context of BSE. A renderer might itself be scrupulous about examining the raw material it received direct from slaughterhouses, but it is difficult to see how it could be absolutely certain of the origin of greaves which it purchased from another renderer for conversion to MBM, or of the quality of the processing. For example, Mr Paul Foxcroft of PDM said:

\[\ldots\] the variety of greaves received covered the full spectrum from \ldots almost black burnt material down to pink very much undercooked material. In fact, on albeit rare occasions, material was so undercooked that it was actually recooked again at Doncaster before it went into the solvent extraction plant.403

**Disposal of MBM derived from SBO**

6.64 The Order introducing the ban did not specify how such material was to be disposed of.

6.65 In January 1991, MAFF introduced inspection reports in order to confirm that renderers and collection centres that dealt with SBO were complying with the legislation.404 The inspection reports had to be submitted every two months. The process required an Animal Health Officer to answer a series of questions about each facility, including how it was disposing of SBO material.405 The results from the reports indicated that the three options being used for disposal were landfill burial, ploughing into the land and storage.406 Prosper De Mulder, for example, was storing the MBM that it had produced in the hope that it could later be used as a fuel.407 Later inspection reports recounted that some of the MBM was being used as a fertiliser. They also showed that some of the tallow derived from SBO was being used in animal feed.408 These monitoring reports are discussed more fully in vol. 5: *Animal Health, 1989–96*.

6.66 Renderers incurred extra costs in the separation, collection, processing and disposal of SBO. Furthermore, closure of all major markets for MBM derived from
SBO resulted in a reduction in revenue for renderers. This quickly led renderers to look to slaughterhouses to make up at least some of their loss of profits in the form of collection charges. Where, before the BSE crisis, slaughterhouses were paid for any waste that they sent to renderers, they were now charged for whatever was separated out as SBO and taken away by renderers:

The abattoirs [took] material from a pile where they would be paid £20 a ton for it, and put it in a pile where they would be charged £50–£70 a ton.\textsuperscript{409}

**MAFF Code of Practice**

6.67 Although not a legislative measure, the Code of Practice on the handling of SBO in rendering plants, which was published by MAFF in July 1992, was a direct response to the animal SBO ban.\textsuperscript{410} The purpose of the Code was both to provide guidance and to set out acceptable methods that would best minimise any risk of transmitting the BSE agent.

6.68 The Code of Practice considered pre-process storage and handling; process machinery used prior to cooking; cookers, centrifuges and associated equipment; and storage of processed material derived from SBO. The essence of all the guidance was the separation of SBO from other material. The maintenance of dedicated facilities at all stages was recognised as best practice but, if that was not possible, then:

- SBO should be stored separately and not be allowed to come into contact with other stored material, and after removal the storage facilities should be thoroughly cleansed.

- Separate tools and equipment should be maintained for handling and processing SBO and MBM derived from SBO, which should be clearly marked as for use with SBO, and stored apart from other equipment. Where separate equipment was not practical, all items should be thoroughly cleansed after use.

- Ideally, separate and dedicated crushers, augers and associated equipment should be used for SBO. Where this was impractical, the equipment should either be thoroughly cleansed before it was used for other material, or should be purged twice with sufficient non-SBO material (eg, the equivalent of 15 minutes normal operation). The material used to purge the equipment should then be treated as SBO.

- Ideally, separate and dedicated cookers, centrifuges and associated equipment should be used for SBO. Where this was impractical, the equipment should either be thoroughly cleansed before it was used for other material, or should be purged twice with non-SBO material. The material used to purge the equipment should then be treated as SBO. Continuous cookers should be run substantially free from solid residues, then sufficient non-SBO material (that is, the equivalent of 30 minutes normal processing) should be processed to purge the system. This material should then be treated as SBO.

\textsuperscript{409} T60 p. 94 – Mr Brian Rogers, UKRA.

\textsuperscript{410} YB92/7.002.1–2.4
All MBM derived from SBO being stored on the premises should be stored in dedicated and separate, leakproof, easily cleanable facilities.

6.69 Some of the larger renderers had multiple lines and were able to dedicate one to SBO, but the smaller renderers often only had one production line, so could not maintain dedicated facilities. Dr Brian Cooke of Dalgety Agriculture Ltd, a compound feed manufacturer, told the Inquiry that he was not satisfied that the cleaning and purging procedures in place were good enough. Mr Andrew Fleetwood of MAFF said that 15 minutes of normal operation in a large rendering plant, to purge it, would involve the processing of at least one ton of material. While this would greatly reduce the amount of SBO material in the machinery, it could not be guaranteed to purge the system completely, and certainly would not have been sufficient in view of the later discovery that 1 gram or less of material was sufficient to transmit infection.

**Bovine Spongiform Encephalopathy Order 1991**

6.70 This Order came into force on 6 November 1991. A provision which affected renderers stated that MBM derived from SBO could only be removed from a rendering plant under authority of a licence and in accordance with any conditions of that licence. The only means of disposal of MBM derived from SBO which were approved were burial in a licensed landfill site or incineration. This meant that it could no longer be used as or in fertiliser, although Mr Brian Rogers of UKRA said that this had only ever occurred ‘to a very limited extent’. This legislation is also addressed in vol. 5: Animal Health, 1989–96.

**Animal By-Products Order 1992**

6.71 This Order required, in part, that, if by-products fell within any of a list of categories of material not fit for human consumption and if the by-products were disposed of by rendering, they had to be subjected to a temperature of at least 133°C for 20 minutes at a pressure of 3 bar (ie, 2.961 atmospheres), or to any of the various rendering systems specified in Commission Decision 92/562/EEC (a). The resultant product had to be free of heat-resistant pathogenic bacteria spores and salmonella. The only requirement for rendering of other animal by-products (generally speaking, by-products which were fit for human consumption) was that the final product comply with the standards in relation to salmonella. In principle SBO was covered by this Order. In practise this did not lead to any change in handling. Given the separate provisions for handling SBO, it was excluded from the operation of this Order by the Animal By-Products Amendment Order 1996.

**Specified Bovine Offal Order 1995**

6.72 This Order, made under the Animal Health Act 1981, came into force on 15 August 1995. It replaced and extended the previous provisions relating to
SBO in the Bovine Offal (Prohibition) Regulations 1989 and the BSE Order 1991. The measures introduced by the 1995 Order affecting renderers included the requirement that SBO be rendered on a separate line dedicated to that purpose, and the SBO had to be stored, handled and rendered separately from other material. It also required the approval of any rendering plant handling SBO.

Annex A to Chapter 6: Tallow and its derivatives

Introduction

6.73 Tallow is one of the main products of rendering and has a diverse range of uses including candles, soap, chemicals and human cooking materials. The derivatives of tallow are used in a large number of pharmaceuticals, cosmetics and other industrial products.

6.74 This section describes some of the main processes of derivation. The high temperatures used in most of these processes are considered to render the derivatives safe for human use. Indeed, in 1996 the European Agency for the Evaluation of Medicinal Products (EMEA) considered that even raw tallow had no discernible infectivity of BSE. Volume 11: Scientists after Southwood describes the consideration given by MAFF and SEAC to the possible infectivity of tallow, including tallow derived from SBO.

Tallow derivatives

6.75 The main derivatives of tallow – fatty acids, fatty esters and soaps – are produced by further refinement of tallow by the oleochemical industry. There are three basic processes: hydrolysis, transesterification and saponification. Glycerol is produced in all these.

6.76 Hydrolysis, which produces glycerol and fatty acids, combines tallow and water at a high temperature (220–250°C), for between 1.5 and 10 hours. A crude fatty acid and dilute crude glycerol result, which have further high pressures and temperatures applied to them. The fatty acid is then distilled at low pressure at about 200°C to remove impurities. These acids can be further refined to make fatty alcohols, metallic soaps, fatty amines, fatty acid esters and fatty amides.

6.77 Transesterification combines tallow and methanol at temperatures over 200°C and under high pressure for longer than 20 minutes. Methyl ester and glycerine are produced. The methyl ester is distilled to remove water and impurities, and then hydrogen is added to it at temperatures in excess of 200°C. This produces tallow fatty alcohol and methanol. The tallow alcohol can be further refined into cetyl and stearyl alcohols.

6.78 Saponification can occur in one of two ways. In the first method, called continuous saponification, the tallow is heated with sodium hydroxide at
temperatures of up to 105°C, and then sent through a saponification reaction column. At this stage, the blend is mixed with more, concentrated sodium hydroxide at a temperature of about 140°C at twice atmospheric pressure for about eight minutes. This produces soap and glycerol. The latter is afterwards washed out of the soap mass. In the second method of saponification, called batch saponification, the tallow is placed in a pan with concentrated sodium hydroxide at about 95°C for about three hours. The soap and glycerol which results is kept at this temperature for about five days to complete the washing process and separation of glycerine. These processes do not produce high quality glycerol and it must be further refined, by distillation or ion exchange.

Annex B to Chapter 6: Manufacturing process of rendering

6.79 This annex describes in more detail the two types of rendering process – batch processing and continuous processing – and discusses the time and temperature commonly achieved in each. It also describes the process of solvent extraction, which took the product of rendering and extracted more tallow from it.

(i) Batch systems

6.80 Up until the 1960s, most rendering plants in the UK used ‘dry rendering’ (atmospheric) batch processing systems. Before being cooked, a batch of raw material was fed from a storage area into a crusher. In a small plant this might have been done by hoisting the storage container above the crusher and emptying it through a hatch. In a larger, more automated plant it was more likely that an auger would load the material into the crusher. The crusher reduced the particle size of the raw material to about an inch, broke up the fatty and gut tissue and conveyed the resultant mass to a cooker. The cooker was a large, steam-jacketed vessel. Inside, a revolving beater shaft helped break down the fatty tissue even further. The cooker was heated at normal atmospheric pressure to around 100°C until the moisture was driven off in the form of steam and released through vents. Of the total processing time, the majority was spent in driving off the moisture. Once this was done, the temperature would rise to 140°C or more. This increase in temperature would cause the cell structure of the residue to break down, releasing the fat as tallow. In some plants the load was discharged once the maximum temperature was reached; in others there was a holding time of up to 30 minutes. The tallow was then run off into a separate container and the solids emptied from the cooker.

6.81 Another method of batch rendering was ‘wet rendering’, in which the raw material was subjected to a temperature of 140°C under high pressure generated either by injecting steam into the cooker, or by allowing the steam from moisture in the raw material to build up. The renderer might choose first to raise the temperature to the maximum and hold it for a while, and then slowly release the pressure, sending the temperature back to around 100°C. The exuded tallow could

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422 M12A tab 7 Annex 1 p. 12
423 M12A tab 7 Annex 1 pp. 12–13
424 M12A tab 7 Annex 1 p.13
425 Although Mr Charles Reynolds of PDM said in oral evidence that, until the late 1960s, the particle size would often have been more like 6 inches – T20 p. 39
426 S35 Bacon para. 13
427 M12 tab 2 p. 98
then be run off and purified by gravity or centrifugation to remove any water and particulate matter. The moist solids would then be dried at this temperature for up to three or four hours. Alternatively, some renderers simply cooked the raw material at an increasing temperature for two or three hours before reaching the chosen maximum temperature, whereupon the material was removed (either immediately or after a holding time) and the tallow extracted using a press. 428

(ii) Continuous systems

6.82 From the 1970s onwards, a variety of continuous rendering systems became available. They worked in different ways, but all used heating, separation and cooling on a continuous flow basis – essentially, raw material was fed in one end of the cooker and the finished product ejected at the other. 429 In most, the heat treatment was similar in principle to the dry rendering batch systems, but more automated. Automation meant that more control was exercised over the crushing of the raw material, and it could be reduced to consistently smaller pieces. Smaller particles meant better and more consistent heat penetration. Automation also meant that the temperature and timing of the cooking process could be better controlled. If the temperature was wrong, the control systems would not allow more material to be fed into the cooker or allow material to be discharged. 430

6.83 In a typical continuous rendering system, a continuous supply of raw material was delivered into bunkers in the floor. This was automatically transported into a crusher, which reduced it to pulp. The workings of the heating stage varied according to the type of plant:

i. **Stork Duke**

The system works on the principle of a deep fat fryer. The rendering vessel operates with a high proportion of liquid fat, the heat being applied via a steam jacket and a steam-heated tube rotor. The particle size of raw material entering the cooker is 20–50 mm. Maximum temperatures achieved are between 135°C and 145°C with an average residence time of at least 30 minutes. The protein material is then processed before being ground into meat and bone meal.

ii. **Stord Bartz**

There are a number of different types and sizes of Stord Bartz systems. The material (reduced to a particle size of 20–50 mm) is heated by a steam-heated disc rotor. The discs occupy the length of the rendering vessel. The average maximum temperature achieved is around 125°C and an average residence time of between 22 and 35 minutes. Pressing and grinding [into MBM] is similar to the procedure operated in the previously described system.

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429 *Journal of the Society of Leather Technologists and Chemists*, vol. 88, p. 71
430 S35 Bacon para. 18
iii. Anderson Carver-Greenfield

Finely minced (to a size of less than 10 mm) raw material is first mixed with recycled heated tallow to form a slurry. This is then pumped through a system of tubular heat exchangers with vapour chambers under partial vacuum before being centrifuged and pressed [into MBM]. The heat treatment involves a maximum process temperature of 125°C with an average residence time of between 20 and 25 minutes.

iv. Low Temperature Systems – Protec and Stord Bartz De-watering Rendering Process

Raw material is initially minced to a particle size of 10 mm before being heated to 95°C for 3–7 minutes. The liquid phases (fat and water) are removed by centrifuging or light pressing and are further separated to recover the tallow. The resultant solids are dried at temperatures ranging from 120°C to 130°C.\textsuperscript{431}

6.84 Some types of continuous rendering system cooked the material at a high temperature before the tallow was removed (similar in principle to the dry rendering batch systems). In others, tallow could be removed throughout the process. In the low temperature systems, because the tallow and moisture were extracted at a temperature of 95°C or below, the tallow was subjected to less pummelling and lower heat than it was in other cookers. This meant that the colour was more likely to be acceptable and, therefore, the value of the tallow higher. Also, less energy was used to extract it. The term ‘low temperature’ referred to the means of producing the tallow, not the temperature to which the solids were heated.\textsuperscript{432} There is evidence that, during low-temperature rendering, once the tallow had been removed, there was better heat penetration into the solid particles than during the other rendering methods, and thus more chance of destroying heat-sensitive organisms.\textsuperscript{433}

Temperature and time in batch and continuous systems

6.85 The temperature and time of the rendering processes were balanced not only to produce the desired product, but also to achieve ‘sterilisation’ as required under the Meat (Sterilisation and Staining) Regulations 1982.

6.86 Cooking temperatures and times for both batch and continuous rendering systems varied considerably, depending on what was being rendered. For instance, if the product was high in fat and low in moisture (as edible fat is), tallow in the material would melt out of the solid at around 45–50°C. Once the material reached 100°C, the moisture would be driven off and the solid residue would cook very quickly, virtually frying in the hot tallow. On the other hand, material such as offal, which was higher in moisture and lower in fat, would take much longer at a higher temperature.\textsuperscript{434} This could lead to discoloration and devaluation of the tallow, which was not of so much concern to producers of low-grade tallow.\textsuperscript{435} The particle size of the raw material would also have been taken into account.\textsuperscript{436} Most renderers

\textsuperscript{431} IBD1 tab 11 para. 2.4.6
\textsuperscript{432} S35A Bacon para. 4
\textsuperscript{433} S35A Bacon para. 5
\textsuperscript{434} T20 pp. 45–6 – Mr Charles Reynolds, PDM
\textsuperscript{435} T20 p. 46
\textsuperscript{436} T20 p. 40
chose maximum temperatures below 140°C, because at that temperature the vitamins and trace elements in the solids were not too much affected, but the solids were sufficiently crisped to make grinding easier. Some renderers of low-quality material could afford to cook it at higher temperatures.

6.87 Mr Bacon, a member of UKRA, said that in dry rendering batch systems, after the moisture was removed, the temperature would rise to 140°C or more. This statement was supported by Dr Gracey, who also said that the temperature was similar in the wet rendering batch systems. Both Mr Bacon and Dr Gracey were of the opinion that total processing times for dry rendering were usually about three or four hours. Investigations by MAFF in 1988 found that batch rendering systems operated at maximum temperatures ranging from 102 to 150°C, often taking between an hour and a half and two hours to drive off the moisture before they could begin to reach these temperatures. In some plants the load was discharged as soon as the maximum temperature was reached; in others the temperature was held for up to 30 minutes. None of the plants observed by MAFF was operating under pressure (that is, as wet rendering systems were).

6.88 Until the late 1970s the temperature controls for batch rendering systems were elementary. The cookers had gauges on the front indicating the temperature in the cooker chamber, the pressure of the steam in the jacket and possibly the pressure in the chamber. Generally temperatures were not recorded or monitored systematically. Furthermore, although high temperatures were reached, they were very variable and not monitored effectively. With batch rendering, it was not necessarily a temperature, but a quality of product that was to be achieved. In the absence of proper managerial control, it was possible to discharge the material before it was completely cooked. This might have happened when the end of the shift was approaching or if there was too much material for the plant to process. For example, it would have been possible to discharge the contents after heating for about two hours at 100°C, which could have been long enough to have driven off the moisture and extracted the tallow, allowing the solid material to be ground into MBM. The definition of ‘sterilised’ in the 1982 Meat (Sterilisation and Staining) Regulations included ‘dry rendered . . . into technical tallow, greases, meals, feeding meals or fertilisers’; so the material in this case would have been ‘sterilised’ in terms of the Regulations. However, the treatment would not necessarily have been sufficient to render the material sterile in the sense of eliminating all bacteria, viruses, etc. There were, of course, some limitations on the short cuts that could be taken, since the resulting solids would still need to be saleable.

6.89 PDM was one of the renderers that sometimes processed greaves that had been produced by other renderers. Their experience of greaves sourced from other companies also suggested that batch processing was highly variable in terms of time, temperature and product condition.

6.90 In giving evidence in relation to the above, witnesses generally referred to batch rendering in the 1960s and 1970s. However, the results of surveys of
rendering plants by Mr Wilesmith’s staff, conducted in 1988, indicated that, while some batch rendering plants had the capacity to monitor temperatures effectively by then, and did so, many still did not have the necessary equipment, and appeared not to use temperature as an important guide when rendering.\textsuperscript{447}

6.91 As noted above, the greater automation of continuous rendering systems allowed more accurate control over both the time and temperature of rendering. The renderer therefore had greater flexibility, allowing a wider range of time and temperature combinations to be used in cooking the material.

6.92 The Inquiry learnt of a variety of time and temperature combinations that have been used in the different types of continuous rendering systems. For example, the 1988 MAFF investigations mentioned above found the following:

- Stork Duke cookers were all operated at a maximum temperature of between 135 and 145°C. Because of the design of the cooker it was difficult to determine the time taken for material to pass from one end to the other. One renderer said that 65 minutes was claimed in German studies, but because the material is pushed through the cooker by new material being fed in, the time depends on what rate of throughput is selected by the renderer. The time for which the material is exposed to the maximum temperature is not certain either.

- Stord Bartz driers operate in a range from 125 to 145°C, except for one plant which operated at 80°C. Again, time spent in the cooker depended on the throughput rate, although experiments indicated that the minimum time was 60 minutes, with an average of 2½ hours. It was believed that the material was exposed to the maximum temperature for only 30 minutes of the total time.

- Carver-Greenfield systems are believed to process the material over 30 to 40 minutes, operating at a maximum temperature of between 104 and 123°C, depending on the material type. The material was exposed to the maximum temperature for only about 15 minutes.

Protec systems were low-temperature rendering systems operated at two plants, at both of which the material was heated for 3 to 7 minutes at about 95°C before the tallow was extracted. At one plant, the solid residue was then dried in a batch cooker at 120 to 130°C. At the other, the residue was tossed around inside a rotating barrel for 25 minutes while being blasted with air that entered at 700–800°C and exited at about 110°C. However, the temperature of the material inside was unknown.

**Solvent extraction**

6.93 Sometimes, the greaves produced by renderers were further processed to remove more tallow, in a secondary, separate process known as ‘solvent extraction’. Greaves produced using either a batch or continuous rendering system could be subjected to solvent extraction, usually after cooling. However, most continuous rendering systems incorporated an expeller press, removing further tallow by pressure and processing the greaves into MBM directly.

\textsuperscript{447} For example, see M14 tab 1 p. 54
In a statement, Mr Bill Bacon, a former member of the UKRA Council, said:

. . . the majority of solvent plants in use in the U.K. were Static Pot plants manufactured by Iwel Ltd. These static pots were cylindrical mild steel vessels constructed to contain 3 or 5 tonnes of meat and bone greaves. The greaves were put into the static pot and heated with a steam coil to a temperature of 65-70°C then benzene type solvent was pumped 2 or 3 times into the vessel. The resultant mixture of tallow and solvent being passed through a heat exchanger to vaporise the benzene and recover the tallow, the benzene also being recovered by cooling the vapour down to ambient temperature and subsequently re-used. The material left in the pot was heated to 90°C to vaporise the solvent and stripped using live steam to remove any residual solvent, then discharged for cooling and grinding. As the name implies there was no mechanical agitation in the pot so that when stripping, live steam did force its way through the mass by the weakest channel leaving certain areas of the mass untouched. This meant that the material would never reach a temperature in excess of 90°C. Again although a dangerous practice but occurring due to human frailties, material could be discharged before the full solvent cycle had been completed.448

The solvent extraction system described by Mr Bacon is an older style of system which processed greaves in batches. There were other types of system: Mr Foxcroft told the Inquiry that PDM used ‘continuous’ extraction in one of its plants. In a document on rendering presented to the Lamming Committee by Mr Lawrence, one type of continuous solvent extraction was described as follows:

[The crushed greaves] travels as a counter current to the solvent at a temperature below the boiling point of the solvent. This is carried out at 70°C. This stage of the process takes up to 8 hours. The solvent saturated solids then pass to a steam jacketed desolventiser in which the temperature of the solids is raised to approximately 105°C over a period of 45–60 minutes. The final stage, in the last compartment of the desolventiser, involves the direct injection of low pressure steam to the solids for about 15 minutes to ensure that all the solvent vapour has been removed.449

Annex C to Chapter 6: Comparison of UK rendering process with the process in other countries

This annex sets out the information available to the Inquiry on the rendering processes in other countries and compares them with those in the UK.

(i) United States

As in the UK, the US used a combination of batch and continuous processes.450 However, as a net exporter of tallow and MBM, the US generally led the way in research and development, continually searching for new markets and more efficient production methods. Therefore, the American industry tended to be 10 to

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448 S35 Bacon para. 16
449 FEG15 pp. 4–5
450 M12 tab 18
15 years ahead of the UK. The first ‘reduced temperature’ continuous systems (Carver-Greenfield) came into use in the mid-1960s. Other, more advanced continuous systems were also first used in the US, in the early 1980s, before their introduction into Europe. The maximum temperatures used in these processes varied between 124°C and 154°C. As with the continuous systems considered in Annex B to this chapter, the description ‘reduced temperature’ referred to the temperature at which the tallow was extracted, not the temperature to which the greaves were exposed.

6.98 Other than advances in technology, which were later mirrored in the UK, the only changes in the American industry in the years leading up to 1986 were:

- attempts to reduce cooking temperatures in order to preserve the nutritional quality of the finished product;
- a reduction in the proportion of sheep waste used; and
- an increase in the proportion of poultry waste used.

6.99 By 1970, most of the solvent extraction plants in the US had ‘blown up, burned down, or closed for safety’.

(ii) Rest of Europe

6.100 Although there have been some common trends, there are aspects of the rendering industry which have developed differently in parts of Europe. This seems to be partly because of the perceived purpose of the industry. In some countries it was seen primarily as a service: the renderers’ main function was to destroy pathogenic waste, and commercial considerations were secondary. In countries such as Germany, Holland and France, a subsidy could be available if companies were not profitable. In other countries, including the UK, rendering was first and foremost a commercial operation. There was also a difference in the use of the word ‘rendering’ in certain continental countries. Mr Charles Reynolds of PDM said:

There is no such thing in Europe as edible rendering. In Europe the production of edible products is known as -fat melting . . . They do not consider that to be ‘rendering’. When the Germans and the Dutch talk about ‘rendering’, they are talking about the disposal of diseased animals, destruction.

6.101 While in some countries the primary objective of rendering may be to destroy dangerous pathogens, another source suggests that, across Europe, the primary objective of ‘rendering’ is not always to destroy the rendered material, but to ‘sterilise’ it (in what sense it is not clear), leaving it capable of use for non-food purposes. It appears that, with the possible exception of rendering of material infected with heat-resistant organisms such as anthrax (see below), such a process is similar to the rendering of inedible products in the UK. The Inquiry is not aware...
of how many ‘fat melting’ plants there are in Europe, nor the specifications for their operation.

6.102 This difference in perception varies from country to country and derives from the way in which certain animal diseases have been dealt with. In Germany, Belgium and Holland, legislation existed since the 1940s and 1950s that required renderers to be able to eliminate spore-forming micro-organisms such as anthrax and foot and mouth disease.458 (These were more heat-resistant organisms than salmonella, the elimination of which was the bacteriological standard set for rendering in the UK by the Protein Processing Order). In these three countries, renderers were expected to process carcasses infected with those diseases and make the resultant meal suitable for use in animal feed. In Germany, such carcasses were dealt with at special ‘destructor’ plants, where they were treated under pressure at 130°C for 20 minutes.459

6.103 However, in other European countries, including the UK, notifiable diseases such as anthrax were dealt with on the farm, by burial or incineration, and renderers were not required to be able to handle them.460 Many of these countries later adopted legislation which made mandatory rendering systems that were sufficiently robust to destroy dangerous pathogens, as was required by (European) Council Directive 90/667/EEC. In the UK this Directive was implemented by the Animal By-Products Order of 1992.461

6.104 In addition, rendering in the UK was generally carried out at normal atmospheric pressure. In some countries in Northern Europe, legislation required high-pressure cooking (eg, Austria, Denmark, Germany, Holland, Sweden and Switzerland). In the rest of Europe its use varied between plants. Mr Brian Rogers told the Inquiry that recent changes to EC Regulations led to the installation of 200 such high-pressure systems throughout the EU, which suggests that their use had by no means been universal.462

6.105 Generally speaking, the rendering industry developed differently throughout Europe, because of ‘different developments of the whole agricultural business, different geographics, different social structure, and different culture in many other respects’.463 However, in most parts of Europe there was a trend towards fewer but larger rendering units, as a result of the need for high investment in the new technologies necessary to meet environmental requirements. For example in 1991:

- In Holland, one company was processing all raw material, mostly in two rendering plants.
- In Belgium, one plant processed 95 per cent of the raw material.
- In Denmark, there were four renderers, but one processed more than 80 per cent of the raw material, in four plants.464

458 M12 tab 17 p. 52
459 YB90/01.29/8.1
460 M12 tab 17 p. 52
461 L1 tab 10
462 T19 p. 105
6.106 On the other hand, in Germany, where federal authorities were directly or indirectly responsible for disposal of animal waste, there were still about 42 public and private plants in operation.\footnote{P Krenk, ‘An Overview of Rendering Structure and Procedures in the European Community’ (M12 tab 3, p. 165)} In Italy in 1995, there were 74 renderers (including those attached to slaughterhouses).\footnote{A Grosso, ‘Present outlook of Italian rendering Industry, UNEGA Congress – Taormina’, 14–16 September 1995 (M12 tab 18)}

6.107 Meanwhile, most European renderers moved from using batch processes, to continuous processing. These were introduced to meet pressure not only for hygienic products but also for lower energy consumption, lower labour costs and greater control of the environmental impact of rendering.\footnote{P Krenk, ‘An Overview of Rendering Structure and Procedures in the European Community’ (M12 tab 3, p. 166); documents provided by European countries on the European rendering industry (M12 tab 18)}

6.108 Solvent extraction fell out of favour throughout Europe during the 1970s, at the same time as renderers adopted continuous systems. In some hotter countries, however, it continued to be used, because of the tendency of MBM with a high fat content to go rancid in hot weather.