1. Introduction

1.1 The carcasses of farm animals have given rise to many industries. In the year that BSE was identified, 1986, there were around 16,000 workers in 1,000 slaughterhouses processing 32.8 million cattle, pigs and sheep. After removal of the human food, which was up to 50 per cent of the liveweight, the remainder of the carcasses yielded about 1.3 million tonnes of animal by-products. Of this, 73 per cent went to renderers, mainly to be turned into tallow and meat and bone meal (MBM) for animal feed or for fertiliser; 15 per cent became pet food; and 4 per cent went to pharmaceutical and other specialist companies. Only 8 per cent was waste. (Many uses for bovine by-products are listed in vol. 16: Reference Material. Medicines, medical devices and cosmetics are dealt with in vol. 7: Medicines and Cosmetics.)

1.2 Three industries were central to the BSE story, both in its emergence and identification and, later, in its control. The first was the rendering industry, which has sometimes been blamed for the whole epidemic. It has been claimed that it was changes in rendering processes in the 1980s which allowed the infective agent to enter cattle feed, and thus led to the emergence of the disease. As a result of BSE, MBM is no longer used in the UK in animal feed, or as fertiliser.

1.3 The second was the animal feed industry. Because it was understood that BSE was spread through animal feed, the introduction of Regulations affecting the industry was an essential part of the control of the disease.

1.4 The third industry was slaughterhouses. Once it was realised that particular cattle organs (later designated as Specified Bovine Offal or SBO) were most likely to carry the infective agent, it was considered essential that slaughterhouses separated these cleanly from those parts of the carcass that were going to enter the human food chain.

1.5 This volume describes these three central industries and the processes they employed. It examines the situation when BSE emerged in 1986 and the changes to these processes that occurred as a result of the measures introduced to stop the transmission of BSE-infective material. The volume also covers some other industries dependent on the cattle carcass.

1.6 Descriptions of the legislation governing the operation of these industries is to be found in vol. 14: Responsibilities for Human and Animal Health.

1.7 Chapter 2 on slaughterhouses describes in detail the slaughter itself and how the carcass is then dealt with. It is at the slaughterhouse that the parts of the animal which are to enter the human food chain are separated from those used for marketable by-products and from those which are waste. Operations at the slaughterhouse were the context in which measures to deal with those parts of even subclinically infected animals that posed a potential risk to humans were introduced.
1.8 Chapter 3 on head-boning and brain removal examines the recovery of meat and brains from bovine heads. Because of the risks of cross-contamination of meat with brain material, this practice was profoundly affected by the various SBO controls.

1.9 The production of mechanically recovered meat (MRM) was driven by the economic need to recover as much edible material from the carcass as possible. This process was a matter of some concern to those responsible for keeping the infective agent out of the human food chain. Chapter 4 on MRM illustrates why this was so, as well as describing the process itself.

1.10 Knackers dealt with fallen stock that was not permitted to be used for human food. They were able to recycle parts of these animals, such as the hides, sell some of the meat to hunt kennels to feed the hounds or to pet food manufacturers, and sell on the remains to the renderers. Some hunt kennels in effect acted as knackers by removing dead cattle for local farmers. Maggot bait farms used carcasses to produce maggots for sale. Chapter 5 describes how BSE affected these trades.

1.11 Renderers processed animal waste to separate the fat, or tallow, from the protein content. The resulting products were used in a number of ways, including incorporation in human and animal food. Early epidemiological work suggested that MBM, the protein product of rendering, was responsible for spreading BSE, and that changes in rendering processes had led to the emergence of the disease. Chapter 6 describes the various processes in use up to around 1986. It also compares the processes used in the UK with those in other countries. Finally, it describes how the industry was affected by the successive SBO bans.

1.12 Animal feed manufacture may appear to have nothing to do with what happens after cattle are killed. However, the incorporation of MBM as a protein source in cattle feed created the potential for recycling infections. Chapter 7 looks at the history of the use of MBM in the animal feed industry; at the way feedstuffs are produced; and at the Regulations, starting with the ruminant feed ban, which were introduced to control the use of MBM in an attempt to prevent the further spread of the disease.

1.13 Other industries that were dependent on the components and by-products of bovine carcasses are examined in Chapter 8. The emergence of BSE had consequences for the processes used in butchery and meat processing for human consumption and the manufacture of pet food, gelatine and fertilisers.

Hygiene, ‘sterilisation’ and the inactivation of the BSE agent

1.14 The conditions and practices developed to protect human health from the dangers posed by unfit or microbiologically contaminated food are collectively referred to as ‘hygiene’. These range from ensuring the general cleanliness of slaughterhouses to testing food samples in laboratories for bacteria and viruses that pose a health risk. Many of these practices have been made compulsory. The layers

2 Fallen stock refers to animals which have died on a farm as a result of accident or disease
of food hygiene regulation are examined in vol. 14: *Responsibilities for Human and Animal Health*.

1.15 Over time, as hazards have been identified and scientific knowledge has accumulated, hygiene practices have become increasingly refined. In the late 1980s, food safety issues took on a high profile following the perceived increasing incidence of microbiological illness such as salmonella in eggs. However, the emergence of BSE presented different problems, and the systems of surveillance and treatment that had been developed to deal with microbiological contamination of food were not effective against the BSE agent.

1.16 The measures introduced to deal with bovine material potentially infected with BSE were designed to control it at the slaughterhouse, before it reached other industries; or to prevent its use, for example in feed, altogether. This was considered necessary because the processing of material by other industries was generally not capable of inactivating the BSE agent. In 1994, the Spongiform Encephalopathy Advisory Committee (SEAC) advised that the minimum conditions necessary to inactivate the most heat-resistant forms of the scrapie agent were autoclaving at $136^\circ$–$138^\circ$C at a pressure of 30 pounds per square inch for 18 minutes. The Committee noted that the BSE agent responded like scrapie in this respect.

1.17 It is important to distinguish ‘inactivation’ from ‘sterilisation’, which usually refers in legislation and elsewhere to hygiene procedures designed to prevent microbiologically contaminated food being consumed by humans. For instance, sterilisation under the Meat (Sterilisation & Staining) Regulations 1982 requires that carcasses are:

i. treated by boiling or by steaming under pressure until every piece of meat is cooked throughout;

ii. dry-rendered, digested or solvent-processed into technical tallow, greaves, glues, feeding meals or fertilisers; or

iii. subjected to some other process which results in all parts of the meat no longer having the appearance of raw meat and which inactivates all vegetative forms of human pathogenic organisms in the meat.

1.18 Sterilisation in the sense of these 1982 Regulations would clearly not meet conditions considered by SEAC to be necessary to inactivate scrapie or BSE.

1.19 The use of the term ‘sterilisation’ in the Bovine Offal (Prohibition) Regulations 1989 (where it was given the same meaning as in the 1982 Regulations) has the potential to add to the confusion about the use of this term. In this volume therefore, unless otherwise stated, ‘sterilisation’ is used in the traditional sense, in relation to the prevention of microbiological contamination.

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3 An autoclave is a vessel that boils water under high pressure (and therefore at high temperature). It is widely used in hospitals and laboratories to sterilise material