

Advisory Committee on Animal Feedingstuffs

ACAF REVIEW OF ON-FARM FEEDING PRACTICES

Recommendations on identifying hazards and minimising risks

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I RECOMMENDATIONS

1. The Committee recommends that all home mixers and livestock farmers adopt arrangements based on recognised risk management approaches (paragraphs 47 and 86).

2. The Committee recommends that all home mixers should have a risk assessment and control programme in place. The system chosen must be proportionate to the potential risks to animals and human health which will be related to the types of feeds being fed, the number of livestock involved, the market outlets for those products and whether the farmer is also selling feed manufactured on-farm (paragraphs 49 and 87).

3. The Committee recommends that farmers seek outside help if necessary, whether from the feed industry, feed material suppliers, private consultants, assurance scheme auditors or other advisers in assessing hazards and risks on their farm (paragraph 88).

4. The Committee recommends that farmers undertake appropriate targeted feed analyses to demonstrate that practical control measures are working and that feeds are safe (paragraph 89).

5. The Committee urges that codes of practice and assurance schemes should be further developed where necessary to address the particular hazards associated with on-farm mixing and feeding (paragraph 9). It also encourages farmers in the use of/participation in such codes and schemes (paragraph 91).

6. The Committee recommends that farmers should take particular care when purchasing either new types of feed or feed material, or from new suppliers, especially when the material in question is abnormally cheap (paragraphs 56 and 92).

7. The Committee recommends that all materials, purchased by farmers for animal feeding, should come from sources and suppliers who can demonstrate compliance with recognised quality assurance standards (paragraphs 55 and 93).

8. The Committee notes that the EC Commission's proposals on feed hygiene will introduce the registration of all feed businesses, including producers of feed materials, who would be required to apply Hazard Analysis and Critical Control Point principles. The Committee supports this development (paragraphs 56 and 93).

9. The Committee encourages farmers selling manufactured feed to be independently assessed for compliance with an appropriate assurance scheme (paragraphs 57 and 94).

10. The Committee recommends that farmers responsible for organising their own road haulage comply with the code of practice for road haulage, which will provide them with a level of independent assurance (paragraphs 61 and 95).

11. The Committee recommends that farmers keep clear records enabling traceability of all purchased feed materials, additives or compound feeds used and fed on-farm (paragraphs 84 and 96).

12. The Committee recommends that everyone involved in on-farm feeding should be able to demonstrate their competence, having appropriate skills to match the scale, risks and complexity of the feed operation (paragraphs 82 and 97).

II INTRODUCTION

Background

1. The BSE Inquiry report¹ in October 2000 concluded that the chain of animal feed manufacture, distribution, on-farm mixing and on-farm use was complex, and that the ease with which cross-contamination occurred within it was one of the most concerning issues in the BSE outbreak. The outbreak of Foot and Mouth Disease provided further focus on on-farm feed and feeding issues. Following discussions at its Open Forum held in July 2001, the Advisory Committee on Animal Feedingstuffs (ACAF) agreed that a review of on-farm animal feeding practices should be included in its forward work plan as a matter of priority.

Scope of the Review

2. The Committee undertook to carry out a review of on-farm feeding practices that would:

- identify current practices, with a view to issuing recommendations on “best practice” for all stakeholders and their advisors involved in supplying, transporting, storing and using feeds;
- include all aspects of feed sourcing, transport, storage, feeding on-farm, including on-farm mixing, liquid feeding systems, the use of bought-in feed materials (such as co-products from the food industry) and handling home grown feeds; and
- identify the main hazards and risks arising from the above processes and increase awareness of these amongst the farming community and other stakeholders.

3. The Committee was mindful of the economic implications to farmers of further regulation or controls. It wanted the report of its review to be a tool to help farmers and others identify hazards and implement controls and corrective action. It was agreed that any recommendations would be based on the need to protect human or animal health.

¹ BSE inquiry report published October 2000 available from www.bseinquiry.gov.uk

ACAF Consultation

4. The first stage of the review consisted of a consultation with relevant stakeholders in December 2001. Details of the consultation and responses received are given in Annex IV.

The Extent of On-farm Mixing of Feeds

5. The Royal Pharmaceutical Society of Great Britain (RPSGB) holds records of 1,820 on-farm manufacturers of medicated/zootechnical feeds, but these represent only a small proportion of livestock farmers. Producers who incorporate additives (such as trace elements and vitamins) into manufactured feeds are required to be registered with their local Trading Standards Authority. Approximately 14,000 farms are registered with local authorities in Great Britain. It is thought that many farmers, who mix products containing additives with home-produced or other bought-in materials, are not officially registered.

6. Complete diet feeding is used increasingly to mix home grown forages, cereals, by-products and other bought-in feeds to produce rations for ruminants. Although detailed figures are not available, it has been estimated that there may be 6,000 feeder wagons used in Great Britain. This represents approximately 20% of all dairy farmers.

7. Information from the Department for Environment, Food and Rural Affairs (Defra) shows that approximately 19.5 million tonnes of animal feed (excluding forages) were fed to livestock in 2002, with approximately half as compound feeds or blends². While some of these will be fed without prior mixing with other feeds, a significant proportion will be mixed. Therefore, it would appear that on-farm mixing of feeds is widely practised.

Legislation and Codes of Practice

8. Animal feed legislation in Great Britain is enforced by local authorities, normally through their Trading Standards authority, the RPSGB, Defra, and in Northern Ireland by the Department of Agriculture and Rural Development (DARD). In April 2003 ACAF embarked on a separate review of feed law enforcement. The various legislative controls are outlined in Annex V together with comments on likely future legislation.

² Defra statistics: Feedingstuffs (including direct inter-farm and intra-farm transfer) in Great Britain.

9. There are a number of codes of practice which are guides to good practice, and assurance schemes related to livestock production, but these generally do not go into detail regarding on-farm feeding. Although an assessment of these is not within the scope of this review, the Committee believes that codes and assurance schemes can provide a valuable means of achieving best practice. **The Committee therefore urges such codes and assurance schemes be further developed to address the particular hazards associated with on-farm mixing and feeding.** The Food Standards Agency's guidance³ on the minimum requirement of assurance schemes is a useful reference document for those devising such schemes and drafting codes of practice.

10. There are two EC proposals that are likely to have implications for existing controls on on-farm feeding, one on feed hygiene and one on official feed and food controls (see Annex V for details).

³ Review of Food Assurance Schemes for the Food Standards Agency – Ruth Kirk-Wilson June 2002.
Available from the Food Standards Agency website at www.food.gov.uk/multimedia/pdfs/FAS_report.pdf

III REVIEW OF CURRENT ON-FARM PRACTICES

11. The production, processing, storage, transport and distribution of safe and suitable feeds are the responsibility of all participants in the food chain, including farmers. It is essential therefore that farmers adopt necessary controls to ensure production of safe feed and food. An overview of the main elements of sources of feeds, on-farm storage, mixing and feeding is given as a flow diagram in Annex I. The following sections identify areas that require particular attention.

Sources and Selection of Feedingstuffs (including feed materials, supplements and compounds)

12. Livestock farmers have several choices regarding the types of feed they use and the form in which they are fed. Feeds may be either purchased or produced on the farm where they are used (on-farm produced). Purchased feeds may be obtained directly from other farms, from compound feed mills, feed merchants, supplement suppliers or food processing factories.

13. On-farm produced feeds are primary agricultural products such as forages, cereals and pulses. Forages may be fed fresh (e.g. grass) or preserved (e.g. silage or hay). Cereals such as wheat and barley, and pulses such as peas and beans, are most commonly harvested at the point of maturity when the seed heads (grains) are at their fullest. These grains may be used on farm or sold for feed or food use. Generally, some form of processing is required to breakdown the seed coat (husk) and improve digestibility. The most common processing prior to feeding involves physical treatment of the grains, e.g. rolling or grinding. Ground cereals and pulses are used both for direct feeding on farms and by commercial feed manufacturers. On some ruminant farms, the entire grains may be treated with alkali (in liquid or solid form) such as caustic soda (sodium hydroxide) or ammonia, in order to degrade the outer seed coat and aid digestibility. Less common is the addition of propionic acid to barley to act as a preservative and aid digestion by beef cattle. Cereal grains harvested before they are fully mature may be crimped before storage as a means of improving the digestibility of the grain. A weak acid may be added to prevent aerobic spoilage. Cereal straw, which remains after the grains have been harvested, can also be fed to ruminant livestock, despite it having low digestibility in its natural state. However, as with grains this can be improved through treatment with caustic soda or ammonia. Cereals and pulses may also be harvested prior to maturity to produce whole crop cereal silage. This may be either ensiled and fermented or, when harvested at a later stage, treated with urea or alkali.

14. Co-products (also referred to as by-products) are associated with the production of food or drink for human consumption, and include cereal by-products after the extraction of flour for bread making (e.g. wheat feed), oilseed meals after oil extraction (e.g. soya bean meal) and liquid by-products (e.g. whey from the manufacture of cheese). By-products of a number of industrial processes, including starch extraction and fermentation, are also used (e.g. maize gluten feed). Moist co-products are usually obtained from local food factories, whereas, dry products may be transported over long distances or imported and pass through intermediate stores.

15. Additionally, primary and manufactured foods intended for direct human consumption, which are either surplus to requirements or have been rejected for quality or presentational reasons (e.g. misshapen biscuits, crisps, vegetables) may either be sold direct to farms or via intermediate processors. However, **farmers buying direct from food factories should find out why the food has been rejected and be aware of the possible hazards to livestock.**

16. Manufactured complementary compound feeds are purchased to complement home grown and other feed materials, and provide the animal with a properly balanced diet. These compounds will vary from vitamin/mineral supplements to higher inclusion/usage products. Many poultry and pig farmers will purchase complete compound feeds requiring no further mixing or dilution on-farm.

17. Details of type and quantities of some of the feed materials used on livestock farms are given in Annex VI. It should be noted that feeding ruminant protein to ruminant animals, such as cattle and sheep, was prohibited in the UK from 1988, with mammalian protein banned from such feed in the European Community from 1994. In the UK, mammalian meat and bone meal was banned from all feed for farmed animals in 1996. The latest EC controls prohibit feeding processed animal protein (including that from poultry) to all farmed animals, although there are some strictly controlled exceptions:

- the feeding to farmed animals other than ruminants of fishmeal;
- the feeding to farmed animals of gelatin derived from non-ruminant animals;
- the feeding to farmed animals other than ruminants of dicalcium phosphate;
- the feeding to farmed animals other than ruminants of hydrolysed protein; and
- the feeding to farmed animals of milk and milk products.

Transport

18. It should be remembered that road hauliers often represent the final part of the transport chain, with many feed materials being imported by ship and then transported to the store prior to delivery to farm.

19. Feed materials can be transported to the farm and/or the farm's storage facilities using either:

- a road haulier;
- a specialist contractor (most likely in the case of harvested forages, etc.); and
- the farmer's own equipment or that of another farmer.

20. Equipment used may or may not be designed specifically for, nor exclusively used for the transport of feed materials.

21. Many of the UK-based hauliers involved in feed transport subscribe to an independently audited code of practice for road haulage⁴. This code emphasises the need for vehicle hygiene and cleanliness, correct loading, avoidance of contamination and cross-contamination, and delivery to the correct destination. It also specifies materials that must not be carried and gives advice on lorry cleaning. However, not all feedingstuff hauliers subscribe to this code of practice. **When farmers employ unapproved hauliers there is an increased risk of contamination.** The industry code is a useful reference for farmers wishing to specify prohibited materials. The code also requires hauliers to provide details of the previous three loads carried for auditing purposes.

Receipt and Handling

22. This section deals with discharge of feeds on arrival at the farm. Ideally, feeds will be discharged to their point of final storage without being discharged to an intermediate point. Bulk feed deliveries may be made with tipper lorries which would preferably unload directly into the store/bunker or into an intake pit for conveyance to a bulk bin. Blower lorries discharge dry feeds directly through a blow line into lofts or bulk bins, etc. Bulk liquids are carried on tankers which pump the liquid direct to the storage tank. Bagged deliveries are made on flatbed lorries with curtained sides or tarpaulin covers.

⁴ The UKASTA Code of Practice for Road Haulage (of combinable crops, animal feed materials, compound feedingstuffs and as-grown seeds).

23. When direct discharge to the final point is not possible, or when farmers need to move feeds to different premises, they may use tractors fitted with front-end loaders or farm trailers. This equipment is rarely dedicated to feed handling.

24. For harvested forages such as silage or hay, farmers may use their own machinery, or that of specialist contractors to cut, transport and store the crops. While some of the machinery, particularly that involved in harvesting, is specific for the purpose, some will have multiple uses.

On-farm Storage

25. There are many options for on-farm storage. These include:

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

26. Due to the variety of feedingstuffs, there is a wide range of potential storage systems and associated mixing and feeding systems on farm. Storage is needed both before and after mixing. The physical nature of the material (i.e. whether dry, liquid or moist) will determine the type of storage facility. The feeding system on the farm will also be taken into account. Because of the over-riding influence of physical form of the material on the storage options, these are described separately below.

Dry Feedingstuffs

27. Dry feeds or feed materials stored in bulk are held in sealed hoppers, lofts or bins. Surprisingly some may also be stored outside where they are exposed to the elements. Feed may be stored in bays or bunkers, on the floor, particularly on dairy and beef farms. Feeds and feed materials are usually moved from the storage hoppers or bins to the mixers or feeding troughs/hoppers by means of conveyors or augers, particularly on pig and poultry units. Pelleted, compound dairy feeds may be stored in a loft above the milking parlour for easy dispensing to dairy cows during milking. Materials stored in an unsealed bunker may be carried by front-end loader to a feeder wagon for mixing with silage to produce a ration for dairy cows. Low

inclusion materials such as vitamin and trace element supplements included at less than 50 kg/tonne in the home mixed ration, and feeds used in relatively small quantities, are purchased and stored in sealed paper or plastic bags.

Moist Feedingstuffs and Dried Forages

28. These materials are most commonly found on ruminant farms although older pigs may occasionally be fed on moist materials (brewer's grains, pressed sugar beet pulp and bread) or on root crops (potatoes and fodder beet). Root crops may be fed *in situ* so avoiding the need for harvesting and storage. Whilst dairy cows, beef and sheep are able to graze grass for several months of the year, they also need preserved forages such as silage or hay. Silage is stored either in large bunkers (clamps) or in smaller bales sealed in plastic to prevent deterioration as a result of exposure to air. Once opened, the silage face is exposed to the elements; birds are a particular problem as far as whole crop cereal silages are concerned. Hay and straw are stored dry (i.e. less than 18% moisture content) in buildings or under plastic sheeting, to prevent deterioration with exposure to moisture.

Liquid Feedingstuffs

29. Use of liquid feed materials is largely restricted to ruminant and pig farms although addition of soluble vitamins to drinking water is common on many poultry units. Liquid feed materials are stored in tanks of varying sizes. Some of these materials may be consumed directly (e.g. molasses may be 'licked' from specially designed feeders or metered into feeder wagons for inclusion in the complete diet). Others, particularly those found on pig farms, may be transferred by pipes to a liquid mixing tank for ultimate feeding via a pipeline feeding system.

Mixing and Feeding Practices

30. The principal objective of feed mixing is to ensure that there is a thorough mix of the feed ingredients, particularly those added at low levels (e.g. minerals, vitamins and medicinal or zootechnical feed additives). This ensures that livestock consuming the feed receive neither an excess nor a deficiency of any particular ingredient or nutrient. There are many different types of farm mixing systems (including the shovel on very small units) ranging from dry mixers through to liquid mixing tanks, feeder wagons and, visiting mobile mill and mix units. Since feeding systems and practices vary widely for different forms of livestock production, they are described separately in paragraphs 32-46 for pigs, poultry and ruminants.

Pigs

Extent of Home Mixing for Pigs

31. Pigs are omnivores and the comparability of the pig's digestive system with that of man has influenced how pigs have been fed over many generations. Feeding a variety of human foods and food co-products has been common practice. This has led to a number of different types of feeding systems, ranging from traditional dry home mix units to liquid feeders. (Note: Swill feeding has been banned in the wake of the Foot and Mouth Disease outbreak.) It is generally thought that approximately 50% of growing and finishing pig units involve some form of home mixing activity. Sow breeding units are more focused on feeding purchased complete compound feeds, not least because an increasing proportion is kept out-of-doors on more extensive farming systems. Some examples of the main types of feed mixing activity are shown in Table 1.

Table 1 – Examples of Feed Mixing Activities on UK Pig Farms

EXAMPLES OF PURCHASED MANUFACTURED FEEDS	EXAMPLES OF 'HOME MIXING' ACTIVITY
Complete compound feed.	No further mixing required. Provides the complete diet.
Complementary compound feed ranging from vitamin/mineral supplements to higher inclusion (10-40%) mixtures.	Will be mixed on-farm with cereals (home grown or purchased) and, possibly, other dry feed materials (often purchased) including medicinal and/or zootechnical additives. Daily ration may also include moist feeds and vegetables.
Complementary compound feed (dry but designed to suit liquid systems).	Mixed with other liquid components and other dry feed materials including medicinal and/or zootechnical additives.

NB These are examples only and do not give an exhaustive summary of the possible feeding systems or combinations.

Feed Mixing Systems for Pigs

32. The main feed mixing systems are:

- (a) Dry mixing – takes place on small farms where relatively few pigs are involved, may involve nothing more than a few feed materials, a bought-in complementary compound feed or vitamin/trace element premix and a shovel. However, dry mixing is generally mechanised. Feeds are usually mixed in batches suited to the size of the mixer and are transferred to other storage bins prior to feeding. The majority of pig home mixers produce feed entirely for their own use.

- (b) Liquid feeding – a proportion of growing and finishing pig farms, historically those sited close to suitable food factories, feed liquids requiring a mixing tank and delivery pipelines to each pen. Many farmers feed a combination of liquid feed materials and dry feeds, mixed in the liquid mixing tank.
- (c) Mobile mill and mix services – in addition to static mixers on farms, a number of service companies operate mobile mill and mixing services. These visit farms, processing homegrown cereals, and mixing them with purchased feed materials and high protein complementary compounds or mineral/vitamin supplements.

Feeding Practices for Pigs

33. The choice of feed type and feeding system is dictated, in part, by the scale and type of housing. There is a preponderance of indoor pig units, although an increasing proportion of UK breeding pigs are now kept out-of-doors.

Indoor Pig Units

34. Traditional dry mixers tend to produce feeds in meal form; few have the facilities to manufacture pelleted feeds. It is estimated that approximately 20% of pigs are fed on diets which include liquids. Although liquid feeds tend to be cheaper than dry feeds, the need for specialised storage and handling facilities means that they tend to be used more on larger sized units. The majority of pig farmers, including home mixers, buy in their piglet starter feed as this is difficult to produce in most farm situations. This high quality, milk-based feed is usually supplied in small pellet form from specialist manufacturers and encourages early feed consumption helping the piglets during the weaning phase. After weaning, dry feeds in meal or pellet form are generally fed in troughs, although 'on-floor' pelleted feeds may be fed. Liquid feeds are pumped into troughs for direct consumption by pigs. Groups of growing and finishing pigs usually consist of animals of similar age and this permits formulation or purchase of diets that meet their specific nutritional requirements depending on the weight of the animals.

Outdoor Pig Units

35. Outdoor sows may be fed in a variety of ways (e.g. by hand or by a mechanical feeder). Home mixing is rarely practised on these farms, as loose 'meal' and even pellets would quickly be wasted when cast on the ground. Instead, farmers tend to purchase compound feed in large nugget form to minimise wastage. Sows are sometimes fed on root crops or moist food co-products. Some growing pigs are reared outdoors for specialist markets e.g. free range and organic.

Poultry

Extent of Home Mixing for Poultry

36. There are four main types of producer as far as the size and scale of feed purchase and on-farm mixing are concerned. These are:

- a) integrators who make their own feed, keep their own birds and even run their own processing factory or egg packing station. Some of these will also sell feed;
- b) those who have farms and undertake processing but do not make feed, and buy compounds from commercial feed manufacturers;
- c) independent flock farmers who buy all of their feed from commercial feed manufacturers; and
- d) independent flock farmers who have feed mixing facilities to produce their own 'home-mix' ration(s). There are not many producers in this group.

Integrators who produce feed for their own use and for sale could be categorised as both home mixers and as commercial feed manufacturers. They are of a scale at least as big as, if not bigger than, the largest independent commercial feed businesses.

37. Some examples of the main types of feed mixing activity are shown in Table 2.

Table 2 – Examples of Feed Mixing Activities on UK Poultry Farms

EXAMPLES OF PURCHASED MANUFACTURED FEEDS	EXAMPLES OF 'HOME MIXING' ACTIVITY
Complete compound feed.	No further mixing required. Provides the complete diet.
Complementary compound feed ranging from vitamin/mineral supplements to higher inclusion (10-40%) mixtures.	Will be mixed on-farm with cereals (home grown or purchased) and possibly, other dry feed materials (often purchased) including medicinal and/or zootechnical additives.

NB These are examples only and do not give an exhaustive summary of the possible feeding systems or combinations.

All the activities outlined in Table 2 involve dry feeds and dry feeding. Apart from integrators described in paragraph 36(a), the majority of poultry farmers now purchase proprietary compounds. Indeed, even integrators may buy-in feed, particularly low volume lines. There are a few traditional 'home mixers' who purchase either a proprietary complementary compound feed (high

protein concentrate) for mixing with cereals, or a mineral/vitamin premix for mixing with cereals and protein materials.

Feed Mixing Systems for Poultry

38. The main feed mixing systems for poultry are as follows.

- a) Dry mixing – on a smaller scale, mixing is done with a grinder, a standalone weigher, a static mixer with associated tip-in hopper and a bagging-off point. As the scale increases, so does the complexity until at the extreme end there may be several bulk raw material bins feeding one or more weighers, a mixer with additives incorporated via a blow-line from the tip-in point, grinders, pelleting lines with different sized presses to form different pellet sizes, coolers, fat sprayers and bulk bins for finished product storage.
- b) Mobile mill and mix services – some poultry farms employ the services of a mobile mill and mixing service.

Feeding Practices for Poultry

39. In general, the choice of feeding system is dictated more by the scale and type of housing than by whether the feed is a home mix or purchased compound feed. Most of the feed produced by traditional home mixers will be in meal form. Larger scale mills are able to produce feeds in a variety of forms, including meals, crumbled pellets (crumbs) for very young poultry, or pellets (ranging from 2.0 mm for smaller birds to 4 mm for adult turkeys). Thus, even home mixers may choose to buy their starter feeds from a commercial feed mill to encourage higher early feed consumption by chicks or poults using crumbs or very small pellets. Early uptake is further encouraged by sprinkling the crumbs on sheets of cardboard to give the young birds easy access to the feed.

40. For poultry reared or bred on the floor in sheds, the feed will be delivered around the house from the bulk feed container by track feeders. Such a system is common for broilers, broiler breeders and replacement laying hens. Alternatively, hoppers or pan feeders may be arranged around the poultry house. This type of regime is more common for turkeys. Laying hens in barn systems or cages may be fed from troughs or chain feeders. For free range or 'outdoor reared' poultry, feeding systems within the available housing are similar. However, some flocks may be fed out-of-doors in troughs. In addition to the 'compound' feed, free-range flocks also have access to the land or pasture, so giving them freedom to peck at the soil and vegetable matter, also pick up worms, insects and small mammals.

Ruminants

Extent of Home Mixing for Ruminants

41. 'Home mixing' in the broadest possible sense is practised on a high proportion of dairy, beef and sheep farms. The feeds used and the types of systems employed are a direct consequence of the ruminant's unique digestive capabilities to digest and utilise large quantities of home grown forages such as grass and other arable and fodder crops with little additional supplementation. However, the available forages are frequently insufficient to meet the nutritional needs of modern livestock, particularly during the colder winter months, and so supplementation with other forages, concentrates and compound feeds is common practice. Conserved forages, which form the basis of cattle diets during the winter, are bulky and therefore difficult to mix with other feeds. As a result there has been increasing use of feeder wagons to mix together all of the dietary components to produce a complete diet.

42. Some examples of the main types of feed mixing activity are shown in Table 3.

Table 3 Examples of Feed Mixing Activities on UK Ruminant Farms

EXAMPLES OF PURCHASED MANUFACTURED FEEDS	EXAMPLES OF 'HOME MIXING' ACTIVITY
Complete compound feed.	No mixing required. Most ruminant compounds are 'complementary' feeds requiring a forage element to complete the daily ration.
Complementary compound feed for feeding with forages.	No actual mixing required but animals also require access to silage, hay or other moist feeds or forage crops. Alternatively the compound may be used to supplement a semi-complete diet that has been mixed in a feeder wagon.
Complementary compound feed ranging from vitamin/mineral supplements to higher inclusion (10-40%) mixtures.	Mixed in a static mixer with cereals (home grown or purchased) and other dry feed materials (sometimes including medicinal and/or zootechnical additives). Daily ration will include forages (fresh or preserved) and possibly moist feeds and root crops fed separately.
Complementary compound feed ranging from vitamin/trace element premixes to higher inclusion (10-40%) mixtures.	Mixed in a feeder wagon, if necessary, with cereals (home grown or purchased) and other dry feed materials (often purchased), silage and other forages, moist feeds and root crops to produce a complete diet.

NB These are examples only and do not give an exhaustive summary of the possible feeding systems or combinations.

Feed Mixing Systems for Ruminants

43. The main feed mixing systems are:

- a) Feeder wagons – the bulky nature of forages means that they are generally difficult to mix with other feeds without the use of specialist machinery. However, a significant and increasing proportion of dairy and beef farmers now use feeder wagons or complete diet feeders to mix forages with other feedingstuffs, complementary feeds or additives to produce total mixed rations. Feeder wagons are fitted with weighing facilities that allow specific amounts of individual feeds to be mixed together. Such rations may be fed several times a day in troughs. Some farmers use feeder wagons to mix forages with other dry or moist feed materials for feeding in troughs whilst still feeding compound feeds, either in the milking parlour or through out-of-parlour feeders.
- b) Dry mixing – a few ruminant farms produce their own home mixed ‘compound’ equivalent for feeding separately from the forage component.
- c) Mobile mill and mix units – as for pigs and poultry, some ruminant farms employ the services of a mobile mill and mixer unit.

Feeding Practices for Ruminants

44. Forages, either fresh or conserved, constitute the main feeds for most ruminant livestock. Fresh forage (e.g. grass) is usually grazed directly by livestock, and not mixed with other feeds. Because of their bulk and physical nature, conserved forages (particularly hay and silage) may be fed as the sole feed or as discrete feeds, depending on the productivity of the stock in question. Grass or maize silage stored in clamps is fed to cattle or sheep on a ‘self feed’ basis, with access controlled by some form of physical barrier. This approach is favoured where the silage clamp is in close proximity to the cattle or sheep accommodation. Alternatively, silage may be removed from the clamp and fed in ring feeders, or along troughs or feed passages, either on its own or as part of a complete diet. Either way, livestock have access to forage for most of the day. Conservation of silage in bales provides greater flexibility, particularly in respect to where it can be fed on the farm and the livestock to which it can be fed.

45. Where forages alone are insufficient to meet the nutritional requirements for growth, pregnancy or milk production, additional feeds are provided. These may be fed as discrete meals or as mixtures of feeds, the former being particularly common for bulky moist feeds (e.g. brewers’ grains) or where only one other feed (e.g. a cereal or a compound feedingstuff) is fed.

46. Ruminant livestock are generally fed on a group basis. Exceptions to this are:

- young calves which, during the first few weeks of life, are usually individually penned and fed on a purchased milk replacer and calf compound. Calves may be fed whole milk produced on-farm. The compound may be a home produced or purchased meal, a coarse mixture or a purchased pelleted feed; and
- milking cows, which are usually fed compound feed in the milking parlour or through programmed out-of-parlour dispensers. The amount of compound feed they receive is related to the quality and quantity of other feeds available to them outside the parlour and their level of milk production. Such compounds are purchased as pellets to aid their flow through the feeding equipment.

IV IDENTIFICATION OF POSSIBLE HAZARDS AND RISKS ASSOCIATED WITH ON-FARM FEEDING PRACTICES AND PRACTICAL CONTROL MEASURES

47. In order to maximise the safety of animal feed and food products, thus protecting animal health and the ultimate consumer, **farmers must apply good manufacturing practice across the farming system and adopt a systematic approach to the identification, evaluation and control of hazards within their own feed production and feeding system.** In evaluating their own procedures, **farmers are encouraged to adopt the principles of Good Agricultural Practice (GAP)/Good Manufacturing Practice (GMP).** There are various guides to GAP and GMP that can be used to identify the general hazards relating to on-farm feed production and handling. Through the application of GMP, farmers can prevent many of the possible hazards from entering into, or developing on their farms. **Alternatively, farmers may choose to initiate a Hazard Analysis and Critical Control Point (HACCP) plan.** HACCP is most useful where hazards are known to exist on the farm and require management to ensure that they do not pose a threat to human or animal health.

48. Section III reviewed the range of on-farm mixing and feeding practices in the UK. The following list summarises the general areas of concern identified in that section:

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

49. This review has highlighted the need for farmers to consider their own farming system when identifying the key components involved in each process step. In overview, these are summarised in Annex II. Please note this Annex does not identify hazards per se; these will be dealt with subsequently.

Hazard Analysis and Critical Control Points (HACCP)

50. HACCP was developed in the early 1960s and in brief, HACCP is a systematic method for identifying hazards to the safety of products and for introducing controls at critical points in the process/supply chain to prevent such hazards from occurring, or for reducing them to levels below critical limits. It is not the intention of this review to describe HACCP in detail. There are a number of excellent textbooks⁵ on the subject and several food and feed industry bodies run training courses. HACCP could be part of a well-managed feed production system.

51. There are a number of hazards which, if not controlled in feedingstuffs can pose a significant risk to animal and/or human health and safety. Some hazards may not be a risk to the animals themselves but can be concentrated in the resulting human food product at a level that is unsafe to the ultimate consumer. The hazards covered by HACCP are categorised as follows:

- biological contaminants e.g. bacteria, fungi and other microbial pathogens;
- mycotoxins and prohibited processed animal proteins;
- chemical contaminants e.g. residues of medicines, zootechnical substances, pesticides, polychlorinated biphenyls and dioxins, lead and other heavy metals, fertilisers or other chemicals; and
- physical contaminants e.g. soil and other foreign material (glass and metal fragments).

In addition, HACCP principles are increasingly being applied to the attainment of other feed quality aims, such as non-GM status, even though this is not necessarily a safety issue.

5 Codex Alimentarius – Food Hygiene Basic Texts – FAO / WHO – ISBN 92-5-104021-4
CCFRA – HACCP: A Practical Guide (Second Edition) April 1997 – ISBN 0-905942-05-01

Good Agricultural Practice (GAP) and Good Manufacturing Practice (GMP)

52. Through GAP and GMP, farmers can successfully avoid many of the above hazards. The following sections, read in conjunction with Annex III, are designed to illustrate the role of good practice in hazard prevention and management.

Sourcing and Selection of Feedingstuffs

53. The hazards and potential risks associated with the supply of raw materials (whether bought-in or home-produced) will vary from negligible to very serious. **For example, the risk associated with purchasing a feed material from farmers or merchants who are certificated to an appropriate quality assurance scheme and therefore have assured storage and handling facilities is low.** In comparison, there may be high risks associated with purchasing a feed material from a non-assured farmer or merchant who lacks technical knowledge and appropriate storage and handling facilities. In the context of this report 'assured' refers to membership of/certification to an independently audited assurance scheme.

54. **The Committee was also concerned that farmers purchasing surplus food materials direct from food factories should not assume that the material is necessarily safe as animal feed.** Such products can be susceptible to spoilage e.g. mould and mycotoxin formation, and require effective removal of any packaging prior to feeding.

55. The commercial feed industry in the UK has taken steps to ensure that feed materials and manufactured feeds are judged independently to be safe and fit as animal feedingstuffs. As a result, many merchants and compounders are already audited independently to a certificated standard embracing both GMP and HACCP. Such companies, in turn, require their suppliers to be 'assured'. Similarly, many UK livestock assurance schemes require their farmer members to purchase feedingstuffs only from assured sources. **By opting to buy from assured sources, the farmer is spared the need to undertake his own in-depth checks unless he has reason to believe that the product is not sound.**

56. As the commercial feed sector increasingly subscribes to assurance schemes, non-assured materials, including those produced on-farm or traded locally between farms, are the only feedingstuffs not subject to the standards of quality control expected of other parts of the industry. **Improved and consistent standards of quality control should be the aim of the farming community and this must eventually encompass all feeds/feed materials from whatever source.** There is no reason, not even on the grounds of small or irregular volumes, for anyone to be excluded from

this requirement. Although the onus for demonstrating quality should be on those supplying the material, **farmers should exercise particular caution when purchasing cheap or unusual feedingstuffs**, including distressed materials. A number of recent food safety incidents in Europe have arisen from contaminated feed materials supplied either to farms or feed manufacturers. It is very much a case of 'buyer beware'. **The European Commission's proposals on feed hygiene will introduce the registration of all feed businesses, including producers of feed materials, who would be required to apply HACCP principles. The Committee supports this development.**

57. Farmers who utilise their own products in effect become their own suppliers with all of the expectations this imposes. The farmer must apply GAP/GMP to the production, handling and storage of such materials taking care to ensure that pesticides and herbicides are used in accordance with published recommendations, and that storage facilities and equipment are cleaned and maintained appropriately. Farmers are reminded that visual inspection alone is insufficient and that some testing is necessary to demonstrate that feedingstuffs do not contain excessive levels of, for example, microbial pathogens, mycotoxins or other undesirable substances. A reputable, accredited laboratory should be used for this purpose. **Farmers who sell feed materials to other farmers or businesses will be required to demonstrate 'due diligence' to their customers; such farmers are likely to require membership of an appropriate farm assurance scheme.**

58. E-commerce is increasingly used as a medium for buying and selling crops and other feeds. There are no additional hazards for materials traded via E-commerce, provided they come from assured sources. However, particular care is needed if buying feed additives or other products advertised via the internet. It is important to ascertain that products bought from outside the UK comply with UK law.

Transport

59. Hazards that may be a risk to feed or food safety can be introduced as a result of contamination prior to arrival at the farm during transportation. Such contamination will not be eliminated simply by good management on the farm and may not be controlled by further processing through the home mix plants (e.g. materials contaminated with salmonella as a result of transport in unclean vehicles will not be effectively de-contaminated unless the feed itself is subsequently processed at a certain temperature for a specified duration or treated using organic acids). Therefore, transportation to the farm must be tightly controlled.

60. **It is imperative that equipment used to transport feeds, either to a home mixer or within the farm itself, is suitable for the purpose, has not been used previously to transport inappropriate loads, is adequately cleaned and is driven by trained personnel.** Inappropriate loads would include, for example, manure, soil, carcasses or other meat materials, domestic waste or non-food/non-feed items such as coal, glass and fertiliser.

61. When the feed supplier provides the transportation, farmers should ensure that they can provide evidence of membership of the industry-wide scheme for road haulage, or request written assurance that the correct standards are applied, adhered to and maintained. **Compliance with the code of practice for road haulage will provide assurance to the farmer.** This code includes a full list of prohibited materials, haulage of which could pose a threat to animal or human health. There is also a list of other materials which trigger thorough cleansing after haulage. The responsibility for safe transport moves to the farmer in situations where the farmer's own vehicles are used. **Farmers responsible for organising their own road haulage are advised that compliance with the code of practice for road haulage will provide them with a level of independent assurance.**

Receipt and Handling

62. The first task here is for the farmer to check that the delivery conforms to the order and that all accompanying paperwork is correct. A visual appraisal of bulk goods is helpful in confirming that the product is as required and free from visible contamination. It would be in the farmer's best interests to take a sample prior to discharge for future reference and possible testing.

63. If the feedingstuff arriving at the farm fails visual and/or paperwork checks, then the supplier must be contacted and an appropriate course of action agreed. Unsafe feeds must be disposed of legally.

64. The risks of spoilage or contamination will depend on the discharge facilities available on the farm and associated practices. These may vary from tipping the raw material directly from a trailer onto a concrete yard that is open to the elements and crossed daily by livestock and/or machinery, to the raw material being blown into a closed bin used specifically for that raw material. **The risks are considerably higher for open tipping than for closed bins.** When direct discharge to the final storage point is not possible, or when there is a need to move feeds to different premises, tractors fitted with front-end loaders or farm trailers may be used. This equipment is rarely dedicated to handling feed alone, and is often used for a wide variety of materials including soils and manure. This poses a high risk of contamination and such machinery should be cleaned thoroughly before feed use. **The hazards and risks associated with the discharge and handling system must be assessed on each farm and effective control measures applied.**

On-farm Storage

65. **Assuming that the feedingstuffs which have been delivered to the farm are wholesome and present minimal or no risk to livestock or humans, they must be stored in such a way as to maintain their high quality status.** For example, if a feed material is stored in warm, damp conditions, the fungus *Aspergillus flavus* could develop and grow, producing Aflatoxin B1, thus rendering the raw material both toxic and illegal for use in livestock feed. Similarly, overheating can occur where damp materials are stored in poorly ventilated conditions, resulting in elevated temperature, growth of mould, and in extreme cases, combustion.

66. It is important that feed materials are kept separate from each other and from other farm materials (e.g. fertiliser or other farm chemicals), and that they are clearly identified. Due care should be paid to the cleanliness and driving of vehicles within storage sheds. It is of critical importance that manufactured feeds (bought-in or home produced), particularly those containing medicines or zootechnical feed additives, do not contaminate feed materials and *vice versa*, and that medicated feeds are kept separate from unmedicated feeds. Storage areas for each type of feed should be entirely separate and clearly marked, and bulk bins should be either dedicated to particular feeds or cleaned thoroughly if switching between different feeds.

67. There are many different types of storage as identified in Section III. Feed material suppliers are best equipped to advise on the most effective means of safe storage. These will vary depending largely on the moisture content of the material or feed. In the case of moist feeds, including home-produced forages, there are three key principles (in addition to the more general rules on hygiene). These are: consolidate, sheet and weigh down. By these means air is forced from the stack and excluded, thus safeguarding against undesirable fermentation.

Manufacturing and Mixing

68. Home mixing is a general term applied to any process by which the farmer mixes differing feedingstuffs together to form either a compound feed and/or a daily ration for the livestock. A wide range of mixing facilities is in use as mentioned in Section III, ranging from the traditional static mixing systems (similar to those used by the feed industry), more recent feeder wagons for ruminants and liquid feeding systems for pigs, to mobile mill and mixing operations that move from farm to farm. In each case, the objectives of the mixing operation are the same:

- a) to obtain a thorough mix of all components, in the right proportions, such that there is good dispersion of nutrients and micro-elements within the feed;
- b) to avoid cross-contamination between batches of differing feeds thus preventing unwanted materials or additives in non-target feeds;
- c) to avoid contamination of feed from build-up of stale residues within the plant through regular cleaning; and
- d) to achieve a consistent product and safeguard against microbial spoilage in liquid feeds.

69. Achieving a thorough mix of the intended components relies on adding the correct amount of each ingredient and ensuring adequate mixing. This requires calibration of the weighing/addition equipment (including buckets, scoops, etc.) and mixing efficiency tests (achieved for example by testing a number of samples from the mix for salt or one of the trace elements such as manganese). Such tests should be conducted on a bi-annual basis.

70. At this point, it may be appropriate to consider in a little more detail the application of HACCP principles within the on-farm mixing situation. Apart from the importance of GAP/GMP in safeguarding against possible hazards, there are instances where farmers are faced with handling existing hazards which can pose a threat to animal and human health. A good example is medicinal and/or zootechnical feed additives in a feed mixing plant that also makes non-medicated feeds.

71. Consider the case of an approved and registered home mixer who produces a feed for growing pigs using a vitamin/trace element premix containing a 'prescription only' medicine and who also produces, using the same plant and equipment, a separate feed for finishing pigs containing a non-medicated vitamin/trace element premix. It is very important that no trace of the medicine gets into the finishing pig feed as this would either delay slaughter (the extent of which would depend upon the specified withdrawal period of the medicine) or may leave residues in the meat for human consumption. Note that the problems arising from cross-contamination could be even higher if the farmer is producing feeds for other species, which may suffer adverse effects from the particular medicinal product used. Any such adverse effects would be highlighted on the premix label. The farmer must not only ensure correct mixing of both feeds but also prevent any of the medicine/medicated feed from contaminating the non-medicated feed.

72. Critical parts of the farm where cross-contamination could occur are:
- a) the bagged material store where the premixes are stored;
 - b) the weighing point for premix additions, including scoops, buckets;
 - c) the tip-in point for premixes and other minor ingredients;
 - d) any transfer lines i.e. conveyors to the mixer;
 - e) the mixer itself;
 - f) any subsequent transfer system for the mixed feed e.g. auger to the bulk bins or bagging-off point;
 - g) the storage facility for the finished feed i.e. bagged store or bulk bins; and
 - h) any equipment used to move the feed to the animals.

73. Control at these critical points is vital. Annex III highlights some of the practical measures which can be taken to prevent cross-contamination. If a batch of non-medicated feed is to be produced after a medicated batch then the areas and equipment identified in paragraph 72 must be cleaned prior to manufacture. Cleaning may be achieved either by sweeping down with a clean brush or, if access is restricted or the feed plant in constant use, by 'flushing' through the plant using a neutral material, e.g. barley. This will pick up any residues which can then be incorporated either into the medicated feed itself or stored for use in the next batch of medicated feed. Alternatively, the sequence of production can be scheduled to ensure that susceptible feed is not made too soon after the medicated feed. Where possible, facilities such as bulk bins should be dedicated to medicated or non-medicated feeds.

74. **It is important to be sure that the methods adopted to prevent cross contamination throughout the plant are effective.** To confirm this, samples of the non-medicated feed should be taken and sent for analysis for traces of the medicine used. If traces are found then extra cleaning, flushing or other control measures will have to be undertaken. Once the control measures have been validated, the frequency of sampling and testing can be reduced. Occasional samples should still be taken to show continued compliance. For their own protection, farmers are strongly advised to take and retain samples of mixed batches of feed for a suitable period of time, for reference in the event of any subsequent feed-related problems. (N.B. The EC Council Directive 95/69/EC requiring on-farm mixers to be

approved/registered is currently interpreted as requiring samples to be taken and retained). Retention of moist or liquid feeds is difficult without access to suitable freezer/refrigeration capacity.

75. Whilst the example given in paragraphs 71-74 refers to the use of a medicine, **similar rules will apply to other zootechnical/feed additives posing a risk either to non-target species or of residues in food products.**

Feeding Practices

76. As Section III illustrates, there are many types of feeding systems depending on the type and age of livestock and the feed materials. **The aim is to ensure that each animal receives the correct quantity of the right feed.** Delivering the correct quantity of feed requires maintenance and calibration of dispensing equipment, not only for automatic feeding systems but also for feed delivered by hand using buckets, scoops. Giving animals the wrong feed can, in extreme cases, be fatal. Such a risk is highest on farms with more than one livestock species. For example, certain zootechnical feed additives included in broiler feeds can be fatal if fed to turkeys and horses. **Clear and unambiguous labelling of bagged feeds and bulk feeds/storage units is therefore vital. Farmers must check the labels on all purchased materials to ensure that they understand any limitations on use or contra-indications applying to the products.** Sheep, for example, are highly susceptible to copper, and for this reason many other ruminant feeds containing supplemental copper are labelled 'Do not feed to sheep'. There have also been occasions when livestock have consumed the wrong feed as a result of poor penning of the animals or inadequate fencing (e.g. sheep have gained unintentional access to cattle feed and ducks and geese to ruminant feed). A further example is that of pet food which often contains processed animal proteins prohibited in farmed animal feeds. All such feeds, including those in bags, must be stored well separated from the feed intended for farmed animals, in such a way that prevents accidental misuse.

77. **Even on single species farms, regular cleaning to remove residues of earlier feeds is essential.** For example, there have been cases of mycotoxicoses in livestock which occurred as a direct consequence of them consuming old feed that had been allowed to deteriorate in troughs and hoppers. One of the main causes of tissue residues of medicinal and zootechnical additives is failure to use up all of a batch of medicated feed and then, failure to empty feed bins thoroughly prior to changing to withdrawal feeds.

78. Another concern is possible contamination of feeds with manure, slurry (e.g. cattle that are floor-fed through feed barriers either side of a passage along which tractors, etc. are driven to dispense the feed in front of the livestock). Livestock cannot be kept separate from their faeces but every effort should be made to ensure that troughs and feed passages are kept clean to ensure there is no build up of microbial pathogens.

79. Certain feed supplements, including salt licks and feed blocks, may be provided to animals at pasture where this may be deficient in essential trace elements and vitamins. Such blocks, as well as oral pastes, drenches and slow release capsules (boluses) can play an important part in meeting the animal's total nutrient requirements. However, **it is important for farmers to be conscious of the total nutrient intake of their animals.** For example, it is well known that copper is toxic to sheep at relatively low dietary concentrations. Less widely appreciated is that excess copper can also be toxic to cattle. Thus, cattle may be receiving copper from pasture, from home-produced or bought-in feed materials, from purchased complementary feeds (premixes or concentrates) as well as from non-feed forms administered direct. This could lead to toxic intakes of copper and health problems for the animals, as well as unnecessary expense for the farmer.

80. 'Top dressing' is a feeding practice used on some farms, where a pre-mixture or complementary feed is spread on top of other feed materials, commonly silage, in the feeding trough. The feed is not mixed and as a result there is a risk that some animals may consume an uneven share of the product spread on top. The Veterinary Medicines Directorate has already made clear to farmers that medicated premixes (complementary feedingstuffs) must not be top dressed in this way as the practice falls outside the marketing authorisations for the medicated premixes.

81. **The grazing of grass pastures and arable crops such as kale or fodder beet should be managed in such a way that possible contamination by physical, biological or chemical food safety hazards is minimised.** For example, an adequate period should be observed before allowing livestock to graze pastures that have been treated with manure and/or between grazing rotations in order to minimise biological cross-contamination from manure. **Farmers should also ensure that required withholding periods following agricultural chemical applications (e.g. pesticides and herbicides) are observed.** An additional consideration for grazing and growing crops is their proximity to factories or other industrial processes, where harmful emissions could lead to elevated levels of certain environmental pollutants, e.g. polychlorinated biphenyls and dioxins, within the surrounding soil and crops. **Redundant farm machinery must be removed from the animals' reach to prevent possible harm caused through leaking batteries, flaking paint, etc.**

Competence and Training

82. Council Directive 95/69/EC on the approval and registration of feed establishments, as implemented into national law, sets out requirements for producers registering as mixers of feed containing additives. Additives will be present in complementary feeds (“premixes” or “concentrates”) bought and used by the farmer. The Directive indicates that the feed manufacturer, in this case the farmer, must have sufficient staff possessing the necessary skills and qualifications. The National Farmers’ Union Code of Practice for On-Farm Mixers Producing Complete Feeds for Their Own Use has provided a useful interpretation. It indicates that **everyone involved in mixing animal feed must be able to demonstrate their competence, having appropriate skills to match the scale, risks and complexity of the feed mixing operation**. Training should be either by practice or instruction. That apart, **it is important that the farmer has access to the necessary expertise when identifying feed and food safety hazards within the business and deciding upon suitable and effective control measures**.

83. The Defra Codes of Practice for the Control of Salmonella during storage, handling and transport of raw materials and on production of final feed for livestock⁶ indicate that there should be sufficient personnel with the ability, training and experience necessary to ensure that the provisions of the Codes are applied. They refer to the need for clear guidance and instruction on their duties, and for training to cover not only specific tasks but also good hygiene practice and GMP generally, as well as the importance of personal hygiene.

Documentation and Traceability

84. The numerous feed-related scares in Europe over recent years, including Foot and Mouth Disease, have highlighted the importance of traceability within the food supply chain. Without the ability to identify rapidly where animals, feed or food products have come from and gone to, it is impossible for anyone to respond quickly and effectively when problems are found within the system. Future legislation will make traceability an obligation for all operators in the feed/food supply chain. **Traceability will not be achieved without adequate and clear documentation. As far as livestock farmers are concerned, the minimum requirement will be:**

- a) records of feedingstuffs purchased – date, description including ingredients, quantity, supplier, batch code for additives;
- b) records of any tests conducted on purchased feedingstuffs;
- c) details of storage e.g. main barn, bay 3;
- d) date and quantity mixed including formulation record and record of mixing sequence;
- e) records of any analyses conducted to confirm adequacy of mixing times, cleaning procedures;
- f) date fed (if different from above) and livestock details; and
- g) grazing records – dates of pasture treatments.

V CONCLUSIONS AND RECOMMENDATIONS

85. On-farm mixing is a varied procedure that can range from a small farmer buying and mixing a few raw materials on a floor to sophisticated integrated poultry units where feed manufacturing is on a scale as large as commercial feed mills. There is also a wide diversity of feeding practices, dependent on the type and age of the livestock species, the nature of the feed materials and whether the farm operates an intensive, extensive or organic system.

86. The identification of hazards and the management of resulting risks has become an essential concept in the food chain. Farmers should apply good manufacturing practice across the farming system and adopt a systematic approach to the identification, evaluation and control of known hazards within their own feed production and feeding system. In evaluating their own procedures, farmers are encouraged to adopt the principles of GAP and GMP. **The Committee recommends that all home mixers and livestock farmers implement a system based on a HACCP and/or GMP.** In this way farmers who keep animals should make themselves aware of the hazards that are part of their feed sourcing, preparation, storage and use (paragraph 48). This is necessary to help avoid harm occurring either to their animals or indeed to the ultimate consumer of animal produce. Thinking through and identifying possible hazards and effective controls could be fundamental in preventing feed-related food scares. It is for this reason that future EC proposals seek to embody the HACCP approach in registration requirements for farmers and other 'feed businesses'.

87. **The Committee recommends that all home mixers should have a risk assessment and control programme in place** (paragraph 49). It is not the Committee's wish to prescribe how individual farmers tackle this exercise. **The system chosen must be proportionate to the potential risks to animal and human health, which will be related to the types of feeds being fed, the number of livestock involved, the market outlets for those products and whether the farmer is also selling feed manufactured on-farm.**

88. Annex III to this report provides a framework for farmers to identify hazards according to the potential risks they present at all stages. This could be a system categorising as high/medium/low or something more sophisticated. Some farmers may consider that they are too close to the mixing and/or feeding operation to be sufficiently analytical or objective. In these circumstances, **the Committee recommends that farmers seek outside help, from the feed industry, feed material suppliers, private consultants, assurance scheme auditors or other advisers in assessing hazards and risks on their farm.** The Committee wishes to encourage use of a checklist similar to that in Annex III, although it is emphasised that this does not cover every possible source of hazard. The hazard analysis will therefore involve different factors, because all farms are different.

89. Identifying potential hazards is only the first step. It is necessary to consider the level of risk associated with each hazard, and then to apply appropriate control measures. The term 'appropriate' is used deliberately because the Committee recognises that full controls may not be economically viable. **The Committee recommends that farmers undertake appropriate targeted feed analyses to demonstrate that practical control measures are working and that feeds are safe.**

90. In terms of volume, large suppliers selling thousands of tonnes of feed have the potential to cause large scale feed and food safety problems; however they are often the participants in assurance schemes that aim to minimise risks. The Committee considered that smaller operators who are not members of assurance schemes, not registered with their local authority or approved by the RPSGB, and are likely to be less aware of hazards, are subject to fewer external controls. The Committee was also aware that several of the more recent European feed scares have resulted from the sale of feed materials and/or feed additives from relatively small operators to a wide network of farms/feed suppliers.

91. Many farmers already follow codes of practice and are members of existing livestock assurance schemes, requiring the establishment of quality assurance systems such as those developed for dairy, pigs, chicken, eggs, etc. Recognising the usefulness of such codes of practice and assurance schemes in developing quality assurance systems on farm, **the Committee urges that such codes and schemes be further developed to address hazards associated with on-farm mixing and feeding practices** (paragraph 9). **It also encourages farmers to participate in such codes and schemes, where available.**

92. The Committee noted that the major feed, and food-linked, incidents in recent years have related to the safety of the feed materials used as animal feedingstuffs. The Committee believes that the production/sourcing, transport and receipt of feed materials must be particularly well controlled. **The Committee recommends that farmers take particular care when purchasing either new types of feed or feed material or from new suppliers, especially when the material in question is unusually cheap** (paragraph 56).

93. Approximately 50% of the feed delivered to UK farms is produced by feed compounders, the vast majority of whom operate under feed assurance arrangements. The remainder is feed materials that are purchased and subsequently either fed 'straight' or are mixed or blended on-farm with home produced materials or other feeds. **The Committee recommends that all materials purchased by farmers for animal feeding, should come from sources and suppliers who can demonstrate compliance with recognised quality assurance standards** (paragraph 55). The Committee noted that the European Commission's proposals on feed hygiene will introduce the registration of all feed businesses, including producers of feed materials, who would be required to apply HACCP principles. **The Committee supports this development** (paragraph 56).

94. Some farmers, particularly those selling feed commercially, are certificated to the appropriate scheme for commercial feed manufacturers. **The Committee encourages farmers selling manufactured feed to be independently assessed for compliance with an appropriate assurance scheme** (paragraph 57).

95. **Farmers responsible for organising their own road haulage are advised that compliance with the code of practice for road haulage will provide them with a level of independent assurance** (Paragraph 61).

96. As the European Commission acknowledges in setting out its proposals on feed hygiene, successive feed crises have demonstrated that identifying the origin of feed is of prime importance in terms of health protection. In particular, traceability facilitates the withdrawal of feed and food that may pose a threat to human or animal health. It is therefore important to keep records that enable retrospective tracing of any subsequently discovered problems. Such problems can be identified at any point in the chain either as a result of feed or food testing or illness/death in animals and/or humans. The Committee believes that all feed materials should be traceable from point of origin through to the point of feeding to animals. **The Committee recommends that farmers keep clear records enabling traceability of all purchased feed materials, additives or compound feeds used and fed on-farm** (paragraph 84).

97. The Committee recognises the importance of the competence and training of those involved in on-farm feeding to the provision of a safe feeding system. **The Committee recommends that everyone involved in on-farm feeding should be able to demonstrate their competence, having appropriate skills to match the scale, risks and complexity of the feed operation** (Paragraph 82).

VI GLOSSARY OF TERMS AND ABBREVIATIONS USED IN THIS REVIEW

ACAF	Advisory Committee on Animal Feedingstuffs.
Aflatoxin	One of a range of naturally occurring toxins produced by certain moulds on food and feed commodities grown in warm, humid conditions.
Assured	Membership of/certification to an independently audited assurance scheme.
Auger	Metal screw for conveying feeds or feed materials.
Blend	A loose homogenous mixture of feed materials and other ingredients.
Boluses	Bullet shaped products containing soluble materials given directly to animals, which provide a slow release of additives in the animal's gut.
By-products	Usually by-products of food or drink manufacture which have value in their own right as feed materials (e.g. soyabean meal, brewers' grains, wheat feed).
Codes of Practice	Guides to good practice.
Complementary compound feed	A compound mixture of feed materials with a high concentration of certain nutrients (e.g. protein) which is sufficient to provide a daily ration only if fed in combination with other feedingstuffs.
Complete compound feed	A compound mixture of feed materials which supplies the total dietary needs of an animal (i.e. the daily ration).
Complete diet	Complete diet (often synonymous with Total Mixed Ration). Produced on-farm using a feeder wagon that weighs and blends forages, complementary feeds and other feed materials into a complete ration.
Compound feed	A mixture of feed materials, sometimes including additives, intended for feeding either as a complete or complementary feed.
Concentrate	A term used to describe an animal feedingstuff with a high nutritional value relative to its weight.
Co-products	See by-products.

Crimped grain	Cereal grain, harvested before it is fully mature, and pressed through rollers to break open the outer coat (husk).
DARD	Department for Agriculture and Rural Development in Northern Ireland.
Defra	Department for Environment, Food and Rural Affairs.
Dioxins	Group of closely related chemicals produced during most combustion processes and as unwanted by-products of some chemical processes.
Drench	Method of applying nutrients or medicines in a liquid, by passing it into the stomach through a tube.
Feed additive	Substances added to feed mainly to perform technological functions (e.g. binders, preservatives) or nutritional functions (e.g. vitamins and trace elements) or to improve animal production (e.g. micro-organisms).
Feed blocks	Type of compound feed consisting of compressed feed materials (e.g. molasses and minerals) usually with added vitamins and trace elements and shaped in a block. Typically used as a supplement for providing animals' nutritional requirements over a prolonged period of time (e.g. animals at pasture).
Feed materials	Any products of vegetable or animal origin, in their natural state, fresh or preserved; any products derived from the industrial processing of such products or organic or inorganic substances which are intended for oral animal feeding, either directly or in a compound feed.
Feed passage	An area separated from ruminant livestock by a feed barrier. Farm equipment can be driven along this passage to discharge feed which livestock can eat from behind the barrier.
Feed supplement	Complementary compound feed used to supplement the ration where it is lacking in particular nutrients e.g. minerals.
Feeder wagon	A mixing wagon in which feed is mixed and then delivered by chute into troughs or otherwise cast in front of the penned animals, usually cattle. These wagons are generally restricted to single farm use. See complete diet.
Forage	Sometimes referred to as roughage. High fibrous crops such as grass, grass or maize silage, hay, whole crop wheat, eaten mostly by ruminants.
GAP	Good Agricultural Practice.

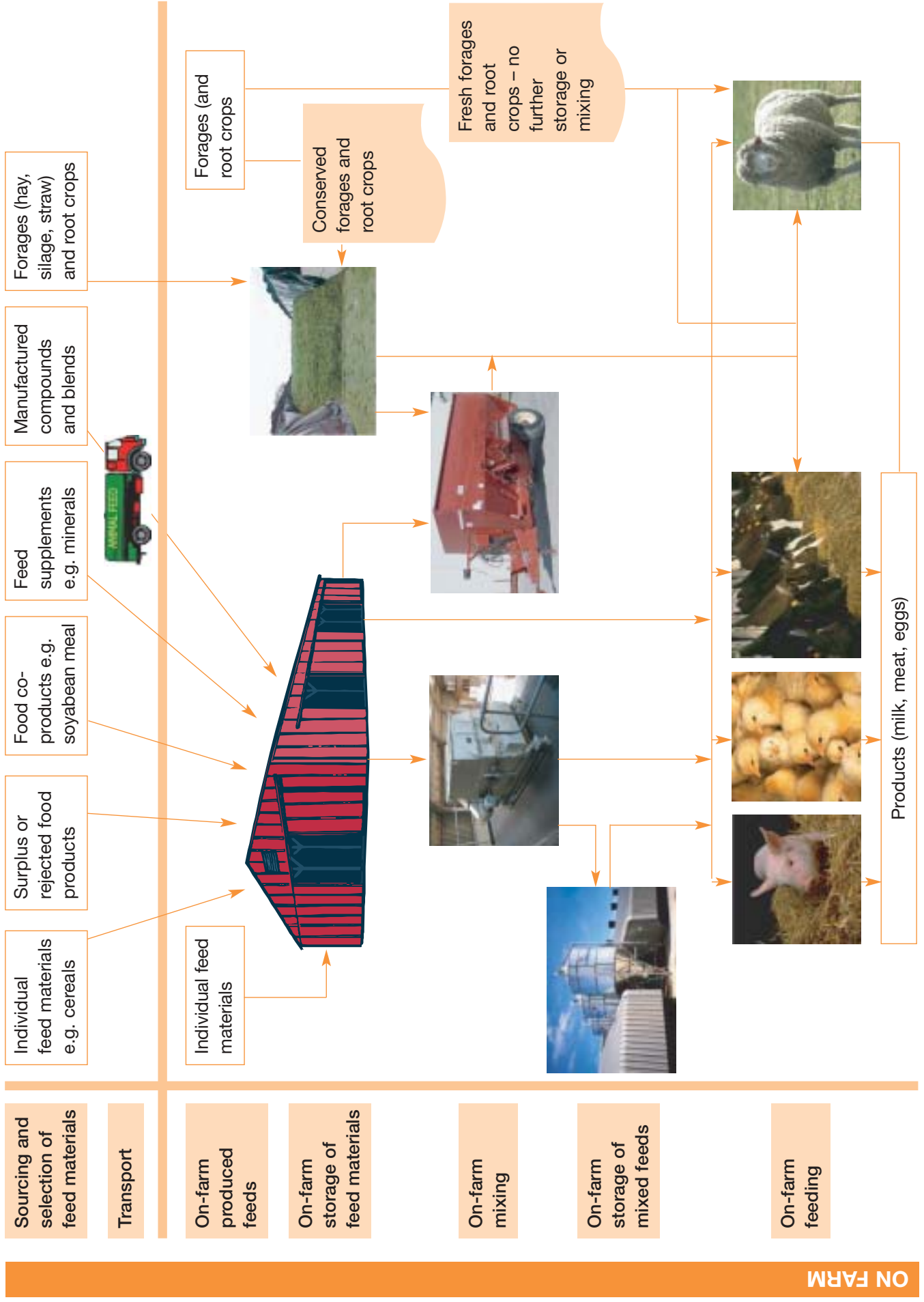
Recommendations on identifying hazards and minimising risks

GMP	Good Manufacturing Practice.
HACCP	Hazard Analysis and Critical Control Points.
Hazard	The potential to cause harm.
Herbage	Green plant material, e.g. grass.
Home grown	Grown on the livestock producer's own farm.
Home mixer	Person who mixes feed ingredients, which may be home produced and/or purchased feeds materials, additives etc. on the premises at which they are to be fed, i.e. a person who practices on-farm mixing.
Hopper	Container with a hole and dispensing mechanism at the base for storing and dispensing compound feeds.
Integrators	Poultry or pig producers who make their own feed, keep their own stock and run their own meat processing factory or egg packing plant.
Licks	Liquid feeds (which may contain additives) in a dispenser which the livestock access by licking.
NFU	National Farmers Union.
Meal	Fine or coarsely ground compound feed for livestock.
Medicated feed	Any mixture of veterinary medicinal product(s) with feed(s) intended for animal feeding without further processing for its curative, preventative or other properties as a medicinal product.
Molasses	A dark syrup, a by-product remaining after the extraction of sugar from cane or beet.
Mobile mill and mix unit	A lorry-mounted facility for milling grain and/or mixing feed materials and additives. The mobility of these units means that mixtures can be tailored to meet the needs of specific livestock groups on individual farms, using the feed materials available.
Mycotoxins	Toxic substances which are produced by certain moulds.
On-farm feeding	Feeding of livestock with purchased feedingstuffs and homegrown feed materials.
On-farm mixing	Mixing of ingredients which takes place at the same location as the livestock to which it is being fed. It may or may not include home-produced feeds.
Oral pastes	Method of applying nutrients in paste, applied onto the tongue of an animal.
Pathogens	Micro-organisms, including viruses, that cause disease.

Premixes	Mixture of additives, with or without a carrier, intended for mixing with feedingstuffs to produce a ration that meets the requirements of the livestock concerned.
Poly-chlorinated biphenyls (PCBs)	Derivatives of biphenyl in which some of the hydrogen atoms on the benzene rings have been replaced by chlorine atoms.
Pot ale syrup	A concentrated by-product of the primary distillation of whisky.
Raw materials	The same as 'feed materials' (see above).
RPSGB	Royal Pharmaceutical Society of Great Britain.
Ruminant	A mammal e.g. cattle or sheep, possessing a rumen. The rumen is one of four 'stomachs' within which microflora aid the digestion of fibrous plant materials.
Silage	Ruminant feedingstuff made by the anaerobic fermentation of high-moisture forage crops (e.g. grass, maize etc.) that is stored anaerobically.
Silo	Storage facility for silage or other feed materials.
Slurry	Liquid manure from livestock, stored in tanks or lagoons and used as fertilizer.
TASCC	Trade Assurance Scheme for Combinable Crops.
Top dressing	A feeding practice whereby a pre-mix or complementary feed is spread on top of other feed materials.
Total mixed ration	See complete diet.
UFAS	UKASTA Feed Assurance Scheme.
UKASTA	United Kingdom Agricultural Supply Trade Association.
VMD	Veterinary Medicines Directorate.
Zootechnical feed additive	Quasi-medicinal substances such as certain growth promoters.

ANNEX I

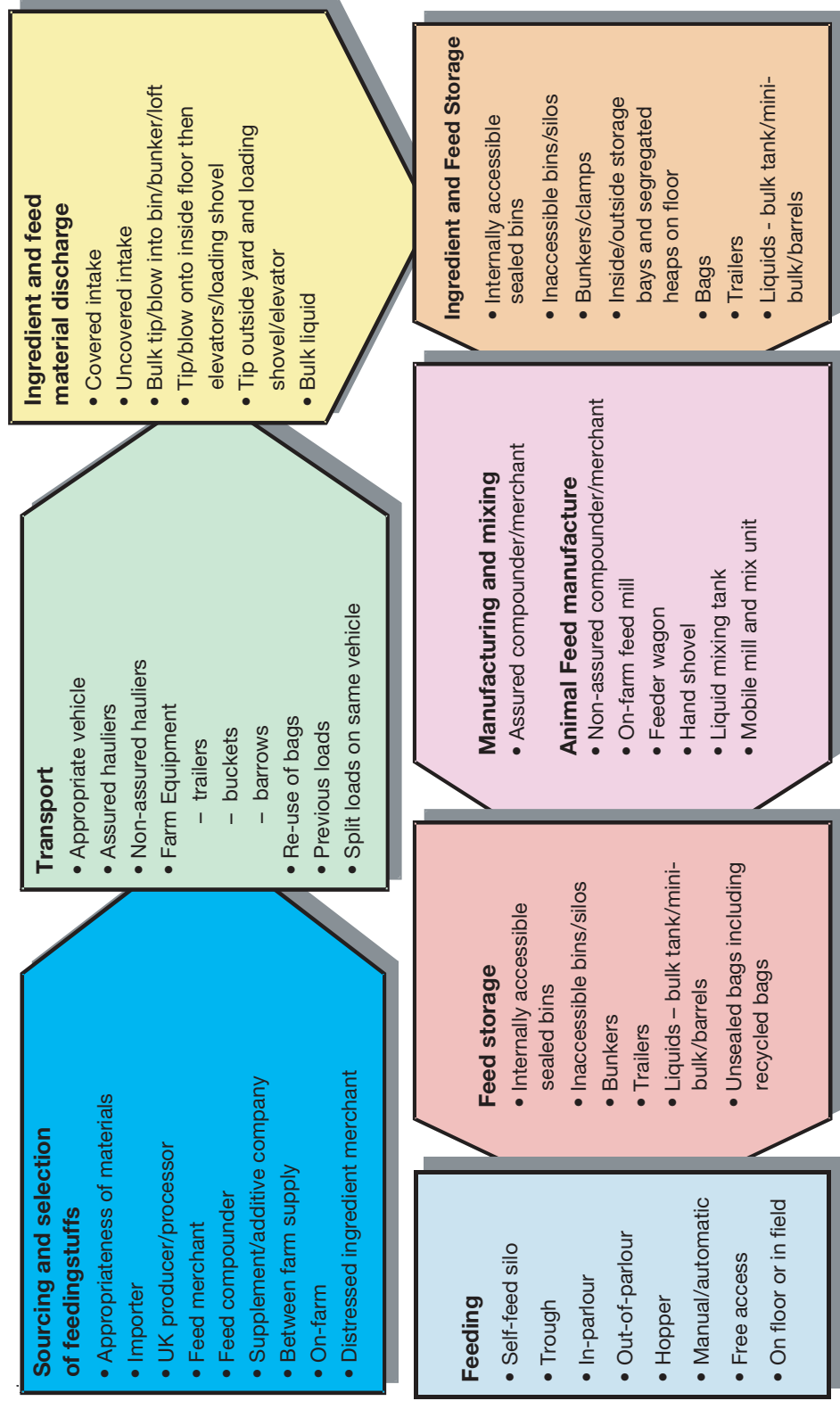
Flow Diagram Illustrating the Sourcing, Storage and Mixing of Animal Feeds.



ANNEX II

Chart to Aid On-farm Identification of Key Components Involved in Each Major Process Step

(N.B. This is not an exhaustive list; e.g. large mills will have many more process steps.



ANNEX III

Identifying Hazards Associated with On-farm Feeding and Relevant Control Measures

Process Step	Possible Hazards and/or Quality Failures	Control measures	Control limits	Monitoring procedures	Corrective action
1. Sourcing and selection of feedingstuffs	<ul style="list-style-type: none"> Product out-of-specification due to incorrect processing or manufacture or poor ingredient selection. Mould and microbial spoilage due to poor harvesting and / or storage conditions e.g. fusarium (pink), ergot. Contamination with other materials during handling or storage. Ingredients containing undesirable substances or other unwanted contaminants such as pesticide residues, heavy metals, etc. which can endanger animal health or, because of their presence in livestock products, human health, as listed in Schedule 7 of the Feedingstuffs Regulations 2000 (as amended). 	<ul style="list-style-type: none"> Purchase from assured suppliers and/or membership of a suitable assurance scheme (e.g. UFAS/TASCC/ACCOS). Contractual terms and obligations. Obtain written warranty from non-assured suppliers. Ensure non-assured suppliers work within current legal limits and have a monitoring system in place. Ensure non-assured producers have suitable storage facilities. 	<ul style="list-style-type: none"> Products pass visual inspection. If necessary test samples for/ or request proof of compliance with legal limits for undesirable substances. Zero for prohibited substances. 	<ul style="list-style-type: none"> Check paperwork confirms assured status. Ensure warranty updated at least annually. Check paperwork for compliance with legal limits e.g. grain passports. 	<ul style="list-style-type: none"> Reject unsatisfactory/contaminated product or notify supplier that product accepted but not satisfactory for the future. Legal disposal of contaminated feed. If necessary change supplier.

N.B. Please read down columns, not across

This table is not intended to be an exhaustive list of all hazards to be found on-farm

Identifying Hazards Associated with On-farm Feeding and Relevant Control Measures

Process Step	Possible Hazards and/or Quality Failures	Control measures	Control limits	Monitoring procedures	Corrective action
2. Transport	<ul style="list-style-type: none"> Contamination of bulk deliveries from previous loads due to inadequate cleanout. Contamination within split loads. Spoilage (due to unsheeted loads exposed to rain, vermin, birds). Broken bags leading to product spoilage. Use of dirty farm vehicles. 	<ul style="list-style-type: none"> Purchase from assured suppliers/haulers. Insist that lorries carry details of the previous 3 loads and have evidence of cleanout between loads. Obtain written assurances. Use dedicated farm vehicles or undertake regular and thorough cleaning. 	<ul style="list-style-type: none"> Issue list of prohibited materials to non-assured suppliers/haulers. 	<ul style="list-style-type: none"> Check paperwork to confirm previous 3 loads and/or assured status. Check lorry adequately sheeted/covered to protect against rain or bird droppings. 	<ul style="list-style-type: none"> Reject loads visibly spoiled or notify supplier that product accepted but not satisfactory for the future. If necessary, change haulier or vehicle.
3. Receipt and Handling	<ul style="list-style-type: none"> Exposure to elements (wind, rain). Exposure to other contaminants such as debris, farmyard manure, chemicals, other feed materials. 	<ul style="list-style-type: none"> Discharge facilities should be clean and preferably covered. Co-mingling with other materials should be prevented. 	<p>Facilities (floors, bays, bins, silos) must be clean prior to receipt</p>	<ul style="list-style-type: none"> Visual assessment by staff and cleanout as necessary. Maintain records of cleaning schedules. 	<ul style="list-style-type: none"> Arrange temporary storage while area/bin is cleaned out.

N.B. Please read down columns, not across

Identifying Hazards Associated with On-farm Feeding and Relevant Control Measures

Process Step	Possible Hazards and/or Quality Failures	Control measures	Control limits	Monitoring procedures	Corrective action
4. On-Farm Storage of Feed Materials and Mixed Feeds	<ul style="list-style-type: none"> Exposure to rain and/or damp conditions. Spoilage due to condensation and mould growth. Access by rodents, birds, cats and other pests. Cross contamination with other feed ingredients. Contamination with other non-feed materials such as chemicals, fertilisers. Air spoilage of moist feeds due to inadequate sheeting of clamps. Contamination of mixed feeds with unprocessed feed materials. Deterioration of feed materials due to poor stock rotation. Feeds for different species and medicated and unmedicated feeds not adequately segregated. Exposure to chemicals used for storage of silage and moist grains. 	<ul style="list-style-type: none"> Weatherproof storage facilities. Pest control procedures in place. Effective segregation of different feed materials, mixed feeds and feed materials, and of mixed feeds particularly when stored on floors. Cleanout procedures between different types of feed. Pest control programme. Separate storage areas for feed and non-feed materials. Proper stock rotation. Effective consolidation and sheeting of clamped forages. Cleaning of vehicles before entering storage area. 	<ul style="list-style-type: none"> All reasonable steps to prevent any type of contamination or deterioration. 	<ul style="list-style-type: none"> Storage areas checked by staff before filling to ensure clean and suitable. Regular checks to ensure that any leaks/loss of containment are controlled. 	<ul style="list-style-type: none"> Reject and dispose of any spoiled or contaminated feedingstuffs posing a threat to animal or human health. Assess safety implications of any admixture of feedingstuffs and handle appropriately.

N.B. Please read down columns, not across

Identifying Hazards Associated with On-farm Feeding and Relevant Control Measures

Process Step	Possible Hazards and/or Quality Failures	Control measures	Control limits	Monitoring procedures	Corrective action
5. Feed Manufacture and Mixing	<ul style="list-style-type: none"> Poor performance/ill health due to unsuitable feed design/formulation. Variable performance and health due to: <ol style="list-style-type: none"> incorrect addition or weighing resulting in over and/or under supply of nutrients; incorrect feed formulation; inappropriate mixing time leading to variable nutrient supply to stock. Possible residues in animal products due to cross-contamination between batches leading to non-target animals consuming additives not licensed for those animals. Health problems due to contamination e.g. microbial spoilage due to dirty plant. Digestive upsets due to microbial contamination in liquid feeding systems. Exposure to chemicals used in processing cereal grains. 	<ul style="list-style-type: none"> Feed formulations produced/checked by someone with appropriate knowledge or skills. Operators suitably trained. Regular cleaning, maintenance and calibration of weighing, metering and mixing equipment. Annual mixer test and routine sampling and testing of feeds. Records of intended and actual mixes. Cleanout procedure between batches (may vary with mixer type) and validated cross-contamination control. Appropriate mixing schedule. 	<ul style="list-style-type: none"> Feeds manufactured to intended formulation. Feeds conform to expected (defined) physical, chemical and microbiological quality specifications. 	<ul style="list-style-type: none"> Records of actual additions checked against formulation targets. Understand the risks associated with various additives, read labels! Sequence of mixing checked against intended sequence. Cleaning, maintenance and calibration records checked against schedules. Samples of feed materials and mixes kept for defined period. A proportion to be tested and checked against formulation targets. 	<ul style="list-style-type: none"> Isolate any suspect batches pending analysis/investigation. Dispose of any mixes posing a threat to animal or human health or likely to lead to unacceptable residues in animal products, e.g. feeds containing hazardous levels of veterinary drugs, contaminants, pathogens. Review procedures in the event of systematic failures.

N.B. Please read down columns, not across

Identifying Hazards Associated with On-farm Feeding and Relevant Control Measures

Process Step	Possible Hazards and/or Quality Failures	Control measures	Control limits	Monitoring procedures	Corrective action
6. Feeding	<ul style="list-style-type: none"> Performance and health problems (and possible death) due to stock being fed the wrong feed. Stock over or under fed due to incorrect feed allocation. Health problems (e.g. salmonella) as a result of unclean feeding facilities or contaminated pastures. Health problems due to 'old' feed residues in bins, hoppers, troughs as a result of disease transference. Unclean or insufficient water leading to performance problems. 	<ul style="list-style-type: none"> Feeds clearly labelled and warnings where risks are high (e.g. medicated feeds). Stock provided with adequate feeding space and clean water. Maintenance and calibration of rationing tools e.g. weight of full bucket/scoop; and other automated equipment. Regular cleaning of feed hoppers, troughs and floors to prevent build up of stale feed and other residues. For grazing animals, use of grazing rotations to minimise manure contamination, parasite build-up. 	<ul style="list-style-type: none"> Action required if problems visible. 	<ul style="list-style-type: none"> Hoppers, troughs and floors clean prior to new feed deliveries and before new livestock placements. Bagged and bulk feed clearly labelled to prevent confusion. Records of grazing rotations. Regular checks on non-mains water supplies and records to show that system is cleaned and maintained. 	<ul style="list-style-type: none"> Seek advice, if necessary, whenever stock gain access to the incorrect feed. Read relevant labels. Seek veterinary or nutritional advice if animals show signs of ill health. Isolate feed as appropriate.

N.B. Please read down columns, not across

ANNEX IV ACAF CONSULTATION

1. A consultation document was sent in December 2001 to 99 interested parties. It requested views/information on on-farm mixing and wider feeding practices, with particular emphasis on the following areas:

- the advantages to farmers of on-farm mixing;
- hazards and risks associated with the practice;
- controls;
- the degree of farmer expertise;
- the extent of use of mixer wagons; and
- comments on the Annex to the consultation paper on feed mixing equipment.

2. A total of 33 substantive responses were received (see list attached). The majority of respondents were farmers or representatives of the farming sector (14), whilst seven responses were from what can be broadly categorised as the feed industry (including mobile mixing contractors). Five responses originated from animal nutritionists and consultants and four from those responsible for the enforcement of feed legislation. The other three responses were from consumer, veterinary and quality assurance organisations.

Summary of Responses

3. There was general agreement on the main advantages of on-farm mixing amongst respondents. These responses were mainly from the farming, feed industry and nutritionist categories. One of the principal advantages stated was the reduction of feed costs to the farmer by using home-grown materials (i.e. material grown on the same farm). There was a general feeling that home-grown ingredients were also of better quality and this resulted in improved livestock performance and productivity. It was claimed that better productivity could also result from the increased flexibility that mixing own rations gave farmers.

4. It was further claimed that the use of home-grown or locally grown ingredients enhanced traceability by keeping the feed chain short and

relatively simple. Environmental advantages claimed for the practice of on-farm mixing included reduced transportation of ingredients, resulting in less energy being consumed and less pollution. The use of unwanted by-products (or co-products) from the food industry e.g. broken biscuits and brewers' grains, meant less waste going to landfill sites.

5. The two most commonly mentioned risks amongst responses were those relating to storage and inaccurate weighing of materials (including additives). Other problems raised in responses included poor traceability, carryover and the need for training for farmers on feeding practices. According to respondents, the main controls over on-farm mixing and feeding are legislative, supplemented by industry codes of practice and assurance schemes.

ACAF on-farm feeding practices review – List of respondents

1. ADAS
2. Banks Cargill Agriculture
3. Brewing, Food & Beverage Industry Suppliers Association
4. Cornwall Trading Standards
5. Dairy Services
6. Fife Trading Standards Service
7. F.J. Bosworth & Sons
8. General Consumer Council NI
9. Goddard, David
10. Harbro Farm Sales Ltd
11. Harpers Home Mix Ltd
12. Hawkes & Wardle Ltd
13. J.A Rankin & Co
14. James, PR
15. Kite Consulting
16. LACOTS
17. Meat and Livestock Commission
18. National Association of Agricultural Contractors
19. National Farmers' Union – Cirencester Branch
20. National Farmers' Union Scotland
21. National Pig Association
22. North of Ireland Veterinary Association
23. Pitt, Tom
24. RC Feed Research
25. Roses Nutrition
26. Royal Pharmaceutical Society
27. Scottish Agricultural College
28. Scottish Food Quality Certification Ltd
29. Society of Feed Technologists
30. Thompson, PR
31. Webb, Tony
32. UKASTA
33. Ulster Farmers' Union

ANNEX V

LEGISLATIVE CONTROLS

(THE POSITION AS AT JULY 2003)

Introduction

1. There are two main aspects of farm feed which are controlled by legislation:

- requirements for feed which the farmer has purchased or otherwise brought onto the farm; and
- requirements covering the feed which the farmer has mixed.

2. The primary legislation is found in Part IV of the Agriculture Act 1970, the Medicines Act 1968, and Regulations made under these Acts and the European Communities Act 1972. Most of the controls implement EC measures.

Purchased Feed

3. The principal controls are set out in the Feeding Stuffs Regulations. Purchased feed may be:

- in the form of feed materials, which are mainly single ingredient products, and which may be fed directly to animals, or be mixed together, or mixed with materials produced on the farm itself (e.g. silage);
- in the form of a compound feed which is a manufactured feed containing a mixture of feed materials. Compound feeds may be mixed and fed with other materials.

4. The legal obligations for purchased feed rests with the seller to the farmer, together with any manufacturer/importer/intermediary.

5. There are requirements in the Agriculture Act that the feed must be accompanied by information about its nature, substance or quality, together with safety information about correct storage, handling or use.

6. It is illegal to sell to the farmer, for use as a feed, any product which contains any ingredient deleterious to the animal, or to humans through consumption of animal products. Deleterious means harmful. As well as this

general prohibition there is also a short list of materials specified in the Feeding Stuffs Regulations which are prohibited from use in compound feeds. The list includes such things as faeces, sawdust treated with wood protection products and waste water. However, the ban on the use of processed animal protein which includes mammalian meat and bone meal, is contained in animal health legislation.

7. It is illegal to use a feed containing prohibited substances. There is a defence, if the farmer can show all reasonable precautions were taken and due diligence exercised to avoid such feed being used.

8. The Feeding Stuffs Regulations also contain maximum permitted limits in feed for a range of undesirable substances (contaminants). These include heavy metals (lead, arsenic) and aflatoxin. Selling feed contravening this requirement to the farmer, or use by the farmer, can lead to legal proceedings. The same defence is available as in the case of prohibited substances.

9. A section in the Agriculture Act makes it illegal to sell to the farmer any material for use as a feed which is found to be unwholesome or dangerous to the animal, or to humans through consumption of animal products.

10. There is also a requirement that all feed materials sold shall be sound, genuine and of merchantable quality.

11. In the case of feeds and feed materials sold to the farmer, the enforcement officer has the power to enter the premises and take samples of the material for analysis. The seller is liable for anything found to be wrong with the feed. The inspector also has the power to inspect and sample any other product used for feed. The samples can be tested for any of the prohibited materials or levels of undesirable substances. In case of an illegal finding the farmer could face legal proceedings. In these circumstances the farmer will be expected to have taken steps to ensure compliance (possibly having tests carried).

On-farm mixing

12. Where the farmer mixes feed materials together (with or without compound feed), to produce feed for the animals, control is on the ingredient materials as described above.

13. If however, the farmer mixes into the feed materials, medicines or certain specified additives, then the premises need to be approved or registered for this activity. The premises must also be approved or registered if compound feeds containing additives are mixed.

14. The requirement for premises to be approved or registered for these mixing activities is found in the Feeding Stuffs (Establishments and Intermediaries) Regulations 1999, which implements EC Council Directive 95/69/EC into UK law. There are also separate registration requirements under the TSE Regulations for using certain derogated protein products to mix in non-ruminant feed.

15. The activities which require farm premises to be either approved or registered can be conveniently divided into three categories as follows.

- (i) Zootechnical (quasi-medicinal additives) contained in premixes, or complementary feeds containing those premixes. These must be mixed into final feed only on premises approved by the Animal Medicines Inspectorate of the Royal Pharmaceutical Society of Great Britain.
- (ii) Specified non-zootechnical additives (e.g., vitamins and trace elements) some of which will already be in premixtures or complementary feeds. These must be mixed into final feeds only on premises registered with the local authority and subject to inspection by their Inspectors.
- (iii) Until 1 August 2003, feed materials containing undesirable substances above the maximum permitted levels could be blended down on approved premises to achieve a legal level. These could include farm premises. Following changes in EC legislation, blending down (or dilution) has been prohibited.

16. Farms where new activities requiring approval are to be carried out must obtain that approval before the activity is commenced. Farms requiring registration for the activities they carry out must make a written declaration that the methods of producing feeds comply with the quality assurance requirements laid down in the Directive. Registered farms will then be included in a rolling inspection programme where the systems in place are checked against the Directive requirements.

Quality Control Requirements

17. The requirements under Directive 95/69/EC as implemented in the 1999 Regulations are more prescriptive for the approval of farms than for those requiring registration. This is because the effects of incorrect mixing of additives which require approval are greater than those which require registration.

18. The requirements are divided in the Directive into six areas as follows.

- Facilities and Equipment – sufficient, effective, clean and well maintained.
- Personnel – number, skills/qualifications and trained to carry out allocated tasks.
- Production – carried out so that proper mixture results.
- Quality Control (QC) – person responsible, formula, QC plan, critical control points, samples and traceability.
- Storage – sufficient and maintained to avoid contamination and cross-contamination, materials identified to prevent incorrect use.
- Register – to be kept to give traceability of additives.

19. Farm establishments subject to these quality assurance requirements vary considerably. When carrying out the inspection, the inspector takes into account, for example, the activity that the farmer wishes to be approved or registered for, the size of the premises and the quantity of feed to be mixed. Small farms with few animals, mixing ingredients with premixes using a shovel can be approved or registered if all the appropriate safeguards are being taken, and the final feed is properly mixed. However, most farmers carrying out these activities have mixing machines, large or small, both fixed and mobile.

Animal By-products legislation

20. The EU Animal By-Products Regulation (EC) No 1774/2002 replaces the Animal Waste Directive and most of the Balai Directive and introduces a number of changes to feed law. The enforcing legislation (the Animal By-products Regulations 2003) has been in force in England since 1 July 2003. Parallel legislation in Scotland, Wales and N. Ireland is applicable.

21. Briefly, the Regulation:

- bans the routine burial of fallen stock;
- allows the treatment of animal by-products in approved composting or biogas plants;
- maintains the existing UK ban on swill feeding;

- introduces controls on animal carcase incinerators;
- requires the treatment of previously uncontrolled animal by-products, such as blood and feathers; and
- bans the feeding of own species material to animals (including fish), with some exceptions.

22. The Regulation separates animal by-products into three categories of material:

- category 1 – e.g. carcasses of BSE suspects, Specified Risk Material (SRM), ruminant carcasses from which SRM has not been removed;
- category 2 – e.g. carcasses of animals with diseases other than BSE, carcasses of animals which were not slaughtered for human consumption (including such ruminant carcasses where the SRM has been removed), manure and gut contents; and
- category 3 – material fit for human consumption.

23. Material from categories 1 and 2 cannot be used in livestock feedingstuffs and will, in most cases, have to be destroyed. Category 3 material can be used in feedingstuffs and fertilisers (subject to the provisions of the TSE Regulation) and Category 2 material can, after rendering, be used for a limited number of uses, such as the production of tallow derivatives or use as fertiliser. These categories apply to all types of animal by-products (mammalian, poultry and fish).

24. The definition of animal by-product includes catering waste (waste food containing meat or products of animal origin from households and restaurants). From 1 November 2002 the Regulations bans the use in animal feedingstuffs of catering waste, including used cooking oils, from restaurants and similar premises. However, the UK has secured a number of transitional measures from the European Commission. The most relevant to animal feed are:

- the continued use in animal feed of used cooking oils, until 31 October 2004;
- the feeding of processed animal protein from all fish to farmed fish, until 31 December 2003; and
- a derogation from the ban on intra-species recycling in Article 22 to allow the feeding to farmed fish of processed animal protein derived from wild fish, subject to suitable controls, from 1 January 2004.

Transmissible Spongiform Encephalopathies Legislation

25. The Community-wide TSE Regulation (999/2001), which came into force on 1 July 2001, aimed to provide a secure legal basis for the full range of Community measures against Transmissible Spongiform Encephalopathies (TSEs). Most of its provisions, including transitional measures relating to it were already in force under UK legislation, but for the sake of clarity and completeness, most existing TSE-related legislation was consolidated into one set of Regulations, adjusting the requirements where necessary to take into account EC and national measures. The TSE (England) Regulations 2002 came into force on 19 April, and Scottish, Welsh, and Northern Irish equivalents were also introduced.

26. There are Guidance Notes available for the Animal Feeding section of the Regulations on the feed ban section of the Defra BSE web site.

27. In EU-wide legislation the existing controls banning processed animal protein from farmed livestock feed, as currently implemented by the TSE (England) Regulations 2002, originally formed part of the transitional measures permitting the changeover to the EU TSE Regulation (999/2001). The Commission now proposes to remove the feed controls from the transitional measures, and to make them permanent from the beginning of September 2003, amending the EU TSE Regulation accordingly.

28. The Commission proposal states that when the appropriate control tools are available (i.e. new testing methods), and there is reasonable evidence that the implementation of the current provisions is satisfactory in all Member States, the prohibition on the use of fishmeal in ruminant feed (and the possibility of permitting avian and porcine proteins in non-ruminant feed) will be reviewed.

29. In essence, the proposal seeks to bring the definition of processed animal protein into line with that given in Regulation 1774/2002 concerning animal by-products, with continuing controls on specific products which are not included in that definition. This does not involve any major changes in principle from the current feed controls, but in addition to the alignment of the definition of processed animal protein with animal by-product legislation, the following notable changes are in the proposal document.

- Blood products of ruminant origin continue to be banned from all farmed animals, but blood products from non-ruminant livestock may be used in farmed fish feed subject to production standards set out in Regulation 1774/2002. The use and storage of fish feed containing blood products, however, will be prohibited in farms where farmed animals are kept.

- Gelatin of ruminant origin continues to be banned from livestock feed, but non-ruminant gelatin can be fed to farmed animals (i.e. without the former specification in 2000/766 of only being allowed in use to encapsulate additives).
- In addition to animal-derived dicalcium phosphate, for the first time tricalcium phosphate is mentioned in this context, and in common with dicalcium phosphate is only eligible for use in non-ruminant feed, subject to production controls set out in Regulation 1774/2002.

Future Legislation

Feed Hygiene

30. The Commission published a proposal on 16 April 2003 for a Regulation on Feed Hygiene that contains a number of provisions to strengthen the controls on feed safety. In particular, the Commission wants to improve existing rules so that, in the case of a feed incident, feeds can be easily traced and recalled if necessary. As indicated earlier, existing legislation requires that premises making or using certain feed additives must be approved or registered and comply with standards on facilities and storage, etc. This includes farmers who mix their own feeds. These arrangements would be extended so that all businesses involved in supplying raw materials and making or marketing feeds would be covered. As currently drafted, the proposal would require the registration of virtually all arable farms that grow crops for inclusion in feeds and virtually all livestock farms. Livestock farmers would have to ensure that all hazards are identified and proper controls put in place under HACCP principles. Farmers feeding food-producing animals would also have to follow a code of good practice.

Official Feed and Feed Controls

31. The Commission published a proposal in February 2003 for a Regulation on Official Feed and Food Controls. Official controls are those activities undertaken by Member States and their designated enforcement authorities for verifying compliance of businesses with feed and food legislation (e.g. inspections and sampling and analysis). As regards animal feed law, there is already a Directive in place (95/53/EC) that provides a framework for official checks. The aim of the new proposal is to create a more comprehensive and integrated 'farm to table' approach for control systems in the feed and food sectors. The main elements of the proposal include operational criteria for enforcement authorities; rules on sampling and analysis; and rules on controls of imports. Checks on the compliance of farms with feed and food law are included within the scope of the draft Regulation.

ANNEX VI

FEED MATERIALS

Forages

1. Forages consist predominantly of grass-derived material fed either in its fresh state as grazed grass or preserved as silage or hay. The use of forage maize, ensiled to produce maize silage, has increased steadily in recent years and now accounts for about 10% of all silage made (expressed on a dry matter basis). There has also been an increase in the amount of whole-crop cereals, cut at an immature stage and ensiled prior to feeding.

2. Although widely diverse in their composition and nutritional value, a characteristic of forages is their relatively high fibre content. This makes them unsuitable as feed for non-ruminants because the fibre is largely indigestible, but they are a major source – and in some situations the only source – of essential nutrients for ruminants.

Origin

3. Almost all forages are fed on the farm where they are grown. Exceptions to this are grass hay, artificially dried grass and cereal straws, which may be traded and transported many miles from the farms on which they are grown to where they are used.

The Use of Forages On-farm

4. There are two major objectives in making hay or grass silage. The first is to remove excess herbage from pasture following its rapid growth in the spring, thereby allowing the land to be grazed subsequently without wastage of surplus grass. The second objective is to conserve the material in such a way that it provides a relatively low cost but nutritious feed for cattle and sheep when grass is not available. To produce grass hay, it is necessary to reduce the moisture content to <16% to avoid mould development during storage. Difficulties in achieving this consistently under UK conditions, coupled with improvements in silage making, have seen a reduction in the amount of hay produced in favour of grass silage. To ensure a stable fermentation, the grass is stored in clamps or bags and sealed with plastic sheeting to maintain anaerobic conditions. To improve fermentation, an additive may be applied at the time of harvest. The majority of additives consist of acids or acid salts, enzymes or bacteria.

5. For low-production stock, e.g. non-lactating dairy cows and store cattle and sheep, forages may be the sole feed provided. In most situations, forages – either as fresh or conserved – can provide all the nutrients required. In some areas of the country grass may be deficient in certain trace elements, and the deficiency may be remedied by providing the necessary nutrients as in the form of supplementary concentrate feeds, feed blocks or licks, or with the use of rumen boluses.

6. When the quality of the forage, or the amount available, is insufficient to meet the nutritional requirements of more productive stock, additional forages or supplementary concentrate feeds may be given, the latter in the form of straights, blends or compound feeds. For animals that are at grass, concentrates are usually fed as discrete meals (e.g. in the parlour at milking time for lactating animals, in troughs for housed animals or in the fields for grazing cattle and sheep). For cattle and sheep on silage-based diets, concentrate feeds may also be fed as discrete meals, although there is increasing trend towards mixing silages and concentrate feeds.

Concentrate feeds

7. Concentrate feeds are derived from cereals or by-products (co-products) which mainly originate from different processes in the human food industry. Despite large differences between them in their form, composition and nutritional value, they share a common origin in that many of them are derived from high quality raw materials that have been selected to meet the demands of human food production or industrial processes. The majority are derived from traditional industries such as brewing, baking, sugar extraction, cereal processing and cheese making, and have been used as feeds for livestock for many years. Others are derived from newer industries, including the production of convenience food and drinks.

Origin

8. Many by-products of the human food processing industries are traded on a global basis. As a result, feeds originating from as far afield as Asia including the Indian sub-continent, Africa and North and South America are used on UK farms. Most of these will be low moisture feeds. Largely due to costs of transport and storage, most of the high moisture feed are produced in the UK or EU, although cane molasses is a notable exception.

The Use of By-products On-farm

9. By-products make a major contribution to meeting the energy, protein, mineral and vitamin requirements of farm livestock. A number of them also have particular characteristics, such that their inclusion in the diets of livestock can result in improvements in feed intake, feed utilisation or the

composition of the milk, meat or eggs being produced. Their use as animal feeds also obviates the need to dispose of these products in other ways, e.g. to landfill with consequent environmental benefits.

10. While some of these feeds are the result of complex processing others (such as vegetable by-products) undergo little or no processing. The way in which these feeds are used is largely determined by their nutritional value, moisture content, storage characteristics and consistency of supply and composition.

11. Many of the low moisture feeds, and in particular those derived from cereals, oilseeds and sugar processing industries, have very high nutritional value and consistent composition. They are widely used in agriculture, both in the manufacture of compound feeds and blends, and for feeding to livestock directly. Soya bean and rapeseed meals are the major sources of protein for both ruminants and non-ruminants (pig and poultry). By-products such as maize gluten feed and molassed sugar beet pulp are staple feeds in many ruminant livestock production systems, and may be the only 'concentrate' feed used to supplement home-grown forages for some cattle and sheep.

12. Feeds originating from confectionery, bakery and bread products typically consist of rejected material (e.g. misshapen and broken biscuits and confectionery, or foods that have passed their 'sell by' date) or material produced as a result of over-production. Because these products frequently originate from more than one production line or manufacturer, and in varying proportions, their composition can be highly variable. They generally consist of flour, sugars, oil and flavouring and therefore are both highly nutritious and palatable. These products may be dried for use (at inclusion levels that would not normally exceed 5-8%) in the manufacture of compound feeds, or fed directly to livestock either as single feeds or mixed with other concentrates as total mixed rations.

13. The by-products of vegetable processing are predominantly used for ruminants and pigs, and to minimise costs of transport and storage tend to be used on farms within close proximity of their production. They may be fed as single feeds or mixed on-farm with other feeds to produce total mixed rations. Because the composition and feed value can be highly variable, they are generally fed to less productive stock.

14. Liquid feeds (e.g. molasses, pot ale syrup, by-products of cheese manufacture) are syrups which have generally been concentrated by a process of evaporation. On farm, they may be fed directly to stock, or included in total mixed rations of forages and concentrates. Cane molasses in particular is widely used in the production of compound feeds, where it both provides nutrients and enhances palatability. Because of the nature of the product, inclusion rates do not normally exceed 10%.

15. The majority of high moisture and liquid feeds will be fed to livestock on farm. They are most suitable for feeding to ruminants or in wet feeding systems for pigs.

Quality Control in the Use of By-products as Feeds for Livestock

16. Legislation and codes of practice related to the use of feeds on farms are described in the main report and Annex V.

17. In addition to legislative controls, a number of Codes of Practice for the manufacture, transport, storage and handling of feed materials and compound feeds have been, or are being developed in the UK and the EU. At farm level, Codes of Practice for the safe storage, handling and feeding of feed materials have been published. Examples of these are the NFU Code of Practice for On-Farm Mixers Producing Finished Feeds, National Dairy Farm Assured Scheme for milk producers, Lion Quality Code of Practice for egg producers, UK Register of Organic Food Standards (amended 2000) and Soil Association Scheme for organic farmers. Defra have issued a Code of Practice for the control of salmonella on farms. In addition to these, a number of Quality Assurance Schemes have been introduced by supermarkets and other organisations e. g. Freedom Food (RSPCA), Farm Assured British Beef and Lamb, Farm Assured British Pigs.

