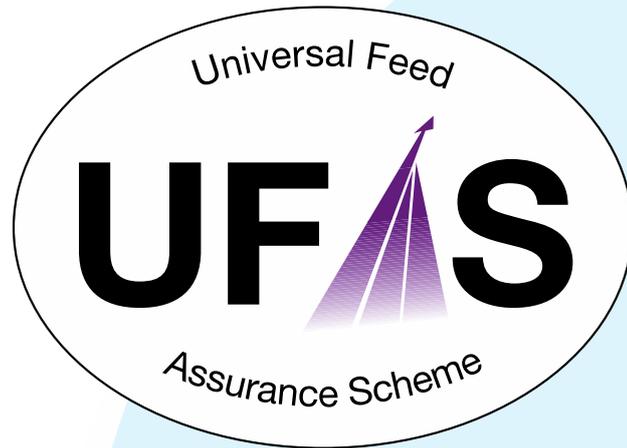




UFAS GUIDANCE - SAMPLING & TESTING

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1. Introduction

The amount of testing a Feed Business Operator should carry out to ensure Quality Control is the product of many considerations, some of them unique to the individual Operator.

Quality considerations will also include evaluation of processes within manufacturing / merchanting, i.e. in process controls, and attention to due diligence and feed safety issues. Some of the information generated will be used as part of the HACCP process.

2. “Quality Control Plan”

This guidance document can be used to form the basis of a Quality Control plan, the method by which a company demonstrates how the management of their Feed Safety controls is carried out. The plan should therefore include a schedule of analyses for feed ingredients and finished feeds, including frequency of sampling, which has been prepared against selection guidelines.

By its very nature this Plan will need to be reviewed whenever there are changes to the process, products, plant and possibly personnel. This may be part of the HACCP review.

3. Sampling and Testing Requirements

Testing requirements encompass the needs to meet legislative controls, feed safety and ensure the nutritional adequacy of products (including the maintenance of feed material matrices used to formulate finished feeds).

It is not always necessary for an individual company to do all the testing itself. Some support data can be obtained from suppliers and other appropriate sources e.g. collaborative schemes.

Whatever the case, the Quality Control plan should describe the source of all testing and the location of data resulting from that testing if it is not held by the company.

It is also important to note that testing does not just mean laboratory analysis. A visual or smell test of an incoming material will often answer questions with regards to whether the material is mouldy, burnt or contaminated.

4. Formal Review of the Quality Control Data & Trial Results

There should be a formal, timely and documented review of all appropriate quality data which should include notes of any preventive and corrective actions taken.

5. Deriving Testing Requirements

The sampling and testing of feed ingredients and finished feeds will be driven by various factors including:

1. Protection of human and animal health
2. Compliance with legislation
3. Compliance with UFAS
4. Company interpretation of due diligence
5. Customer Requirements
6. Company Quality Policy

Many of the above are interwoven.

5.1. Protection of human and animal health

The testing requirements for the protection of human and animal health will be driven by an understanding of the feed ingredients, finished product types, manufacturing processes and types of storage. It is vital to consider the origin of a potential hazard.

- Could it arise from incoming materials?
- Could it arise from storage conditions?
- Could it be generated or worsened within the production plant or the associated storage?

The answers to these questions help the decision on whether incoming materials or finished product testing should be carried out. The greater the amount of control and checking of raw materials initially and then within the process, the less the requirement for checking finished product.

5.1.1 Feed Ingredients

Feed ingredient assurance schemes are designed to ensure that there is adequate control and testing of feed ingredients. However this does not preclude the requirement to carry out a certain amount of testing, particularly for those ingredients where there may be a potential risk inherent in the material or from its source or the way it has been processed and/or stored. These potential risks can be identified using the Specification which should be available from the supplier for that material. The FEMAS calculator is also a useful guide in understanding some of the potential risks involved.

5.1.2 Type of Manufacturing Plant and Species

Where the hazard could arise internally e.g. from storage contamination from within the plant, then analyses should concentrate on finished or in-process products. For example, if a ruminant only plant is assessed, the potential hazards could be;

- Mycotoxins - from incoming materials
- Heavy Metals – from incoming materials
- Copper contamination of sheep feeds

Of these copper is the potential manufacturing hazard, as it could be introduced by use of an incorrect premixture or a copper source, or contamination within the mill. Hence adequate finished product testing would be required to monitor the copper content, but the testing requirement might be less to cover heavy metals or mycotoxins.

Where production sites are multi-species, the hazards which may be generated within them are increased. A wider variety of finished products may require more safety-related analyses.

Note: It is not possible to provide a risk assessment guide to cover every possible risk for all sectors of the compound feed industry, however, each UFAS participant must be aware of the known major hazards and how they arise. Manufacturers of feeds containing Controlled Products must be aware of the risks specific to the products they handle.

5.2. Compliance with Legislation

Under Feed Legislation there is a range of potential testing required to demonstrate compliance. The [AIC website](#) contains guidance on current legislation. Some examples of legislation are listed below but this is not exhaustive.

- a. EU 1831 2003 Feed Hygiene Regulations (as amended). ‘Feed hygiene’ is defined as the measures and conditions necessary to control hazards and to ensure fitness for animal consumption of a feed, taking into account its intended use; Annex II outlines the sampling and testing requirements.
- b. EU 767 2009 Marketing and Feed Use Regulations. ‘To confirm that the composition of a feed material or compound feed meets the labelled composition.’
- c. DEFRA Salmonella Code of Practice – ‘The buildings, environment, plant and equipment (including vehicles), as well as incoming and outgoing product must be subject to appropriate monitoring for the presence of Salmonella.’
- d. EU 2002 32 Undesirable Substances in Animal Feed and subsequent amendments. ‘Using or putting into circulation products intended for animal feed which contain levels of undesirable substances that exceed the maximum levels laid down in Annex I must therefore be prohibited.’
- e. EU 225 2012 Oils and Fats Dioxin Testing - ‘It is necessary to provide for an obligation for feed business operators to test fats, oils and products derived thereof for dioxin and dioxin-like PCBs in order to reduce the risk that contaminated products enter the food chain.’
- f. The Veterinary Medicines Regulations – Schedule 5. ‘A manufacturer must ensure that, so far as is reasonably practical, the veterinary medicinal product is evenly incorporated throughout the feedingstuffs. Unless otherwise specified in the marketing authorisation, it is a defence if the active ingredient in the medicated feedingstuff sample is within the following tolerances....’

5.3. Compliance with UFAS

There are specific requirements for inspection, sampling and testing within UFAS over and above the requirements detailed in these sections. For example:

- Inspection and sampling of incoming feed materials (D1.1, G 5.1.1).
- Sampling of all outgoing products (G 5.3)
- In-Process Evaluations such as Mixer Efficiency Trials (G3)

5.4. Company “due diligence and all reasonable precautions” requirements

Although assurance schemes require suppliers to ensure their products conform to safe and legal levels of relevant substances, depending on the size and nature of the business there may also be a requirement for some testing by the person using these materials or placing products containing them onto the market as part of their ‘Due diligence’ procedures. Determination as to whether testing should be carried out on Feed Ingredients, Finished Feeds or both can be determined by two simple questions.

- Is there a legal limit set for Feed materials and/or Finished Feeds?
- For the type of analysis identified is there a possibility that the substance can be introduced and/or increased once the material has been introduced into the mill?

6. Summary Guidelines to preparing a QC Testing Schedule

From the above it can be seen that the testing schedule has to take into account:

1. The manufacturing / merchandising process to be controlled – multispecies, single species, bagging etc., tonnage, number of lines, types of products;
2. Feed ingredients used and split of usage;
3. Availability of data from other sources including AIC schemes.
4. Finished feedingstuffs manufactured – species and stage of growth, tonnage;
5. Test parameters – including routine, in process, contaminants, due diligence, etc;

The frequency of testing will depend on all of the above. A framework for the preparation of a typical QC schedule is given in [Appendix 1 \(Feed Ingredients\)](#) and [Appendix 2 \(Finished Feeds\)](#).

7. Sampling

7.1 Sample Size

This should be sufficient to carry out the required analyses. Typically, this would require approximately 250 grams;

7.2 Sampling Points

7.2.1 Feed Ingredients

Where possible, bulk feed ingredient samples should be a composite of several samples from different points in the load / delivery.

7.2.2 Finished feeds

Sampling for Mixing and Cross-contamination trial purposes are described in a later section.

A retained representative sample for each delivery must be taken preferably at the point of Outloading or alternatively within the process if sampling at Outloading is not feasible.

7.3 Sampling Equipment

This should be suitable to permit a representative sample to be taken in a safe manner. Attention should be given to hygiene – always use clean sampling equipment to avoid any contamination. Samples for microbiological testing should be handled in accordance with the Defra/DARD Code of Practice for the control of salmonella to prevent any contamination from the person taking the sample.

8. In-Process Evaluations

These requirements ensure that the manufacturing process is both effective and produces safe finished feeds.

8.1 Mixer-efficiency

Where additives (including added vitamins) are used, a measurement to ensure that these are adequately mixed must be carried out at least once every six months on each mixer in use. This is referred to as a Mixer Efficiency Trial. Note if different batch sizes are manufactured and/or different mixers are used then trials should be carried out to confirm that the homogeneity of the mix is not compromised by batch size.

8.1.1 Mixer-efficiency test – method of measurement

A batch of feed is manufactured, containing the target parameter which typically could be a trace element or mineral such as Manganese. A minimum of 8 individual samples should be taken as close to the mixer discharge as possible and at predetermined intervals throughout the batch. The best way of determining the intervals is to establish the time taken for the batch to discharge from the mixer and to divide this by the number of sample to be taken. These samples should then be put into sequentially numbered bags and the whole set of individual samples sent for analysis.

8.1.2 Mixer-efficiency test – interpretation of the results

Interpretation of the data must look at variation between samples and can be used to look at average recovery.

The normal measure for this test is the Coefficient of Variation (CV). This is a statistical measure which gives an indication of the degree of variation in levels across the batch. The calculation is as follows:

$$CV = (SD/Mean) * 100$$

For compound mills a target CV of less than 10% should be achieved, for other plants a target CV of less than 20% is acceptable.

In general this figure should be taken as a measure of the mixer performance and as such once a figure for that mixer has been established then any deviation away from this should be investigated as it could indicate a hygiene and/or mechanical issue.

8.2. In process carry-over/ cross contamination monitoring

Definitons

Carry-over	The level of transfer of a portion of one production batch to the immediate subsequent batch.
Cross-contamination	the unintentional introduction of a feed or additive into another at unacceptable levels.
Limit of detection (LOD)	the smallest concentration of analyte that can reliably be detected by the method.
Limit of quantification (LOQ)	the smallest concentration of analyte that can reliably be quantified by the instrumental method.

Monitoring is necessary to ensure that where controls are required to avoid contamination i.e. that substances from a preceding batch do not lead to unacceptable levels of residues of those substances in the following batch(es), these are working.

For some substances such as coccidiostats there is a legal limit set for the amount of unavoidable carryover into a batch of feed, which is determined by the type of feed.

For manufacturing, the testing carried out here will determine whether the level of carryover is acceptable or whether a flush is required to reduce it. The tests will then determine whether the flush is adequate.

Where contamination at Packing is to be avoided the testing may show that an increase in the numbers of bags discarded at the start of a run may be needed.

The analyte chosen for testing should be based upon risk assessment and the lab used be able to measure to a suitable limit of detection/ quantification. This could be a controlled product, specified feed additive or feed additive added at the mixer. Trace elements such as copper can also be used but recovery can be variable.

Magnetic, coloured tracers may be used to measure carry-over, providing the method used has been validated and gives equivalent results to those given by a range of different veterinary medicinal products or specified feed additives with different physical properties.

Carry-over tests can be carried out as part of the investigation into any cross contamination or could be carried out if sections of the plant are replaced or altered.

8.2.1 Method of Measuring carry-over

- a. Manufacture a feed containing the feed ingredient for which the carry-over is being measured.
- b. Make a subsequent batch, which may or may not be a material/product that does not contain the feed ingredient.
- c. Samples of the immediate subsequent batch should be taken as close as possible to the section of plant being investigated such as the mixer and/or the press. The frequency needs to be a minimum of 5 samples through the batch.
- d. Each sample should be tested. The carry-over is calculated from the mean recovery of the analyte in the immediate subsequent batch, expressed as a percentage of the original batch of feed.

For example, a 3000 kg batch of feed containing the feed ingredient at 10 mg/kg is immediately followed by a batch of 3000 kg. Analysis shows the batch to contain an average of 1 mg/kg.

The original batch contains $10\text{mg/kg} \times 3000\text{kg} = 30,000$ mg of the ingredient

The next batch contains $1\text{mg/kg} \times 3000\text{kg} = 3000$ mg of the ingredient.

The carry-over is the amount of ingredient found in the following batch (3000mg) expressed as a percentage of ingredient added to the original batch (30,000mg) therefore:

$$(3000\text{mg}/30,000) \times 100 = 10\%$$

The level of the undesirable substance in the feed should also be taken into consideration as this may be needed to compare with levels laid down in legislation as described for coccidiostats above.

8.2.3 Method of measuring cross contamination

- a. The process is similar to that for carryover but all sampling is carried out after a flush has been used to clear the system. This should be a Mixer flush and a Press flush. Samples are taken post mixing and at the point of out-loading where possible using routine sampling.
- b. Generally the number of samples taken and the cross contaminant measured is determined by risk assessment but a minimum of 4 samples for each measurement is suggested.

8.2.4 Measuring cross contamination – interpretation of results

Consideration should be given to legislation, the danger to non-target species and food safety issues with immediate follow-up. This information should also be used in subsequent HACCP reviews.

If for instance the results show a level of contamination at the press but not at the mixer then the press flush level may need to be increased or steps put in place to ensure that manufacture is planned to avoid the risk of the products being manufactured in that order.

9. Microbiological Monitoring

9.1. Salmonella

Salmonella testing must be undertaken in accordance with the current Defra/DARD Code of Practice for the control of Salmonella.

9.2. Enterobacteriaceae (Enteros):

These are a group of bacteria often used in poultry feed microbiology as indicator organisms to validate and verify, where required, the effectiveness of heat treatment or acid treatment as a kill step. Their presence in processed poultry feed may indicate inadequate treatment or post process contamination from the environment. Entero testing may be used to monitor plant hygiene.

10. Testing Controlled Product Recovery in Finished Feed

10.1. Method

Samples of finished products containing controlled products should be selected using the routine sampling procedure and submitted for analysis according to the minimum requirements of the VMD guidelines i.e.

- Square root of 1% of the medicated/specified feed additive feed produced per annum (minimum 1 sample).

The testing should take into account all of the VMPs and SFAs used on the manufacturing site where reliable analysis is available.

10.2. Interpretation of results

As a minimum standard should be within the permitted legal tolerance as detailed in Schedule 5 of the Veterinary Medicines Regulations.

Appendix 1 Suggested guidelines for Feed Ingredient Testing

Key: R – Recommended for minimum testing A – Advised additional tests. Where R or A not indicated – individual company assessment required

Ingredient	Cere al grains	Cereal by-products	Oil seeds/ fruits & their By-products	Legumes & by-products	Tubers, roots & by-products	Other seeds & fruits & by-products	Molasses	Milk products & by-products	Fishmeal	Misc food by-products	Fats & oils	Minerals	Min/ Vit premixes
Analyte / Type of Test													
Dry Matter	R	R	R	R	A	A	R			R	R		
Protein	R	R	R	R	A	A	R	R	R	R			
Oil A/B	A	A	R	A	A	A		R	R	R			
Crude Fibre/ NDF	A	R	R	R	R	R				R			
Ash	A	A	A	A	R	A	A		R	R			
Vitamin A													A
Vitamin E													A
Mineral & trace elements							A					R	A
Salt/ sodium								A	R	R			A
Fat quality											R		
Undesirable s	As per FEMAS Calculator. Numbers adjusted for Due diligence purposes only.												

Appendix 2 Suggested guidelines for Finished Feeds Testing

	Cattle	Sheep	Pig	Layers	Growing poultry	Medicated	Non-GM
Nutritional							
Moisture	R	R	R	R	R		
Protein	R	R	R	R	R		
Oil A/B	R	R	R	R	R		
Crude Fibre/ NDF	R	R	R	R	R		
Ash	R	R	R	R	R		
Salmonella	A	A	A	R	R		
Enterobacteriaceae				A	A		
Mixer efficiency	As per UFAS CoP	R					
Carry-over/ cross-contamination		A				R	
Routine medicine/ SFA analyses						As per VMD	
Contaminant (med/ SFA)						R	
Copper		R					
GMO	A	A	A	A	A		R

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