

Sampling Advice: Mycotoxins in Foodstuffs



The purpose of this document is to provide information to enforcement authorities and food business operators on the legislation regarding mycotoxins in foodstuffs and the official methods of sampling cereals, dried fruit, groundnuts, nuts, products derived from nuts, spices, coffee, fruit juice, cider, milk, wine and apple products for mycotoxins.

This document should be read in conjunction with the relevant legislation. It is not a statutory code of practice or a substitute for the regulations, decisions or statutory instruments to which it refers.

If you require any further advice on sampling of mycotoxins then please contact the Food Standards Agency, clearly stating your enquiry.

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Mycotoxins

- Mycotoxins are naturally occurring toxins that are produced by moulds growing on food crops during production and subsequent storage.
- Mycotoxins are found in a wide range of foods from around the world, but particularly in foods from countries with climates of high temperature and humidity.
- There are a number of contaminants covered by the class of mycotoxins; these include aflatoxins, ochratoxin A, the fusarium toxins and patulin.

Aflatoxins

- Aflatoxins are produced by mould species that grow in warm, humid conditions.
- Aflatoxins occur mainly in commodities imported from third countries (i.e. outside the EC), in particular peanuts (groundnuts) and other edible nuts and their products, dried fruit, spices and maize. Milk and milk products may also be contaminated owing to the consumption of aflatoxin contaminated feed by ruminants.
- There are a number of different types of aflatoxin, with aflatoxin B₁ being the most toxic. It is a potent carcinogen in laboratory animals and there is evidence that it is a genotoxic human carcinogen i.e. it can cause cancer by reacting with genetic material.

Ochratoxin A

- Ochratoxin A is produced by mould species that grow in warm humid conditions and by other moulds that generally favour climates with lower temperatures and humidity.
- Ochratoxin A is found as a contaminant in a wide range of commodities, particularly cereals and cereal products and dried vine fruit (currants, raisins and sultanas). Other commodities that can also be affected include coffee and coffee products, wine, grape juice, cocoa and cocoa products and spices. It has also been detected in animal products from non-ruminant animals exposed to ochratoxin A from animal feeding stuffs.
- Ochratoxin A has been implicated as a cause of kidney damage in humans.

Fusarium Toxins

- *Fusarium* moulds produce a number of different mycotoxins, known as fusarium toxins.
- Fusarium toxins include deoxynivalenol, T-2 and HT-2 toxins, fumonisins and zearalenone
- Fusarium toxins are commonly found in cereals grown in temperate regions such as Europe, Asia and America.

Patulin

- Patulin contamination is mainly found in apple products, although it can occur in other mouldy fruits, grains and foods.

Information for Food Business Operators

The Responsibilities of Food Business Operators

- The responsibilities of a food business, derived from EU food safety legislation, are described in a guidance document from the European Commission. This document is available from the European Commission website:
http://europa.eu.int/comm/food/food/foodlaw/responsibilities/obligations_en.pdf
- This requires businesses to ensure the food they place on the market is safe and places an onus on processors to identify critical control points and carry out quality controls on their products before they are put on sale in order to ensure that their products meet legal requirements.
- In the UK, regular checks are carried out to ensure products comply with legislation. These checks are carried out by port health authorities (PHAs) or local authorities at the point of import and by trading standards officers and environmental health officers throughout the food chain, including manufacturer's premises and at retail level.

The Food Standards Agency undertakes its own surveys of contaminants in food. FSA surveys are not intended to be official controls, but instead a snapshot of what is available on the market for UK consumers, in order to monitor consumer exposure and the effectiveness of controls throughout the food chain. However, in such instances where surveys reveal non-compliance with food law or other risks to food safety, the Agency will take action to ensure consumer protection such as product recall or withdrawal.

Additionally, depending on the severity of the contamination and the distribution of the product, the Agency may put out a "Food Alert: for information", which alerts Local Authorities across the UK of a potential problem with the product.

'Due Diligence'

Although the testing of imported consignments for mycotoxins is not a compulsory requirement, importers and food business operators have a responsibility to ensure the food they trade is safe for human consumption. If a food business operator is found to have placed on the market food that is injurious to health or unfit for human consumption they can be prosecuted under the General Food Regulations 2004. These Regulations are enforced by local authorities and port health authorities.

'Due diligence' is a defence to certain offences under the Food Safety Act 1990, the General Food Regulations 2004 and the Contaminants in Food (England) Regulations 2007. This balances the proper protection of the consumer against contaminated food with the right of food business operators not to be convicted of an offence they have taken all reasonable care to avoid committing. If it can be proved that an operator "took all reasonable precautions and exercised all due diligence to avoid the commission of the offence by himself or by a person under his control" then it can enable that person to be acquitted of the offence.

Analysis of Foodstuffs

Analysis of Foodstuffs for Mycotoxins

If a food business operator wishes to have samples analysed for mycotoxins in the UK it is recommended that a laboratory accredited for mycotoxin analysis is used. Further information on accredited laboratories can be found on the UKAS (United Kingdom Accreditation Services) website (www.ukas.org). Official samples must be analysed at an Official Control Laboratory (OCL). A list of OCLs can be found on the FSA website (www.food.gov.uk/enforcement/foodsampling/foodcontrollabs).

A sample which is taken and analysed according to all the relevant legislation is considered to be a formal sample. Formal official samples are split at the laboratory into three samples, known as enforcement, defence, and referee samples. When the sample is taken the enforcement officer advises the food business operator that they can have the defence sample for their analysis if they wish. In the case of the enforcement sample being non-compliant and the food business operator wishing to challenge this they have the right to a second expert opinion. Thus they can request that the referee sample is analysed at the Laboratory of the Government Chemist (www.governmentchemist.org.uk). It is for the enforcement officer and the owner to agree who is responsible for the fee for the analysis of the referee sample.

The contaminants legislation states that the measurement uncertainty and the recovery must be taken into consideration when enforcement authorities are interpreting analytical results. All analytical results have variability known as the measurement uncertainty; this is the range of values that the analyst believes could be reasonably attributed to the measurement value. The analytical result should be reported as " $x \pm 2u$ " or " $x \pm U$ ", where x is the analytical result and u is the standard measurement uncertainty. The expanded measurement uncertainty ($2u = U$) gives a confidence level of approximately 95%.

The table below shows the expected expanded uncertainties for a range of concentrations.

Concentration	Expanded Measurement Uncertainty	Range of Acceptable Concentrations
100 g / 100 g	4%	96 – 104 g / 100 g
10 g / 100 g	5%	9.5 – 10.5 g / 100 g
1 g / 100 g	8%	0.92 – 1.08 g / 100 g
1 g / 1 kg	11%	0.89 – 1.11 g / 1 kg
100 mg / 1 kg	16%	84 – 116 mg / 1 kg
10 mg / 1 kg	22%	7.8 – 12.2 mg / 1 kg
1 mg / 1 kg	32%	0.68 – 1.32 mg / 1 kg
<100 µg / 1 kg	44%	56 – 144 µg / 1 kg

Example of the Use of Measurement Uncertainty

- The EU sets a maximum limit of 5 µg/kg for aflatoxin B1 in spices (Commission Regulation 1881/2006)

The analysis of three different batches of paprika gave the following results for aflatoxin B1:

1. 3.0 µg/kg (44% MU) = 3.0 ± 1.3 µg/kg → range 1.7 – 4.3 µg/kg
2. 6.0 µg/kg (44% MU) = 6.0 ± 2.6 µg/kg → range 3.4 – 8.6 µg/kg
3. 9.0 µg/kg (44% MU) = 9.0 ± 4.0 µg/kg → range 5.0 – 13.0 µg/kg

The result for batch 1 is below the limit both with and without measurement uncertainty being taken into account. This sample is therefore compliant with the limits.

The reported result for batch 2 is above the statutory limit, but the true value for this analysis lies in the range 3.4 – 8.6 µg/kg. In the EU this sample is considered compliant, as it is not beyond reasonable doubt that the maximum limit has actually been exceeded.

The reported result for batch 3 is once again above the statutory limit and the acceptable range of values obtained are also above the limit. This sample is therefore non-compliant.

Legislation

The Food Safety Act 1990 provides the framework for much of the legislation concerning food in the UK and covers all types of food business. It is an offence under the Act for anyone to sell food which is not of the nature, substance or quality demanded by the customer. It is the responsibility of a food business to ensure that they have adequate food hygiene standards within their business.

European and UK Legislation

European Community Regulations are directly applicable in the UK and other members of the European Union. These pieces of legislation set limits for certain contaminants in foodstuffs, as well as detailing the official methods of control and requirements for complying with food laws. In addition to EC Regulations made by the Council and the European Parliament, and by the European Commission, Commission Decisions are also used to provide additional commodity specific safeguard measures.

European legislation is given effect in England via the use of Statutory Instruments; these are used in the case of EC Regulations to specify the offences and related penalties that are applicable in the enforcement of the European legislation. Scotland, Wales and Northern Ireland have similar procedures in place for the enforcement of European legislation.

General food law is enforced by the following European and English legislation:

- **EC Regulation 178/2002** – lays down the general principles and requirements of food law and describes procedures in matters of food safety and traceability, including those for imported foods. This is given effect in the UK by **The General Food Regulations 2004** which creates the offence of placing unsafe food on the market.
- **EC Regulation 882/2004** – describes how official controls (checks) should be performed by the enforcement authorities to ensure that food business operators comply with food laws. Such controls may be carried out at all stages of production, processing and distribution to ensure that requirements are met. It also contains specific provisions concerning controls on imports from countries outside the European Community. This Regulation is implemented in England by **The Official Feed and Food Controls (England) Regulations 2006**.

Maximum levels for certain contaminants are set by European legislation. Further details of maximum levels set for individual commodities are given in the following pages; however, these should be read in conjunction with the full Regulation.

- **Commission Regulation 1881/2006** – this Regulation sets the maximum levels for certain contaminants in foodstuffs, including levels for mycotoxins. This Commission Regulation is enforced by **The Contaminants in Food (England) Regulations 2007**.

Where to Find Copies of the Legislation

The Food Standards Agency has produced a guidance document on the Contaminants in Food (England) Regulation 2007. This guidance document can be found at:

<http://www.food.gov.uk/foodindustry/guidancenotes/foodguid/contamgn>

The European legislation listed is available on the internet.

EC Regulation 178/2002

http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l_031/l_03120020201en00010024.pdf

EC Regulation 882/2004

http://europa.eu.int/eur-lex/lex/LexUriServ/site/en/oj/2004/l_191/l_19120040528en00010052.pdf

Commission Regulation 1881/2006

http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_364/l_36420061220en00050024.pdf

Commission Decision 2006/504/EC as amended by Commission Decision 2007/459/EC

http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_199/l_19920060721en00210032.pdf

http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/l_174/l_17420070704en00080017.pdf

Copies of UK Statutory Instruments are also available online.

The Contaminants in Food (England) Regulations 2007

<http://www.opsi.gov.uk/si/si2007/20070210.htm>

The Official Feed and Food Controls (England) Regulations 2006

<http://www.opsi.gov.uk/si/si2006/20060015.htm>

The General Food Regulations 2004

<http://www.opsi.gov.uk/si/si2004/20043279.htm>

Cereals and Cereal Products

Maximum levels as set by Commission Regulation 1881/2006

	Maximum Limit (µg/kg)	
	Aflatoxin B1	Total Aflatoxins
Aflatoxins		
All cereals and all products derived from cereals (with the exception of those foodstuffs listed below)	2.0	4.0
Maize to be subjected to sorting or other physical treatment before human consumption or use as an ingredient	5.0	10.0
Processed cereal-based foods and baby foods for infants and young children; dietary foods for medicinal purposes intended specifically for infants	0.1	-
Ochratoxin A	Maximum Limit (µg/kg)	
Unprocessed cereals	5.0	
All products derived from unprocessed cereals (with the exception of those foodstuffs listed below)	3.0	
Processed cereal-based foods and baby foods for infants and young children; dietary foods for medicinal purposes intended specifically for infants	0.5	
Deoxynivalenol	Maximum Limit (µg/kg)	
Unprocessed cereals, other than durum wheat, oats and maize	1250	
Unprocessed durum wheat and oats	1750	
Unprocessed maize	1750 ^(*)	
Cereals intended for direct human consumption, cereal flour, bran for direct human consumption and germ (with the exception of products for infants and young children listed below)	750 ^(*)	
Processed cereal-based foods and baby foods for infants and young children	200	
Bread, pastries, biscuits, cereal snacks and breakfast cereals	500	
Zearalenone	Maximum Limit (µg/kg)	
Unprocessed cereals, other than maize	100	
Unprocessed maize	200 ^(*)	
Cereals intended for direct human consumption, cereal flour, bran for direct human consumption and germ (with the exception of those foodstuffs listed below)	75	
Maize intended for direct human consumption, maize flour, maize meal, maize grits, maize germ and refined maize oil	200 ^(*)	
Bread, pastries, biscuits, cereal snacks and breakfast cereals (excluding maize snacks and breakfast cereals)	50	

Cereals and Cereal Products continued

Maize snacks and breakfast cereals	50 ^(*)
Processed cereal-based foods (excluding processed maize-based foods) and baby foods for infants and young children	20
Maize-based foods for infants and young children	20 ^(*)
Fumonisin	Sum of B ₁ and B ₂ (µg/kg)
Unprocessed maize	Under discussion
Maize-based foods for direct human consumption (with the exception of those foodstuffs listed below)	Under discussion
Maize flour, maize meal, maize grits, maize germ and refined maize oil	Under discussion
Processed maize-based foods and baby foods for infants and young children	Under discussion
T-2 and HT-2 toxin	Maximum Limit (µg/kg)
Unprocessed cereals and cereal products	Under discussion

(*) These limits came into force on the 1 July. However, since these maximum levels were specified revised maximum levels have been proposed and drafted. It is intended that when the amending Regulation is made giving effect to the new maximum levels, this instrument should be made to apply retro-actively. It is expected that this new Regulation will be put in place in autumn 2007.

Groundnuts and Nuts

Maximum levels as set by Commission Regulation 1881/2006

	Maximum Limit (µg/kg)	
	Aflatoxin B1	Total Aflatoxins
Aflatoxins		
Groundnuts to be subjected to sorting, or other physical treatment, before human consumption or use as an ingredient in foodstuffs	8.0	15.0
Nuts to be subjected to sorting, or other physical treatment, before human consumption or use as an ingredient in foodstuffs	5.0	10.0
Groundnuts and nuts and processed products thereof, intended for direct human consumption or use as an ingredient in foodstuffs	2.0	4.0

Commission Decision 2006/504/EC as amended by Commission Decision 2007/459/EC also sets special conditions on the import of certain foodstuffs from third countries due to the increased risk of contamination of these products by aflatoxins. Nuts covered by this Commission Decision are:

- Brazil nuts in shell from Brazil
- Peanuts from China
- Peanuts from Egypt
- Pistachios from Iran
- Hazelnuts and pistachios from Turkey

For further information on the special conditions for importing these products please refer to the Commission Decision.

Dried Fruit

Maximum levels as set by Commission Regulation 1881/2006

Aflatoxins	Maximum Limit (µg/kg)	
	Aflatoxin B1	Total Aflatoxins
Dried fruit to be subjected to sorting, or other physical treatment, before human consumption or use as an ingredient in foodstuffs	5.0	10.0
Dried fruit and processed products thereof, intended for direct human consumption or use as an ingredient in foodstuffs	2.0	4.0
Ochratoxin A	Maximum Limit (µg/kg)	
Dried vine fruit (currants, raisins and sultanas)	10.0	

Commission Decision 2006/504/EC as amended by Commission Decision 2007/459/EC also sets special conditions on the import of certain foodstuffs from third countries due to the increased risk of contamination of these products by aflatoxins. Dried fruits which are covered by this Commission Decision are:

- Dried figs from Turkey

For further information on the special conditions for importing these products please refer to the Commission Decision.

Spices

Maximum levels as set by Commission Regulation 1881/2006

Aflatoxins	Maximum Limit (µg/kg)	
	Aflatoxin B1	Total Aflatoxins
Following species of spices: <i>Capsicum</i> spp. (dried fruits thereof, whole or ground, including chillies, chilli powder, cayenne and paprika) <i>Piper</i> spp. (fruits thereof, including white and black pepper) <i>Myristica fragrans</i> (nutmeg) <i>Zingiber officinale</i> (ginger) <i>Curcuma longa</i> (turmeric)	5.0	10.0

Products which contain the specified spices (such as curry powder etc) are also covered by these maximum levels for aflatoxins.

Coffee and Coffee Products

Maximum levels as set by Commission Regulation 1881/2006

Ochratoxin A	Maximum Limit (µg/kg)
Roasted coffee beans and ground roast coffee, excluding soluble coffee	5.0
Soluble coffee (instant coffee)	10.0

Drinks

Maximum levels as set by Commission Regulation 1881/2006

Aflatoxins	Maximum Limit Aflatoxin M1 (µg/kg)
Raw milk, heat-treated milk and milk for the manufacture of milk-based products	0.05
Infant formulae and follow-on formulae, including infant milk and follow-on milk	0.025
Ochratoxin A	Maximum Limit (µg/kg)
Wine (including sparkling wine, excluding liqueur wine and wine with an alcoholic strength of not less than 15% vol) and fruit wine	2.0
Aromatised wine, aromatised wine-based drinks and wine-product cocktails	2.0
Grape juice, concentrated grape juice as reconstituted, grape nectar, grape must and concentrated grape juice as reconstituted, intended for direct human consumption	2.0
Patulin	Maximum Limit (µg/kg)
Fruit juices, concentrated fruit juices as reconstituted and fruit nectars	50
Spirit drinks, cider and other fermented drinks derived from apples or containing apple juice	50
Apple juice for infants and young children (labelled and sold as such)	10

Apple Products

Maximum levels as set by Commission Regulation 1881/2006

Patulin	Maximum Limit (µg/kg)
Solid apple products, including apple compote and apple puree intended for direct human consumption (with the exception of those foodstuffs listed below)	25
Solid apple products, including apple compote and apple puree, for infants and young children and labelled and sold as such	10

Sampling

- This document describes the methods of sampling commodities for which there are EU maximum limits set. Mycotoxins are known to be unevenly distributed in foods and so it is important to be able to detect isolated 'hot spots' of contamination. It is therefore necessary to take a large number of small incremental samples at various places distributed throughout the consignment in order to obtain a representative sample. This applies regardless of whether the sample is taken formally or informally, as it is impossible to confidently assess what further action should be taken based on the analysis of an unrepresentative sample.
- The European Commission have laid down the official procedures for sampling foodstuffs for mycotoxin analysis for enforcement purposes, these procedures are described in Commission Regulation 401/2006
http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_070/l_07020060309en00120034.pdf
- The Commission has provided additional information to officers carrying out sampling official controls for aflatoxins in a specific guidance document.
http://ec.europa.eu/food/food/chemicalsafety/contaminants/aflatoxin_guidance_en.pdf
- This document provides information on sampling of lot weights of <15 tonnes for dried fruit, nuts, groundnuts, spices and coffee and sampling of lot weights of <50 tonnes for cereals and products derived from nuts, groundnuts and dried figs. For lot weights above these amounts please refer to Commission Regulation 401/2006 for sampling guidance.

The following sections describe the best practices for carrying out sampling of commodities for mycotoxins and sending these samples for analysis. It is advised that these practices are followed; however, you may wish to use your own discretion when collecting samples within the limits allowed by EC legislation and guidance.

General Information on Sampling

- Ensure that samples are taken from the same lot, i.e. they should have the same batch code or at the very least the same best before date.
- When collecting samples avoid any changes which would affect the mycotoxin content, the analytical determination or make the aggregate samples collected unrepresentative (e.g. do not open packaging in adverse weather conditions or expose samples to excessive moisture or sunlight. Avoid cross-contamination from other potentially contaminated consignments nearby).
- Take incremental samples of the appropriate weight at various places distributed throughout the lot.
- Place samples collected in a clean, dry, leak-proof container (such as food quality plastic jars or bags) that can be securely sealed.

- Combine incremental samples together into one container to make up the aggregate sample to be sent to the analyst. It is important that the samples are stored in opaque containers to reduce exposure to light which can affect the analytical results.
- When sampling from retail outlets the number of packs that may be available to you could be limiting. Always ensure that enough packs have been taken to give an aggregate sample representative of a batch, i.e. do not take just one pack. We recommend that you take at least 8 retail packs if possible, picked at random from the same batch. If this number of packs is not available then take as many packs as will make up one kg. For foods such as spices and crisps it may not be possible to obtain the necessary 500g. In these cases take at least the minimum required by the analytical laboratory. This amount depends on the nature of the sample. In general, at least 50g of sample are required for each replicate, i.e. at least 150g for the three samples. It should be noted that some laboratories require 1kg of sample for the preparation of solid samples by homogenisation. It is advisable to contact the analytical laboratory prior to sampling.
- General guidance on sampling foods can be found in the Food Law Code of Practice and Practical Sampling Guidance for Food Standards and Feeding Stuffs. The procedures outlined here are in addition to the provisions of these documents.
<http://www.food.gov.uk/enforcement/foodlaw/foodlawcop/>
<http://www.food.gov.uk/enforcement/foodsampling/guidance/>

Recording Sample Information

- Record as much information as possible about the lots from which samples have been taken to provide as much traceability data as possible.

Sending the Sample for Analysis

- Store samples in a cool dark place.
- Do not remove pre-packed retail samples from their packaging. Seal the entire pack in a plastic bag after purchase, and put the sample code on the outside of the bag.
- Send the **entire aggregate sample** to the analytical contractor; the sampler is not required to split the sample.
- **Dispatch samples to the laboratory as soon as possible after collection, ensuring that they are in a good condition.**

Cereals and Cereal Products

- Aflatoxins in cereals and processed cereal products, baby foods and processed cereal products for infants and young children
- Ochratoxin A in cereals and processed cereal products, baby foods and processed cereal products for infants and young children
- Fusarium toxins in cereals and processed cereal products, baby foods and processed cereal products for infants and young children

Number of incremental samples to be taken for lots of <50 tonnes

Lot Weight	No. of Incremental Samples	Aggregate Sample Weight (kg)
< 50 kg	3	1
> 50 kg - ≤ 500 kg	5	1
> 500 kg - ≤ 1 tonne	10	1
> 1 tonne - ≤ 3 tonnes	20	2
> 3 tonnes - ≤ 10 tonnes	40	4
> 10 tonnes - ≤ 20 tonnes	60	6
> 20 tonnes - ≤ 50 tonnes	100	10

If you are sampling at the retail stage and it is not possible to follow the above sampling plan, an alternative method of sampling may be used provided that it ensures a representative sample is obtained and that a minimum of 1kg aggregate sample is collected.

Worked Examples

Total Weight of Lot	Recommended Number of Incremental Samples to Take	Packaging Size	What to do
35 kg	3	100 gram retail packs	Take 10 retail packs, taken at random from the entire batch, to give an aggregate sample weight of 1kg.
130 kg	5	400 gram retail packs	Take 5 retail packs (or a minimum of 3 retail packs) to give the 1kg aggregate sample.
160 kg	5	10 kg sacks	Take one scoop (of 200 grams) from 5 different sacks, to give 5 incremental samples with a 1kg aggregate weight.
8 tonnes	40	25 kg sacks	Take one scoop of 100 grams each from 40 different sacks, to give 40 incremental samples with a 4kg aggregate weight.

Dried Fruit
(not including dried figs)

- Aflatoxins in dried fruit (excluding dried figs)
- Ochratoxin A in dried vine fruit

Number of incremental samples to be taken for lots of <15 tonnes

Lot Weight	No. of Incremental Samples	Aggregate Sample Weight (kg)
≤ 100 kg	10	1
> 100 kg - ≤ 200 kg	15	1.5
> 200 kg - ≤ 500 kg	20	2
> 500 kg - ≤ 1000 kg (1 tonne)	30	3
> 1 tonne - ≤ 2 tonnes	40	4
> 2 tonnes - ≤ 5 tonnes	60	6
> 5 tonnes - ≤ 10 tonnes	80	8
> 10 tonnes	100	10

If you are sampling at the retail stage and it is not possible to follow the above sampling plan, an alternative method of sampling may be used provided that it ensures a representative sample is obtained and that a minimum of 1kg aggregate sample is collected.

Worked Examples

Total Weight of Lot	Recommended Number of Incremental Samples to Take	Packaging Size	What to do
70 kg	10	100 gram retail packs	Take 10 retail packs taken at random from the entire batch, to give a 1 kg aggregate sample.
130 kg	15	400 gram retail packs	Take the minimum number of packets required to make up the aggregate weight. In this case this is 1.5 kg; so take 4 packs.
160 kg	15	10 kg sacks	Take one scoop, of 100 grams each, from 15 different sacks to give a 1.5 kg aggregate sample.
8 tonnes	80	25 kg sacks	Take one scoop, of 100 grams each, from 80 different sacks to give 80 incremental samples.

Dried Figs, Groundnuts & Nuts

- Aflatoxins in dried figs, groundnuts (also known as peanuts) and nuts

Number of incremental samples to be taken for lots of <15 tonnes

Total Lot Weight	No. of Incremental Samples	Aggregate Sample Weight (kg)
≤ 100 kg	10	3
> 100 kg - ≤ 200 kg	15	4.5
> 200 kg - ≤ 500 kg	20	6
> 500 kg - ≤ 1000 kg (1 tonne)	30	9
> 1 tonne - ≤ 2 tonnes	40	12
> 2 tonnes - ≤ 5 tonnes	60	18
> 5 tonnes - ≤ 10 tonnes	80	24
> 10 tonnes - ≤ 15 tonnes	100	30

If you are sampling at the retail stage and it is not possible to follow the above sampling plan, an alternative method of sampling may be used provided that it ensures a representative sample is obtained and that a minimum of 1kg aggregate sample is collected.

Worked Examples

Total Weight of Lot	Recommended Number of Incremental Samples to Take	Packaging Size	What to do
70 kg	10	100 gram retail packs	Take a minimum of 10 retail packs taken at random from the entire batch, to give at least 1 kg of aggregate sample.
130 kg	15	400 gram retail packs	Take the minimum number of packets required to make up the aggregate weight. In this case this is 4.5 kg; so take 12 packs.
160 kg	15	10 kg sacks	Take one scoop, of 300 grams each, from 15 different sacks to give a 4.5 kg aggregate sample.
8 tonnes	80	25 kg sacks	Take one scoop, of 300 grams each, from 80 different sacks to a 24 kg aggregate sample.

Nut Derived Products & Compound Foods

- Aflatoxins in peanut butter, flour and other processed nut products

These sampling methods are to be used when nuts, or other foodstuffs, have been subjected to a process which results in a homogeneous mixture where mycotoxin 'hot-spots' have been eliminated.

Number of incremental samples to be taken for lots of <50 tonnes

Total Lot Weight	No. of Incremental Samples	Aggregate Sample Weight (kg)
≤ 1000 kg (1 tonne)	10	1
> 1 tonne - ≤ 3 tonnes	20	2
> 3 tonnes - ≤ 10 tonnes	40	4
> 10 tonnes - ≤ 20 tonnes	60	6
> 20 tonnes - ≤ 50 tonnes	100	10

If you are sampling at the retail stage and it is not possible to follow the above sampling plan, an alternative method of sampling may be used provided that it ensures a representative sample is obtained and that a minimum of 1kg aggregate sample is collected.

Worked Examples

Total Weight of Lot	Recommended Number of Incremental Samples to Take	Packaging Size	What to do
70 kg	10	100 gram retail packs	Take 10 retail packs at random from the entire batch, to give a 1 kg aggregate sample.
130 kg	10	400 gram retail packs	Take the minimum number of packets required to make up the aggregate weight. In this case this is 1 kg; so take 3 packs.
160 kg	10	10 kg sacks	Take one scoop, of 100 grams each, from 10 different sacks to give a 1 kg aggregate sample.
8 tonnes	40	25 kg sacks	Take one scoop, of 100 grams each, from 40 different sacks to give a 4 kg aggregate sample.

Spices

- Aflatoxins in spices

Number of incremental samples to be taken for lots of <15 tonnes

Total Lot Weight	No. of Incremental Samples	Aggregate Sample Weight (kg)
≤ 10 kg	5	0.5
> 10 kg - ≤ 100 kg	10	1
> 100 kg - ≤ 200 kg	15	1.5
> 200 kg - ≤ 500 kg	20	2
> 500 kg - ≤ 1000 kg (1 tonne)	30	3
> 1 tonne - ≤ 2 tonnes	40	4
> 2 tonnes - ≤ 5 tonnes	60	6
> 5 tonnes - ≤ 10 tonnes	80	8
> 10 tonnes - ≤ 15 tonnes	100	10

If you are sampling at the retail stage and it is not possible to follow the above sampling plan, an alternative method of sampling may be used provided that it ensures a representative sample is obtained and that a minimum of 0.5 kg aggregate sample is collected.

Worked Examples

Total Weight of Batch at Warehouse	Recommended Number of Incremental Samples to Take	Packaging Size	What to do
70 kg	10	100 gram retail packs	Take a minimum of 10 retail packs taken at random from the entire batch, to give at least 1 kg of aggregate sample.
130 kg	15	400 gram retail packs	Take the minimum number of packets required to make up the aggregate weight. In this case this is 1.5 kg; so take 4 packs.
160 kg	15	10 kg sacks	Take one scoop, of 100 grams each, from 15 different sacks to give a 1.5 kg aggregate sample.
8 tonnes	80	25 kg sacks	Take one scoop, of 100 grams each, from 80 different sacks to give an 8 kg aggregate sample.

Coffee & Coffee Products

- Ochratoxin A in roasted coffee beans, ground roasted coffee and soluble coffee

Number of incremental samples to be taken for lots of <15 tonnes

Total Lot Weight	No. of Incremental Samples	Aggregate Sample Weight (kg)
≤ 100 kg	10	1
> 100 kg - ≤ 200 kg	15	1.5
> 200 kg - ≤ 500 kg	20	2
> 500 kg - ≤ 1000 kg (1 tonne)	30	3
> 1 tonne - ≤ 2 tonnes	40	4
> 2 tonnes - ≤ 5 tonnes	60	6
> 5 tonnes - ≤ 10 tonnes	80	8
>10 tonnes - ≤ 15tonnes	100	10

If you are sampling at the retail stage and it is not possible to follow the above sampling plan, an alternative method of sampling may be used provided that it ensures a representative sample is obtained and that a minimum of 1 kg aggregate sample is collected.

Worked Examples

Total Weight of Lot	Recommended Number of Incremental Samples to Take	Packaging Size	What to do
70 kg	10	100 gram retail packs	Take 10 retail packs at random from the entire batch, to give a 1 kg aggregate sample.
130 kg	15	400 gram retail packs	Take the minimum number of packets required to make up the aggregate weight. In this case this is 1.5 kg; so take 4 packs.
160 kg	15	10 kg sacks	Take one scoop, of 100 grams each, from 15 different sacks to give a 1.5 kg aggregate sample.
8 tonnes	80	25 kg sacks	Take one scoop, of 100 grams each, from 80 different sacks to give an 8 kg aggregate sample.

Fruit Juice, Grape Juice, Wine & Cider

- Ochratoxin A in wine and grape juice
- Patulin in fruit juices, spirit drinks, cider and other apple derived drinks
- Aflatoxin M1 in milk

Minimum number of incremental samples to be taken

Packaging Form	Volume of Lot (litres)	No. of Incremental Samples	Aggregate Sample Volume (litres)
Bulk	-	3	1
Bottles/packages (excluding wine)	≤ 50	3	1
Bottles/packages (excluding wine)	50 – 500	5	1
Bottles/packages (excluding wine)	> 500	10	1
Bottles/packages (wine only)	≤ 50	1	1
Bottles/packages (wine only)	50 – 500	2	1
Bottles/packages (wine only)	> 500	3	1

If you are sampling fruit juice, milk, wine or cider which is packaged in ≥1 litre volumes, you must take the minimum number of incremental samples as stated in the table above. Please note that this is a different strategy to sampling of non-liquid goods, where the minimum number of incremental samples to take is that which gives the aggregate sample weight.

Worked Examples

Total Volume of Lot	Recommended Number of Incremental Samples to Take	Packaging Size	What to do
35 litres (fruit juice)	3	1 litre bottle	Take 3 bottles at random from the lot, to give a aggregate sample volume of 3 litres in this instance.
132 litres (wine)	2	75 cl bottle (750 ml)	Take 2 bottles at random from the lot, to give an aggregate sample of 1.5 litres.
160 litres (cider)	5	500 ml bottles	Take 5 bottles at random from the lot, to give a 2.5 litre aggregate sample.
250 litres (cider)	5	440 ml cans	Take 5 cans at random from the lot, to give a 2.2 litre aggregate sample.

Apple Products & Apple Based Baby Foods

- Patulin in solid apple products and apple juice and apple products for infants and young children

Number of incremental samples to be taken from a bulk lot

Total Lot Weight	No. of Incremental Samples	Aggregate Sample Weight (kg)
< 50 kg	3	1
50 kg – 500 kg	5	1
> 500 kg	10	1

Number of packages (incremental samples) to be taken if the lot consists of individual packages/jars

No. of Packages in the Lot	No. of Packages to be Taken	Aggregate Sample Weight (kg)
1 - 25	At least 1 package	1
26 - 100	About 5%, at least 2 packages	1
>100	About 5% to a maximum of 10 packages	1

Worked Examples if the lot consists of individual packages/jars

No. of Packages in lot	Recommended Number of Incremental Samples to Take	Packaging Size	What to do
20	At least 1	200 g	Take enough packages to give a 1 kg aggregate sample, in this case 5 packages.
80	4	125 g	Take enough packages to give a 1 kg aggregate sample, in this case 8 packages.
140	7	200 g	Take 7 packages at random from the lot, to give an aggregate sample of 1.4 kg in this instance.
500	10	200 ml	Take 10 bottles at random from the lot, to give an aggregate sample of 2 L in this instance.

Vacuum Packed Goods

- **Dried Fruit (not including dried figs)**

For dried fruit traded in vacuum packs in lots of <15 tonnes, 25% of the number of incremental samples shown in the table on page 17 should be taken. The appropriate aggregate sample weight for the total batch weight given in the table should be maintained.

- **Dried Figs, Groundnuts and Nuts**

For pistachios, groundnuts, Brazil nuts and dried figs traded in vacuum packs in lots of <15 tonnes, 50% of the number of incremental samples shown in the table on page 18 should be taken. The appropriate aggregate sample weight for the total batch weight given in the table should be maintained.

For other nut types traded in vacuum packs in lots of <15 tonnes, 25% of the number of incremental samples shown in the table on page 18 should be taken. The appropriate aggregate sample weight for the total batch weight given in the table should be maintained.

- **Nut Derived Products and Compound Foods**

For other products derived from nuts, groundnuts and dried fruit traded in vacuum packs in lots of <50 tonnes, 25% of the number of incremental samples shown in the table on page 19 should be taken. The appropriate aggregate sample weight for the total batch weight given in the table should be maintained.

- **Spices**

For spices traded in vacuum packs in lots of <15 tonnes, 25% of the number of incremental samples shown in the table on page 20 should be taken. The appropriate aggregate sample weight for the total batch weight given in the table should be maintained.

- **Coffee and Coffee Products**

For coffee beans, ground coffee and soluble coffee traded in vacuum packs in lots of <15 tonnes, 25% of the number of incremental samples shown in the table on page 21 should be taken. The appropriate aggregate sample weight for the total batch weight given in the table should be maintained.

Sampling Advice Flow Chart

This flow chart outlines possible scenarios when sampling at a wholesalers. Please familiarise yourself with this figure **before** sampling. The flow chart should be used as a guide to determine which consignments you should sample.

