Ministry for Primary Industries
Manatū Ahu Matua

Making Uncooked Salami (Uncooked Comminuted Fermented Meat or UCFM)

A guidance document to help small businesses make safe UCFM products

New Zealand Government

Growing and Protecting New Zealand

Title

Making Uncooked Salami (Uncooked Comminuted Fermented Meat or UCFM): A guidance document to help small businesses make safe UCFM products

About this document

This guidance document has been developed by the Ministry for Primary Industries (MPI) as guidance to help small businesses making uncooked comminuted fermented meat (UCFM) products, such as salami, to meet the requirements of the Food (Uncooked Comminuted Fermented Meat) Standard 2008 (the Standard).

Disclaimer

This guidance does not constitute, and should not be regarded as, legal advice. While every effort has been made to ensure the information in this guidance is accurate, the Ministry for Primary Industries does not accept any responsibility or liability whatsoever for any error of fact, omission, interpretation or opinion that may be present, however it may have occurred.

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Is this guidance document for me?

This guidance document has been developed by the Ministry for Primary Industries (MPI) to help UCFM manufacturers who:

- meet requirements under the appropriate legislation (e.g. Food Act 2014, Animal Products Act 1999, Food Standards Code);
- use meat including fat of New Zealand origin. If you use meat / fat not of New Zealand origin you will need to undertake extra validation which is not covered in this guidance document (you may require assistance from a food consultant);
- use the National Microbiological Database (NMD) or supplier data for incoming raw meat *Escherichia coli* (*E. coli*) count;
- use the *Tom Ross Model* (page 25) for validating the process lethality; and
- produce a finished shelf-stable product with a validated pH and water activity.
  (As a general rule this can be achieved by a final pH of less than 5.2 in combination with a water activity of less than 0.95).

The guidance document is not for you if you:

- validate your UCFM process in a different way (such as through challenge testing which is not covered in this guidance document);
- produce a final product that relies on only pH or only water activity to reduce microbial numbers and preserve the product. An example of this is dried sausage such as droewors which does not use fermentation to reduce the pH, but is generally shelf stable because of low water activity; or
- produce other dried meat products that are not fermented through the use of a starter culture (e.g. biltong).

If you cannot follow the practices provided in the guidance document, you need to consider seeking advice from a qualified food consultant or stopping processing this type of product.

Common terms and abbreviations in this guidance document

E. coli at the 98th percentile you must know the level of *E. coli* microorganisms in raw meat that you use for making UCFM

Food Standards Code means the Australia New Zealand Food Standards Code which lists requirements for foods such as composition, additives, labelling and microbiological limits. The Food Standards Code can be found at: www.foodstandards.govt.nz

National Microbiological Database Programme (NMD) is a programme administered by MPI. Under the NMD programme, slaughter premises processing cattle (bovine), pigs (porcine), deer (cervine), goats (caprine) and ostriches / emus, test meat for *E. coli* at least weekly and their data is recorded in the national microbiological database. Further information is available at: http://www.foodsafety.govt.nz/industry/general/nmd/overview.htm

Process lethality means the amount of *E. coli* that is killed by the fermenting, drying and/or maturing processes combined. One of the ways of determining process lethality is the purpose-made programme – the *Tom Ross Model* – which calculates lethality from the information gathered during processing.

Standard means the Food (Uncooked Comminuted Fermented Meat) Standard 2008.

Tom Ross Model means the Meat and Livestock Australia *E. coli* inactivation model that can be used as a tool to *indicate* how effective your UCFM process is at killing *E. coli.*

UCFM means uncooked comminuted fermented meat, which has not had its core temperature maintained at 65^{o}C for at least 10 minutes or an equivalent combination of time and higher temperature during processing.

Validation includes collecting information about the UCFM process to confirm that it meets the processing requirements of the Standard and testing products to confirm that the process is creating products that are safe. All UCFM recipes must be validated.

Water activity (Aw) is a measure of the amount of water available for microorganisms to use for growth. Water activity of food products is measured relative to pure water, which has a water activity of 1.00.

< is the mathematical symbol for less than.

> is the mathematical symbol for greater than.

pH is a measurement of acidity or alkalinity. The pH scale is a set of values from 1 to 14 with 1 being a strong acid and 14 being a strong alkali. A pH of 7 is neutral.

% is the mathematical symbol for percentage.

Kg, g, mg are measurements of weight – kilogram, gram, milligram.

What's in this guidance document?

This guidance document contains information on how to process UCFM to meet the legal requirements of the Standard and how to validate your UCFM processes. It also contains forms to help with the record-keeping requirements of the Standard.

Making it yours

Read through the guidance document and make sure it is suitable for your UCFM process. Some of the pages enable you to identify the way you make UCFM products. This guidance document will help you to show others how your business meets the Standard.

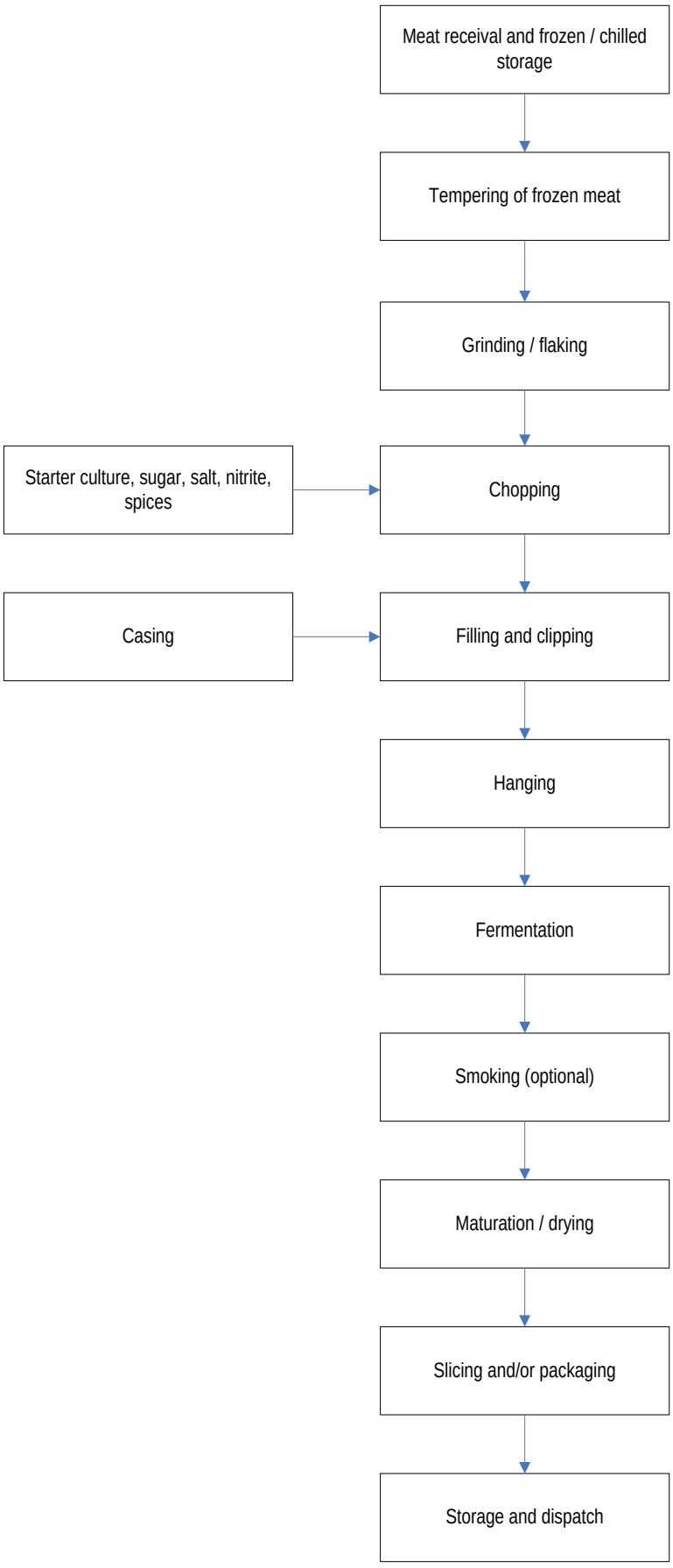
Once you have done this, make sure that any other people in your business who are involved in making UCFM are familiar with the parts that relate to their job.

Management: Food Legislation That Applies to UCFM

There are detailed and specific food laws that apply when making UCFM products. It is important to take precautions to ensure your products are safe.

The legislation	What does this mean for you?
The Food Standards Code Standard 1.6.1, sets limits for-bacteria in UCFM that must not be exceeded. Limits are given for: • coagulase-positive staphylococci; • *E. coli*; and • *Salmonella.* Ready-to-eat foods must also meet the microbiological limits for *Listeria monocytogenes* set out in Standard 1.6.1 and corresponding Schedule 27. Standard 2.2.1 (section 8–10), describes the labelling requirements that applies to UCFM. Standard 1.2.1 describes the general food labelling requirements that applies packaged food for sale. Standard 1.3.1 sets out the limits for food additives that can be added to UCFM products.	UCFM product that exceeds the limits could cause sickness and even death. *Salmonella* and *E. coli* can be introduced into the product through raw meat and other ingredients. *Staphylococci* could be introduced into the product through the meat or be introduced from people during processing. These bacteria can multiply during processing, especially during the fermentation process. Safe product will come from having: 1. strict control of the meat and other ingredients; 2. confidence that unwanted bacteria are kept to safe levels by the process, (for example by low pH and water activity); and 3. records for every batch of product that show the controls and process were working. Some consumers, such as pregnant women, young children and/or the elderly have weak immune systems and are advised not to eat some uncooked products. The information you put on the UCFM labels must therefore be correct and informative for consumers. Maximum levels of nitrites and nitrates must not be exceeded.
The Food (Uncooked Comminuted Meat) Standard 2008 (referred to as the Standard) applies to all UCFM products made in New Zealand. The Standard requires: 1. A UCFM product to be made using: • a validated process; • raw meat with an *E. coli* count known to the 98th percentile; and • a fresh fermentation starter culture for each batch. *2.* Each batch of UCFM to be monitored and records kept of the: • temperature and time of fermentation; • temperature and time of maturing and drying; and • temperature and time of smoking. 3. The operator must monitor and record the pH and water activity of UCFM during processing. 4. Corrective actions to be documented where problems are found with raw meat or during the processing of UCFM. 5. Products to be tested to show that they meet the microbiological limits.	The process used to produce each type of UCFM needs to be written down. The details of the process, for example, time, temperature, pH need to be assessed to show that they will lead to safe product. The time and temperature during processing can be input to the *Tom Ross Model* to verify effectiveness of the process at killing bacteria. Records must to be kept for each batch of product, and when limits are exceeded, for example, pH not reached in the expected time, corrective actions must be applied. Regular microbiological testing of product by an ISO/IEC 17025 accredited laboratory will be needed to confirm the controls and process are working and the product is safe. For operators under the APA regime, testing needs to be carried out by a laboratory registered under the MPI Recognised Laboratory Programme. See the MPI website or email animal.products@mpi.govt.nz for further information on this.
Making and handling UCFM products are also subject to other food safety requirements, such as: • the Food Act 2014 (for operators with a Food Control Plan (FCP)); or • the Animal Products Act 1999 (for operators with a Risk Management Programme (RMP)). In particular, these pieces of legislation set requirements for the registration of food businesses and hygienic operation.	This means that you should already have good hygienic practices in place. Your premises should be well maintained and staff aware of good food safety practices. In this guidance document, "Write it down" headings gives instructions on: • any procedures to write down in your FCP or RMP; • any product and process parameters; and • any records that should be kept.

Management: General UCFM Process Flow Chart



Management: UCFM Getting Started Checklist

Read through all the pages of this guidance document and use the following checklist to assist you to introduce it to your UCFM process. Each procedure explains the processing steps and any validation requirements.

1. How to prove the process is safe – Validation	Reference page	Done [✓]
Read the procedure "Validating the UCFM Recipe"	7	
Decide on your recipe – new or existing	Own records	
Gather together all the equipment, ingredients and criteria you need to make the recipe		
Temperature (and humidity) controlled facility for fermentation and drying	8	
Access the *Tom Ross Model*	25	
Raw meat selection with appropriate *E. coli* count of incoming meat	9, 10	
Herbs, spices and additives of correct quality, including correct size casings	12	
Suitable starter culture	14	
Calibrated pH meter	17, 27-28	
Calibrated thermometer	17-19, 26	
Batch Record Sheet	32	
Making the product		
Ingredient and meat preparation including additive additions	11-13	
Starter culture preparation	14	
Preparing the batter and filling including weighing for weight loss	15-16	
Fermentation	17	
Smoking	18	
Drying / maturing	19	
Slicing and packing	21	
Labelling	22	
Checking the product meets the requirements		
Validating water activity and pH	20	
Testing finished product	23	
Validating Process Lethality Using the Meat and Livestock Australia *E. coli* inactivation model (*Tom Ross Model*)	25	
Final product checks	24	
Correcting the process if the product is not right		
Check each procedure for appropriate corrective actions	In each step	
Alter the process criteria and repeat the validation above using new criteria		
Record validated process criteria on summary sheet	33	

2. Making sure the product is safe every batch – Process control

Fill in your Batch Record Sheet for every batch
Follow your product recipe and validated process criteria (e.g. time, temperature, humidity, air flow etc.)
Calibrate pH meter, measure and record the pH during processing
Verify procedures are being followed correctly and process criteria is met
Record your process times and temperatures (product and room / chamber) during fermentation, smoking and drying
Record water loss and water activity
Check the finished product including undertaking any required testing
Check records are complete
Undertake any corrective action

Management: Summary of Regulatory Requirements and Where They Are Found in This Guidance Document

The following table cross references the requirements of the Standard with where they are covered in this guidance document. These are legal requirements and **must** be met by all processors of UCFM products. This table also contains requirements of the Food Standards Code.

Mandatory requirements

Food (Uncooked Comminuted Fermented Meat) Standard 2008	Reference – the Standard	Reference page – this guide
Validation requirements – process lethality must be validated	Clause 4	7
The *E. coli* count for the ingoing raw meat ingredients used for UCFM must be known to the 98th percentile and be equivalent or below the process lethality for the validated process	Clause 5 (1)	10
The number of *E. coli* organisms in the UCFM must be measured and recorded after the product has finished maturation and when the product is ready for sale at a frequency determined by the operator	Clause 5 (3)	23
Fermentation of UCFM must be initiated by a starter culture	Clause 6 (1)	14
Meat and batter mix used in processing UCFM and stored before fermentation must be stored at 5°C or colder	Clause 6 (2)	15
A processor must monitor and record the temperature and time of fermentation during the processing of the UCFM for each batch	Clause 7 (1) a)	17
A processor must monitor and record the temperature and time of maturation or drying during the processing of the UCFM for each batch	Clause 7 (1) b)	19
A processor must monitor and record the temperature and time of smoking during the processing of the UCFM for each batch (if applicable)	Clause 7 (1) c)	18
A processor must monitor and record the pH and water activity of UCFM during processing	Clause 7 (2)	17
Any records generated from the UCFM production process must be kept for four years	Clause 8	32
A processor must not use back slopping in processing UCFM	Clause 9	14
A processor may only reprocess or rework fully processed compliant product	Clause 10	13
A processor must document and undertake corrective actions where verification and monitoring indicates a non-compliance with the validated time / temperature requirements and/or the incoming raw meat and final product *E. coli* counts	Clause 11	throughout
Australia New Zealand Food Standards Code	Reference – FSC standard	Reference page
Levels of *E. coli, Salmonella* and *Staphylococcus* must comply with Standard 1.6.1	1.6.1	23
Levels of *Listeria monocytogenes* must comply with Standard 1.6.1	1.6.1	21
Levels of additives, for example, nitrites and nitrates must comply with Standard 1.3.1	1.3.1	13
General labelling	1.2.1	22
Labelling specific to UCFM	2.2.1	22

UCFM Safe Processing: Validating the UCFM Recipe

Goal	Why?
• To ensure that all UCFM recipes will produce a safe product.	• All recipes need to be checked to confirm that the final product will consistently meet the requirements of the Food Standards Code and the Standard. • If a recipe does not deliver a safe product, customers could get ill.

How this is done

Validation

Validation will show that your process(es) can consistently meet:

- the microbiological limits of the Food Standards Code 1.6.1;
- a validated pH and water activity combination that will produce a safe final product (for example, a final pH of <5.2 in combination with a Aw of <0.95 is generally accepted as safe); and
- process lethality of a log 2.0 (or other value based on test results from your meat supplier) reduction in *E. coli*.

Validation is usually only done once, but must be repeated if you change your process (for example, a different recipe, meat type, casing size, process time / temperature).

What if I've been making product for years?

You may not need to change what you do, but you will need to demonstrate that the way you do things leads to a safe product. This will mean:

- making a record of your process(es);
- carrying out checks during processing;
- performing simple calculations (e.g. process lethality, weight loss during processing); and
- testing your final product.

If a product does not meet all applicable legal requirements during validation, you must change your processes so that it does.

Once you have a safe and validated process written down, follow the recipe every time you make that product. You will need to keep all records including what happens with each batch for four years.

If you make any changes to a recipe, you will need to have it validated again.

I'm a butcher not a mathematician – how hard are the calculations?

Any calculations will be explained in this guidance document. In some instances, all you will need to do is go online and use a model that will do the calculating for you.

What if I don't want to change my process?

You would need evidence to show that your process set out in your registered Food Control Plan or Risk Management Programme consistently produces a safe product.

The validation process

- Make your product following the UCFM processing sections of this guidance.
- Wherever something needs validating, you will see a box with the heading:

! Validate this step

This box will contain information on:

- what you need to do to validate this part of your process; and
- where to put information on the Validation Summary Sheet.

At the end of the process:

- check your process lethality using the *Tom Ross Model* (page 25) to predict the log reduction in *E. coli*; and
- send samples to an accredited laboratory, see *Checking the Finished Product - Microbes* (page 23).

Once all test results show that the product(s) meet the requirements of the Food Standards Code and the Standard, validation has been completed. This confirms that the processing criteria does deliver a safe product.

What if there is a problem?

If you do not want to use this guidance document to meet the requirements for UCFM product, contact a person with knowledge of safe manufacturing methods for UCFM products.

A list of consultants can be found on the MPI website:
http://www.foodsafety.govt.nz/registers-lists/.

Check the capability of the consultant before you contract them. Not all of them have experience with UCFM.

! Validate this step

On the Validation Summary Sheet, (page 33):

- identify any recipes that you use to make UCFM products that are very different from each other (these will need separate validation);
- write down all the products made and group by meat species; and
- write down the casing size for each product.

If you've made any changes to your process, (e.g. a different recipe, casing size or process time/temperature), you need to re-validate. The first three batches of any new process, recipe or group of products should be tested.

UCFM Safe Processing: Fermentation and Drying Facilities

Goal	Why?
• To ensure that UCFM product is fermented and dried under controlled conditions.	• Controlled conditions are necessary to validate a safe process.

How this is done

It is strongly recommended that temperature and humidity controlled rooms or cabinets are used for fermentation and drying.

Deviations from the validated process temperatures can affect the lethality of the process and the *E. coli* reduction.

Fermentation

Control of temperature during fermentation

The temperature should be controlled at the optimum growth temperature of the starter culture bacteria.

This will ensure that sufficient numbers of the starter culture grow and produce acid to reduce the pH rapidly. This prevents the growth of harmful microorganisms. Also see *Ingredients* (page 12).

Control of relative humidity during fermentation

Control of relative humidity prevents case hardening. This occurs when the outer layer dries too quickly and hardens preventing loss of moisture from the centre. This may allow harmful microorganisms to grow in the centre of the casing / stick.

Smoking (optional)

Smoking generally occurs after fermentation and is part of the drying process.

Drying

Control of temperature during drying

Drying occurs following the end of fermentation, and continues to the point where the casing / stick has reached the desired water activity or weight loss.

Drying time will vary depending on the type and size of the product, the required water activity and meeting the process lethality. See *Validating Process Lethality Using the Tom Ross Model* (page 25).

Control of relative humidity and air flow during drying

It is important that the rate of water evaporation from the surface of the product allows water to migrate from the product interior without case hardening occurring.

The rate of drying is largely determined by relative humidity and air speed (e.g. by use of fans).

What if there is a problem?

Fermentation and drying (including smoking) at room (ambient) temperature means that:

- validation must be undertaken using the worst-case temperatures and time to achieve inactivation; or
- the time and temperatures of the product should be checked for each batch (e.g. by using the *Tom Ross Model* (page 25)), and the process adjusted (e.g. extending the drying time), if necessary, to ensure the required inactivation is met.

Write it down

Record how you control and monitor temperature, humidity and air flow for fermentation, smoking and drying in the appropriate sections of this guidance document as follows:

- *Fermentation* (page 17)*;*
- *Smoking* (page 18)*;*
- *Drying / maturation* (page 19).

UCFM Safe Processing: Sourcing Meat from a Regulated Supplier

Goal	Why?
• To ensure that all meat comes from a regulated source.	• Regulated meat has been examined to ensure that it does not carry disease and is suitable for human consumption. • Any business that sells meat must be registered.

How this is done

Reputable suppliers

Slaughter

All meat used for UCFM must come from animals that have been slaughtered and dressed by a business that operates a Risk Management Programme in accordance with the Animal Products Act 1999.

A list of operators with registered Risk Management Programmes can be found at: http://www.foodsafety.govt.nz/registers-lists/.

It is illegal to sell home kill and recreationally caught meat that has not been through the regulated system.

Cutting, processing and packaging of meat

Meat has been processed by a business that is registered to do so, operating under a:

- Risk Management Programme in accordance with the Animal Products Act 1999; or
- Food Control Plan in accordance with the Food Act 2014.

The details of each slaughter business and each meat cutting, processing and packaging business from where meat is obtained is provided in the *UCFM Supplier Record* (page 31).

Imported meat

Imported meat may be used if the incoming raw meat *E. coli* count is known to the 98th percentile.

When considering the use of imported red meat or fat, check with your supplier that they are able to supply *E. coli* counts of the raw meat. See procedure – *Checking Meat Quality* (page 10).

There are specific biosecurity processing requirements for imported pig meat and pig meat products. These products need to be processed in an MPI registered approved transitional facility.

Wild Meat

Wild Meat is not included in the NMD. While it can be used in UCFM, you should note that it may contain higher levels of harmful microorganisms.

MPI has found pathogenic bacteria in wild meat UCFM during a past microbiological survey (http://www.foodsafety.govt.nz/elibrary/industry/2016-03-Validation-of-UCFM-processes-with-MPI-SIS.htm)

Each incoming batch of wild meat must be tested to establish the *E. coli* count. Testing can be done by the UCFM manufacturer or the meat supplier.

What if there is a problem?

If a supplier is not registered or approved for a particular activity, they will not be able to supply you and you will need to find a different supplier.

Confirm that this supplier is registered appropriately.

If you find that a supplier is not registered to supply you with a particular product but does so, inform your verifier.

Write it down

Write the approved suppliers' details in the *UCFM Supplier Record* (page 31).

If there are any issues with the quality, temperature or *E.coli* counts of the incoming meat, write them down. Do not use the meat for making UCFM product.

Raw meat should be no warmer than 5°C for cartoned meats and 7°C for carcases.

Unless you are an MPI-registered approved transitional facility, you must not be using any imported pig meat or pig meat products to produce UCFM or any other meat product.

UCFM Safe Processing: Receiving Meat

Goal	Why?
• To ensure only meat of good microbiological quality is used to produce UCFM.	• The UCFM process may not kill all harmful microorganisms, so the meat needs to start with as few as possible. • UCFM products made with meat that contains a large number of harmful microorganisms can make people ill.

How this is done

It is important to know how many *E. coli* your process will kill because:

- making UCFM doesn't involve heat that would reliably kill all the harmful microorganisms; and
- the amount of acid produced during fermentation can only kill a limited number of harmful microorganisms.

E. coli die off over time during the drying process. It is important to kill any other harmful bacteria.

How many microorganisms are "okay" to start with, and how do I find this out?

There are three ways you can determine how many *E. coli* are on the meat you use to make UCFM products (If you use either Option One or Option Two, the *E. coli* count will have been determined for you).

- Option One: Use results from the MPI NMD. For beef, pork and venison species, NMD results confirm *E. coli* at the 98th percentile. Your process must then be able to consistently kill this number of microorganisms so there are none left in the finished product.
- Option Two: Ask your supplier for the species NMD results (premises profile for the past year) from each slaughter premises that your meat comes from. Random test results will not be sufficient.
- Option Three: Carry out your own tests on raw meat at an ISO/IEC 17025 accredited laboratory.

Note: You need expert technical advice to carry out Option Three, which is not covered in this guidance document.

More information on NMD can be found on the MPI website: http://www.foodsafety.govt.nz/industry/general/nmd/

Which cuts to use?

Certain meat cuts (for example, hindquarter meat and some forequarter cuts) will contain fewer harmful microorganisms as they are further away from meat-dressing activities.

Meat from bobby calves should not be used for UCFM as it can be widely contaminated by harmful microorganisms during carcass dressing.

Meat trimmings and mechanically separated meat should not be used for UCFM as they contain more microorganisms due to the way they are processed and handled.

Wild or game meat from a regulated source

Meat that is killed by certified hunters and inspected and dressed in premises with Risk Management Programmes may have higher levels of microorganisms.

Additionally, this meat is not subject to the NMD testing programme and the *E. coli* count is not known to the 98th percentile unless specific testing is undertaken as noted in Option Three.

This meat source is not recommended for use in making UCFM products unless the requirements of Option Three are met.

What if there is a problem?

Do not make product unless you know the *E. coli* counts of the raw meat.

Write it down

- Write down the business(es) that supply you with raw meat that meet the UCFM raw meat requirements in the *UCFM Supplier Record* (page 31).
- Write down the species of meat used and how the *E. coli* count is determined.

Write down any corrective actions taken.

! Validate this step

On the Validation Summary Sheet (page 33):

- if you use Option One, write down the *E. coli* count log 2.0 from the NMD.
- if you use Option Two, write the *E. coli* count to the 98th percentile as a log value for each meat species you use.
- if you use Option Three, seek technical advice regarding developing an *E. coli* sampling and testing plan for each species of raw meat used and how you determine the 98th percentile.

If you use imported raw meat, you must refer to the *Guidelines for the Production of Uncooked Comminuted Fermented Meat* at: http://www.foodsafety.govt.nz/elibrary/industry/guidelines-production-uncooked-guide/index.htm and establish the 98th percentile for that product.

If you are an MPI registered approved transitional facility, ensure that the specific biosecurity processing requirements for imported pig meat and pig meat products are met.

UCFM Safe Processing: Tempering of Meat

Goal	Why?
• To temper meat used in UCFM to a temperature of between–5°C to –2°C.	• To prevent the fat from softening and smearing during grinding or chopping. • To prevent the temperature of raw meat rising above 5°C during processing. • To prevent harmful microorganisms from growing in meat that is too warm.

How this is done

Tempering helps control meat temperature during processing.

Ambient or room temperature thawing is not recommended as it is difficult to get the meat to a uniform temperature. The surface will thaw and soften while the centre remains frozen.

Tempering of frozen meat

- Plan ahead and allow enough time to temper (partially defrost) the meat before use.
- Blocks of frozen cartoned meat may take several days to reach the right temperature.
- Use a chiller set at a temperature just above the desired tempering temperature (–5°C to –2°C) to ensure uniformity throughout the meat.
- Prevent any drips from contaminating other foods or surfaces by using clean drip trays or containers.
- Empty and clean drip trays or containers daily.
- Check tempered meat before use for any trapped plastic wrapping or carton liner.

Chilled meat

- Fresh chilled meat should be frozen until it reaches the required temperature (–5°C to –2°C).
- Plan ahead and allow enough time to freeze the meat before use. Blocks of chilled cartoned meat may take some time to freeze to the required temperature throughout.

Do not refreeze meat once it has thawed.

What if there is a problem?

If meat is not fully tempered, continue to temper or freeze until the required temperature is reached.

Write it down

Write down any problems and what you did to remedy them.

UCFM Safe Processing: Ingredients

Goal	Why?
• To ensure that all ingredients come from a reputable supplier and are suitable for UCFM processing.	• Herbs, spices and other ingredients may be contaminated with harmful microorganisms. • If too much of a permitted additive is used, consumers can get ill. • Starter cultures need to be specifically formulated for UCFM production so that they will ferment the product properly and produce the right amount of acid to kill harmful microorganisms.

How this is done

Reputable suppliers

- All UCFM ingredients and packaging come from reputable suppliers and are safe to use in or with UCFM products.

Herbs, spices and premixes

Herbs, spices or premixes can contain harmful or unwanted microorganisms that may affect the fermentation process, or contaminate the product.

Dried herbs and spices should be sourced from suppliers who can supply microbiological certificates of analysis or other evidence of sterility.

Fresh herbs and spices are not recommended. If they are used then source them from suppliers with good food safety systems.

Ingredients permitted at certain levels by the Food Standards Code

- Ingredients and additives used in UCFM must be permitted for use by, and comply with, the applicable requirements in the Food Standards Code.

Permitted food additives

Nitrites and nitrates

Sodium and potassium nitrate or nitrite can be added to UCFM. Nitrite on its own, or as a result of conversion of nitrates, prevents the growth of harmful microorganisms and gives colour and flavour to meat products. It is toxic so must be added in controlled amounts.

The Food Standards Code Standard 1.3.1 and Schedule 15 specifies that the amount in the final product must not exceed 500 parts per million (mg/kg) expressed as the total of nitrites and nitrates calculated as sodium nitrite.

Other permitted additives

The Food Standards Code does not permit the use of other additives except sorbic acid, sorbate and pimaricin where limits are placed on the amount of those additives that can be in the final product.

More information can be found in the Food Standard Code, Standard 1.3.1 Food Additives and Schedule 15 at:
http://www.foodstandards.gov.au/code/Pages/default.aspx.

Other ingredients

- Ingredients must not interfere with the fermentation process.
- Alcohols and acidulates may be used to provide flavour. If you do add alcohol you need to make sure that it does not interfere with growth of the starter culture.

Starter culture

The Technical Data Sheet for the starter culture has been checked and it:

- is suitable for use and specifically made for UCFM processing;
- can be used at the fermentation temperatures used in recipes;
- provides instructions for use;
- provides storage instructions;
- provides information about any other ingredients that need to be added (for example, salt, sugar and nitrite) when using the starter; and
- identifies any ingredients that should not be used when using the starter.

The starter culture is stored according to the manufacturer's instructions until needed.

The starter culture is usually freeze-dried bacteria and may include species of *Staphylococcus*, *Lactobacillus*, *Pediococcus* and *Micrococcus*. The type of bacteria will be written on the Technical Data Sheet that accompanies the starter culture.

Write it down

Write suppliers of UCFM ingredients in the *UCFM Supplier Record* (page 31).

Record nitrite / nitrate receipt in your Nitrite / Nitrate Inventory.

Keep copies of:

- certificates of analysis and guarantees; and
- Starter Culture Technical Data Sheet.

UCFM Safe Processing: Following Recipes

Goal	Why?
• To produce a safe and suitable UCFM product. • To ensure that only permitted additives are used to make UCFM. • To make sure a starter culture is used correctly.	• Using a validated recipe that has been tried and tested helps ensure a safe product. • If too much of a permitted additive is used, consumers can be made ill. • Fermentation and correct processing will not occur unless the correct amounts of the right ingredients are used.

How this is done

Do I need to have the recipe written down?

Writing down and following a validated recipe is a way of making sure that a safe product is made each time. The recipe can also be used to check what should have been added to each batch against the batch records showing what was actually added.

Following a recipe and keeping a record of what went into each batch also helps show how you consistently meet the Standard.

Changing a tried and tested recipe could affect the safety of the product. Any changes need to be validated to ensure that the safety of the product has not been compromised.

Recipe check of UCFM ingredients

Nitrite / nitrates

The type and amount of ***nitrite*** added is:

☐ as part of a premix (an amount calculated by the supplier);

☐ coloured curing agents of nitrates / nitrites are used and the % of sodium nitrite is ……..%

☐ You must ensure that the final product has less than the maximum level specified in the Standard 1.3.1 (500 mg/kg (parts per million)), see *Validate this step* opposite

Sugars (sucrose / saccharose and glucose / dextrose)

- The type and amount of sugar that the starter culture manufacturer recommends is added to each batch.

If the starter culture manufacturer does not specify an amount of sugar, then the amount added should be between 0.4% and 0.8% of the total weight of other ingredients.

The starter culture needs sugar for food and converts it to lactic acid. The amount of acid produced is important in reducing the pH so that harmful microorganisms are killed and the UCFM product is made safe.

Salt

- The amount of salt is calculated. Typically 2.5% to 3% of the total weight of ingredients is sufficient to ensure food safety outcomes and product characteristics are met.

Salt is another essential ingredient. It is responsible for reducing the water activity in products, which helps to inhibit the growth of some harmful microorganisms.

Alcohol

- The amount of alcohol, for example, wine or rum, added is calculated so that it does not affect the starter culture and slow the fermentation process.
- Always add a pre-set amount as determined from your particular recipe and batch size.

Acidulants

- Acidulants (for example, gluconolactone) may be used in combination with the starter culture.

Reworked product

Only product that has been completely processed and meets all the requirements of the Standard may be reworked.

What if there is a problem?

If the amount of nitrite or nitrate added exceeds the limit, the product must be thrown away.

If fermentation does not occur, check:

- the starter culture has been added;
- the amount of inhibiting ingredients (for example, alcohol) added; and
- whether the batch can be reworked (in a cooked product), otherwise throw it away.

Review processes to identify how this happened and identify how to prevent it from happening again.

! Validate this step

On the **Validation Summary Sheet** write down the amount of nitrite in the final product:

- from laboratory tests; and
- from calculation (see below).

Worked Example

Calculating sodium nitrite level (mg/kg)

Example: 5 grams of sodium nitrite* is added to a total raw batch weight of 20 kilograms:

$$\frac{5\text{ g}}{20\text{ kg}} = \frac{5 \times 1000\text{ mg}}{20\text{ kg}} = \frac{5000}{20} = 250\text{ mg/kg}$$

(parts per million) in the original batter mix

In this example, during processing the product loses 25% water, so the concentration of nitrite increases by this amount in the final product. The 20 kg original weight is now 25% less (5 kg) and now weighs 15 kg.

$$250 \times \frac{20\text{ (wet weight)}}{15\text{ (dry weight)}} = 333\text{ mg/kg}$$

(parts per million) sodium nitrite in the final product.

This is less than 500 mg/kg (parts per million) maximum allowed by the Food Standards Code.

* The weight of sodium nitrite may need to be corrected if pure nitrite is not used.

Write it down

Write on each **Batch Record Sheet** (page 32) the weight of each ingredient added to the batch and the batch number.

UCFM Safe Processing: Preparing the Starter Culture

Goal	Why?
• To correctly prepare and use the right type of starter culture. • To add the correct amount of starter culture to each batch of UCFM product.	• The wrong type of starter culture may not produce enough growth or acid to destroy harmful microorganisms and make the product safe. • Too few microorganisms in the starter culture will lead to slow fermentation and may allow any harmful bacteria present to multiply

How this is done

Why is a dedicated starter culture needed to consistently produce a safe product?

A dedicated starter culture is required by the Standard. You cannot use back slopping or wild fermentation This is so that only the "right" microorganisms grow in the mix. The specially selected microorganisms in the starter culture grow more quickly than harmful microorganisms, essentially starving them and stopping them from growing.

Why no back slopping?

Back slopping is the process of adding partially fermented product from a previous batch of UCFM to start fermenting a new batch. This can introduce unwanted microorganisms into the batter, slow the fermentation process and lead to conditions that do not destroy harmful microorganisms. This makes a product unsafe to eat.

Why no wild fermentation?

Fermentation relying on microorganisms already present in the mix is also not acceptable as this results in the same problems as back slopping.

A dedicated starter culture **must** be used for fermentation in order to meet the requirements of the Standard.

Starter culture preparation and use

Starter culture is prepared according to the manufacturer's instructions.

☐ The weight of starter culture that needs to be added to each kilogram of product is ……..gram(s).

☐ My normal batch size is ……..kilogram(s).

☐ The total amount of starter culture needed per batch is……..gram(s).

☐ The starter culture manufacturer requires other ingredients to be added to the batch of product. The total amount per batch is (tick which apply and amount):

☐ Sugar at ……..gram(s).

☐ Salt at ……..gram(s).

☐ Other (state)……..gram(s).

The starter culture is added according to the manufacturer's instructions (tick one):

☐ Dry and added directly to the batch.

☐ Mixed in drinking water for …… minutes and then added to the batch.

It is important to accurately weigh starter culture ingredients

Scales need to be able to weigh small amounts accurately otherwise the fermentation process, and the safety of the product, could be affected. For example, in order to weigh 20 grams of starter culture, you need to use scales that can identify 20 grams. Scales that can weigh only to the nearest 100 grams would be too inaccurate.

Additional instructions for the preparation and use of the starter culture

The manufacturer identifies that these actions must be taken when preparing and adding starter culture to each batch (specify):

e.g. clean and sanitise containers used for preparing starter culture after use to destroy wild organisms.

What if there is a problem?

The batch must be thrown away if the batch cannot be corrected before fermentation and:

- no starter culture has been added;
- an insufficient amount of starter culture is added; or
- the starter culture has been incorrectly stored and/or prepared.

If the batch isn't thrown away, spoilage and harmful microorganisms may grow.

Recheck the instructions from the starter culture manufacturer and the amount needed for the weight of batch material and method of adding to batch.

Retrain staff in the correct use of starter culture.

Write it down

Write down:

- the amount of starter culture and other ingredients required as per the manufacturer's instructions for each batch size on this page; and
- any additional instructions for the use of the starter culture.

Write on each **Batch Record Sheet** (page 32) the amount of starter culture used.

UCFM Safe Processing: Preparing the Batter Mix and Filling Casings

Goal	Why?
• To correctly prepare the UCFM batter mix.	• Adding the correct ingredients in the correct amounts will ensure that fermentation can take place and that harmful microorganisms are destroyed. • Following a recipe known to deliver a safe product will safeguard customers.

How this is done

Grinding and flaking

- Grinders and flakers are checked before use that they are clean and there is no risk of metal contaminating the product.
- Partially defrosted (tempered) meat is used. See *Tempering Meat* (page 11).
- Ground or flaked meat is stored in a chiller and used within 48 hours, if not used immediately.

Chopping and adding ingredients

- The bowl chopper is checked before use that it is clean and there is no risk of metal contaminating the product.
- The proportion of ingredients is calculated. See the procedures for *Following Recipes* and *Preparing the Starter Culture* (pages 13-14).
- All ingredients are accurately weighed before adding. See the procedures for *Following Recipes* and *Preparing the Starter Culture* (pages 13-14).
- Only fully processed compliant product can be reprocessed (e.g. off cuts, slicing and packing remnants of previous batches).
- All ingredients are thoroughly mixed.
- Batter mix is placed in a chiller below 5°C, if not put into casings immediately.

Filling and hanging

- Casings (if soaked) are soaked in potable water.
- Clean casings are immediately filled with batter mix.
- Casings are filled to the size and weight identified in the validated recipe.
- Casings are hung evenly to help air circulation and create an even fermentation process.

Identification of batch

- Casings / sticks are identified so that, at all times, they can be related to a batch (e.g. tags, labelled area).

What if there is a problem?

If the wrong and/or incorrect weights for ingredients have been used, reassess product ingredients.

Discard the product if you are unable to correct the recipe.

If the chiller breaks down, dispose of product as this may lead to a high microbiological count and growth of harmful microorganisms in the product.

Dispose of batter mix that is not immediately used or stored in a chiller.

Review in your :

- weighing and batching procedures; and
- staff training.

Do I need to keep records for each batch?

Yes – recording information, such as the date and time that the batch is started and all checks made. This shows that the tried and tested (validated) recipe has been followed and that the product is likely to be safe (pages 17-19).

Records must be kept for four years.

Write it down

Write down on each Batch Record Sheet (page 32):

- the type of product, the batch identification and the date and time you mixed the batch;
- the amount of meat and ingredients added (see the procedures for *Following Recipes* and *Preparing the Starter Culture*, page 13-14);
- the date and time you placed any batter mix in the chiller and chiller temperature;
- the date and time you filled the casings;
- the product temperature at time of filling; and
- the size and weight of filled casings sampled for weight-loss assessment (mark these casings / sticks so they can be identified for reweighing at the end of processing).

UCFM Safe Processing: Checking Weight Loss During Processing

Goal	Why?
• To ensure that product has lost a sufficient amount of water during processing.	• A reduction in weight during processing indicates that water is being lost. • Dry products (products with low water activity) prevent harmful microorganisms from growing.

How this is done

What does checking weight loss tell me?

As a product dries, the amount of water in it (water activity) goes down. This is important as it reduces the amount of water available to harmful microorganisms to let them grow. Adding salt and drying as part of the processing reduces water activity.

What weight loss do I need to achieve?

Weight loss is related to water activity. The water activity for each particular recipe and casing size must be validated.

The water activity in the final product needs to be tested by a laboratory as part of the initial validation of your process. See *Validating Water Activity and pH* procedure (page 20).

The test will relate water activity in the finished product to the calculated weight loss. You will know that, if you achieve the same percentage weight loss for that size of casing in the future, your product will have met that level of water activity.

- The weight of samples of casings / sticks from each batch is checked and weight loss calculated.

How can I work out the percentage weight loss?

For each batch:

1. Select 3 to 10 casings / sticks from a batch, ensuring all casing sizes (different diameters) are included.
2. Tie a label on each and number it. This will help track the water loss of each casing / stick throughout the drying process.
3. Record each casing size and filled weight on the Batch Record Sheet (page 32).
4. Carry out the UCFM process and reweigh the casings / sticks at the end of the process.
5. Enter the weight when dry for each casing on the Batch Record Sheet.
6. From the Batch Record Sheet subtract the "weight when dry" from the "weight when filled" for each casing.
7. Enter this in the "weight loss" column against each casing.
8. Divide "weight loss" by the "weight when filled".
9. Multiply this figure by 100 to obtain the percentage weight loss.
10. Check that the percentage weight loss corresponds to the required water activity for each casing. See *Validating Water* Activity *and pH* (page 20).

You can use laboratory results for water activity to show that the percentage weight loss is equivalent to the required water activity.

Is there an alternative to weighing product?

Yes. Water activity meters can be used to directly measure the water activity in product. They can be costly to buy and need regular calibration but will give an instant result.

What if there is a problem?

If the percentage weight loss does not meet the required amount:

- repeat the process but dry the product for longer;
- send the sticks to a lab (or measure water activity yourself);
- repeat this until the weight loss corresponds to a water activity of less than or equal to 0.95;
- write down the new drying time in your recipe and follow for all future batches.

Write it down

Write down on each Batch Record Sheet (page 32):

- the weight of each marked casing before and at the end of the process;
- the calculated percentage weight loss; and
- any corrective actions taken.

Tick the box if the required weight loss is met.

! Validate this step

On the Validation Summary Sheet (page 33), write down the results for:

- weight (moisture) loss percentage; and
- water activity (see *Validating Water Activity and pH* procedure, page 20).

Worked Example:

Calculating weight loss

1.966 kg (fill weight) – 1.572 kg (dry weight) = 0.394 kg

$$\frac{0.394 \text{ (weight loss)}}{1.966 \text{ (fill weight)}} \times 100 = 20.0\% \text{ weight loss}$$

Check against laboratory results that the percentage weight loss correlates to the required water activity (or less). See *Validating Water Activity and pH* (page 20).

UCFM Safe Processing: Fermenting UCFM Product

Goal	Why?
• To ensure that a quick and thorough fermentation is achieved during processing.	• If acid production and starter culture growth during fermentation is not fast enough, harmful microorganisms could grow to unsafe levels.

How this is done

What happens during fermentation?

The starter culture bacteria should grow faster than any harmful microorganism. The starter culture turns sugars in the batter mix into acid and makes other chemicals that destroy harmful microorganisms or do not allow them to grow.

The speed at which acid is produced is important and will depend on the starter culture, correct ingredients and the temperature at which fermentation takes place (process temperature). To ensure that the process temperature does this quickly enough it needs to be validated.

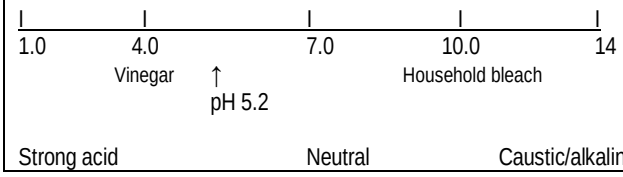
The pH of fermenting UCFM must be reduced quickly to a low pH. For example a drop to 5.2 (or less) within 48 hours is recognised to be effective at controlling harmful microorganisms. The time it takes for pH in the product to drop is critical for food safety. If fermentation takes longer than 48 hours, or the pH does not drop far enough, there is a likelihood that harmful microorganisms or toxins will still be present.

What is pH?

The pH scale (see below) is a set of values from 1 to 14 with 1 being a very strong acid (such as sulphuric acid) and 14 being a very strongly alkaline (such as caustic soda). A pH of 7 is neutral.

The pH is most accurately measured using a pH meter, which should be used when checking fermentation. pH papers are not accurate enough for this process.

There are two methods of pH measurement: spear or direct contact probes, which are inserted directly into the meat or by measurement of a prepared mixture. See *pH Meter Use and Calibration Procedures* (page 27).



Fermentation should be done in dedicated temperature/humidity controlled rooms or cabinets. Additional validation will be required if fermentation is done at ambient air temperatures. See *Fermentation and Drying Facilities* (page 8).

Fermentation

- Fermentation is ideally carried out in a dedicated temperature / humidity controlled room or cabinet.
- If carried out at ambient (changing) air temperatures you will need to keep a record of temperatures, and check them by using the *Tom Ross Model* at the end of the process. You will also need to ensure that temperatures are warm enough for the starter culture, because if it is too cold it will not grow quickly enough.
- Casings / sticks are evenly hung with sufficient space to help air circulation and ensure an even fermentation process.
- The temperature of fermenting product needs to be checked and recorded at least twice daily using a calibrated thermometer (with a sanitised probe). Measurements are taken from the centre of the product and from different casings / sticks in the room targeting those likely to be the coldest.
- Room temperatures are checked and recorded when measuring product temperatures.
- Product pH is checked and recorded to ensure that it has dropped to an appropriate level, for example less than pH 5.2 in 48 hours (if probing the product directly then sanitise the probe with alcohol wipes before and after use).
- Temperature and pH are checked and recorded at the end of fermentation.

What if there is a problem?

If the pH does not drop quickly enough (e.g. to below 5.2 or less within 48 hours) then the product must be destroyed or otherwise disposed of in agreement with your verifier.

The reason for the failure to reach the required pH must be investigated and corrected.

Check that the starter culture and sugar ingredients were added. (If this leads to a change in the recipe, you will need to re-validate the UCFM process).

If the fermenting room temperature goes down:

- record the temperatures;
- restore room to correct temperature; and
- enter the fermentation time and temperature data into the *Tom Ross Model* (page 25) to determine the increased fermentation time required at the lower temperature.

Review staff training.

Write it down

Write down on the Batch Record Sheet (page 32):

- the validated fermentation time and air temperature for your recipe;
- the room and product temperature at the start of fermentation and regularly (at least twice daily) during fermentation, and the dates and times you take it;
- the pH 48 hours into fermentation (this is the minimum, it is better to take more frequent pH samples);
- pH at the end of the fermentation; and
- any corrective actions taken.

! Validate this step

On the Validation Summary Sheet (page 33), write down the:

- fermentation time (hours);
- air or product temperatures during fermentation (if carried out in a controlled way);
- range of air or product temperatures during fermentation (the lowest recorded and highest recorded), if not carried out in a controlled way;
- pH at 48 hours; and
- final pH.

Product temperatures will be used later in the validation process.

UCFM Safe Processing: Smoking UCFM Product (Optional)

Goal	Why?
• To ensure that the product is smoked correctly.	• Smoking the product can help destroy harmful microorganisms as part of the drying process. • If smoking is not carried out correctly, harmful microorganisms could grow in the product.

How this is done

What happens during smoking?

Smoking is an optional process, however if used, the smoking time and temperature has to be taken into account when working out a safe process.

Smoking produces chemicals that inhibit the growth of microorganisms. It also imparts flavour and colour to products.

Untreated wood that is guaranteed to be free from toxic substances (for example, free of paint and wood preservative chemicals) should be used as the source of smoke.

The rate of smoking is affected by a number of matters that you need to take into account when you first set up your process, including:

- product pH;
- temperature;
- rate of air flow over the product (air velocity);
- relative humidity (% moisture content of the air);
- diameter of the sausage; and
- drying time.

UCFM products are "cold" smoked usually at temperatures between 18ºC and 30ºC.

Smoking should be done in a dedicated temperature-controlled room or cabinet to ensure consistency. Additional air and product temperature readings will be required for validation. If using a smoke house this is managed manually.

Smoking

- Smoking is best carried out:
  - in a temperature-controlled room or cabinet; or
  - in the smoking chamber;
- Sticks should be hung evenly to help air circulation and even smoking.
- Only use untreated wood to make the smoke.
- Product temperature (from more than one casing) is checked and recorded at least twice during smoking using a calibrated thermometer (the temperature probe should be sanitised before and after use).
- Measurements are taken from the centre of the product and from different casings / sticks in the smoke house, targeting those likely to be the coldest.
- Product temperature should be checked at the end of the smoking period.

What if there is a problem?

If the validated time and temperature requirements during smoking are not met then the drying time may have to be extended to ensure the required lethality is met (log reduction).

Using the *Tom Ross Model* (page 25), enter the time and temperature data taken throughout processing of the batch. Adjust the drying time and/or temperature until it achieves the required log reduction.

The reason for the temperatures not being met must be investigated and corrected. If this leads to a change in the recipe or process, you will need to re-validate the UCFM process.

Review staff training.

Write it down

Write down on the Batch Record Sheet (page 32):

- the validated smoking time and air temperature for your recipe and process;
- air velocity and settings (if applicable);
- relative humidity (RH%) (if applicable);
- the date and time the smoking started;
- the date and time when you measure air and product temperature; and
- any corrective actions taken.

! Validate this step

On the Validation Summary Sheet (page 33), write down the:

- smoking time (hours); and
- air or product temperature during smoking.

Product temperatures will be used later in the validation process.

UCFM Safe Processing: Drying / Maturing UCFM Product

Goal	Why?
• To ensure that the product is dried correctly.	• Drying / maturing a product reduces the amount of water in the product that can support the growth of harmful microorganisms.

How this is done

Note: Drying and maturing have corresponding meanings, and the term is used interchangeably.

What happens during drying?

The rate of drying is affected by a number of matters that you need to take into account when you first set up your process including:

- product pH;
- temperature;
- rate of air flow over the product (air velocity);
- relative humidity (% moisture content of the air);
- diameter of the sausage; and
- drying time.

Further information about this is found in the *Validation* sections (pages 20 and 25)

Drying should be done in a temperature, air velocity and humidity controlled room or cabinet to ensure consistency. Additional air and product temperature readings will be required for validation if drying at ambient temperatures.

Drying

- Drying should be carried out in a temperature and humidity-controlled room or cabinet.
- If drying is carried out at ambient (changing) air temperatures, you will need to record the temperatures and put them into the *Tom Ross Model* (page 25) at the end of the process.
- Casings / sticks should be hung evenly in the drying area to help air circulation and even drying.
- Temperature of drying product should be checked and recorded at least twice daily using a calibrated thermometer (with the probe sanitised before and after use). Measurements are taken from the centre of the product and from different casings / sticks in the room targeting those likely to be the coldest.
- Room or cabinet temperatures should be checked and recorded when monitoring product temperatures.
- The air velocity (e.g. fan speeds) should be checked and recorded each day, if applicable.
- The relative humidity (e.g. using a relative humidity meter) should be checked and recorded each day, if applicable.
- The product temperature is checked and recorded at the end of the drying time.
- The marked casings / sticks should be reweighed at the end of the drying time and the percentage weight loss calculated. Refer to *Checking Weight Loss During Processing* (page 16).

What if there is a problem?

If the air temperature during drying is not high enough, the drying time must be extended to ensure the required log reduction (e.g. log 2.0) is met.

Using the *Tom Ross Model* (page 25), enter the time and temperature data taken throughout processing the batch. Adjust the drying time and/or temperature until it achieves the log 2.0 reduction (or other value based on test results from your meat supplier).

If the percentage weight loss is not met, the drying time must be extended until the required water loss is met.

The reason for the drying temperatures not being met must be investigated and corrected. If this leads to a change in the recipe or process, you will need to re-validate the UCFM process.

Review staff training.

Write it down

Write down on the Batch Record Sheet (page 32):

- the validated drying time and air temperature requirements for your recipe and process;
- the date and time the drying started and ended;
- temperature of the product;
- air velocity and settings (if applicable);
- relative humidity (RH%) (if applicable);
- the calculated percentage water loss (see *Checking Weight Loss During Processing* (page 16)); and
- any corrective action taken (such as extending the drying time).

! Validate this step

On the Validation Summary Sheet (page 33), write down the:

- drying time (hours and/or days);
- air temperature during drying
- range of air temperatures during drying (the lowest recorded and highest recorded) if not in a controlled way.

Product temperatures will be used later in the validation process.

UCFM Safe Processing: Validating – Water Activity and pH

Goal	Why?
• To ensure the water activity and pH produce a safe product.	• Product that does not meet safe levels of pH and water activity may not be safe to eat.

How this is done

Validation confirmation – water activity and pH

Samples sent to the laboratory are tested for water activity and pH to confirm that the recipe delivers a safe product. A final pH of < 5.2 in combination with an Aw of <0.95 will generally be safe, but you can use other combinations as long as you can demonstrate that they will also be safe.

See *Checking Weight Loss During Processing* (page 16) and *Checking the Finished Product - Microbes* (page 23).

Check that the laboratory is able to test for water activity – not all laboratories can do this test.

Example of using weight loss as a proxy for water activity

You calculate the % weight loss from processing a recipe for a particular casing size as: 20.0%, 19.5%, 21.2%, 23.0%, 18.5% and 19.3%.

The lowest weight loss is 18.5% (also considered the 'wettest'). You send a sample of the "wettest" product to the laboratory, as it represents the "worst case" from the batch. For greater peace of mind send more than just one stick.

The result from the laboratory shows the water activity for the 'wettest' product equals 0.94.

This means that when making the same size of casing to the same recipe in the future, provided the % weight loss is calculated to be at least 18.5%, you will know that the water activity will be 0.94 or less.

Selecting samples to send to the laboratory

(see also *Checking the Finished Product - Microbes* (page 23))
At the end of the drying process for each batch, the casing with the lowest weight loss is selected and a sample sent to the laboratory. This could also be the same sample sent for microbiological and pH testing.

Water activity confirmation

The water activity results from the laboratory confirm the water activity calculated from the % weight loss is equal to or less than the required water activity for your process.

Confirmation of pH

The laboratory pH result should generally agree with the final processing pH as recorded on the Batch Record Sheet (page 32).
If you get a different result for pH than the laboratory, you should check that your pH meter is clean and has been calibrated.

What if there is a problem?

If test results from the laboratory show the water activity of the final product is too high you must take appropriate action – e.g.:

- submit further sticks for water activity testing; or
- dispose of all sticks from that batch.

Review the recipe and process to identify the cause and determine new times and temperatures for drying or smoking the product.

Make the product to this revised recipe and send a sample of "worst case" finished product to the laboratory to validate the new time(s) and temperature(s).

If the test results from the laboratory show the final product pH is too high (e.g. > 5.2) you must take appropriate action, e.g.:

- submit further sticks for pH testing; or
- dispose of all sticks from that batch.

If you get different pH results than the lab, check the condition of the pH meter probe and re-calibrate.

Review the recipe and process to identify the cause of the high pH and rectify.

Write it down

Identify on your Batch Record Sheet (page 32) which sample was sent for water activity and pH testing.

! Validate this step

On the Validation Summary Sheet (page 33), enter the:

- water activity from the laboratory test; and
- pH from laboratory test.

UCFM Safe Processing: Slicing and Packaging UCFM Product

Goal	Why?
• To ensure that slicing and packing is carried out hygienically.	• Dirty slicing equipment, hands, surfaces and packaging materials can contaminate products with harmful microorganisms.

How this is done

Finished Product

Finished UCFM products are ready-to-eat and must not come into contact with other foods and surfaces that could contaminate them, such as raw products or ingredients, dirty hands and dirty equipment.

The best way to prevent this is to:

- use dedicated equipment (e.g. slicers, work surfaces, display trays, utensils) for finished UCFM products; and
- keep raw and finished products in separate rooms at all times.

If it is not possible to use separate rooms, use a dedicated area for:

- finished product slicing;
- packing;
- storage; and
- display.

Failing this, use the same area or equipment, but at different times, and thoroughly clean and sanitise before handling, slicing and packing finished products.

Other things to remember when preventing cross-contamination include:

- cleaning and sanitising moveable equipment (including wheels) before it enters finished-product areas; and
- not using pallets and boxes for finished product that have been used for raw materials.

Slicing and packing UCFM

Prevent or minimise recontamination of finished UCFM product by:

- using dedicated equipment (e.g. slicers, work surfaces, utensils);
- thoroughly cleaning and sanitising shared equipment (including hidden and non-product contact surfaces), before use for finished product;
- separating raw and ready-to-eat processing areas, e.g.:
  - a separate room for raw processing;
  - the same room as raw processing but in a dedicated area;
  - the same room but before raw processing;
  - the same room but on different days;
- Clean, new food-grade packaging materials.

Staff hygiene activities

Before handling, slicing and packaging UCFM finished products, staff should:

- thoroughly wash and sanitise hands before handling product and between handling raw and ready-to-eat foods;
- put on a clean apron;
- use clean disposable gloves or wash and sanitise multi-use gloves between handling raw and ready-to-eat foods;
- clean food surfaces; and
- check for other signs of potential contamination.

What if there is a problem?

Product that has been dropped or contaminated must be thrown away.

Review staff training.

Write it down

Write down the specific cleaning procedures that you want staff to follow. See *Cleaning Schedule* (page 36)

! *Listeria*

Listeria monocytogenes is a microorganism that causes severe illness in vulnerable people (young, elderly, people with lowered immunity, pregnant women).

Listeria microorganisms are widespread in the environment and on raw products.

The fermentation and drying should reduce the numbers of *Listeria*, and the low pH and water activity limit their growth.

UCFM products, like other ready-to-eat products, can be easily contaminated by *Listeria* during handling, slicing and packing.

Surveys have shown a high incidence of *Listeria* in UCFM product. This is most likely to be from handling after drying.

It is therefore very important to have good cleaning and sanitation programmes, separate raw product from ready-to-eat product and practise good personal hygiene to minimise the risk of cross-contamination.

If you are slicing and packaging UCFM product, you will need to demonstrate you meet the requirements set out in the Food Standards Code Standard 1.6.1 and corresponding Schedule 27.

UCFM Safe Processing: Labelling of UCFM Product

Goal	Why?
• To ensure product is labelled correctly.	• The Food Standards Code requires certain foods to be labelled. • UCFM products also have to be labelled according to their meat content, and this requires certain statements to be made.

How this is done

What do I need to put on my label?

The general labelling requirements of the Food Standards Code require information to be in English, legible and include:

- food identification requirements (see below for the Food Standard Code requirements);
- quantity marking (e.g. net weight in grams);
- the name and address of the manufacturer or supplier;
- date marking (use by or best before);
- an accurate description of the meat or product;
- statement of ingredients;
- nutritional information;
- warning and/or advisory statements (e.g. sulphites); and
- instructions for storage and use.

Food Standard Code, Standard 2.2.1 sets out the specific labelling requirements for UCFM products based on the amount of meat in the product and whether it has been heat treated (e.g. cooked) or not.

UCFM product containing no less than 660 g/kg (66%) of meat must be labelled "fermented manufactured meat – not heat treated".

UCFM product containing no less than 330 g/kg (33%) of meat must be labelled "fermented processed meat – not heat treated".

When trade names are used, only the word "fermented" is required.

Unpackaged UCFM product must have the name displayed.

Further information on Standard 2.2.1 can be found at:
http://www.comlaw.gov.au/Series/F2008B00634

What if there is a problem?

Relabel incorrectly labelled UCFM product.

UCFM Safe Processing: Checking the Finished Product – Microbes

Goal	Why?
• To confirm a product is safe and/or the process produces a safe product.	• Microbiological testing will show whether harmful microorganisms are present in the finished product. • Microbiological testing will help to validate that the recipe, if followed, will consistently produce safe product.

How this is done

What testing do I need to do?

Microbiological testing needs to be done on the finished product at the end of drying and/or maturation, both when validating a new recipe or process and on an ongoing basis.

Validation sampling and testing

The first three batches of any new process, recipe or group of products should be tested.

Five random samples are taken from each batch and tested for *E. coli*, coagulase-positive *staphylococci* and *Salmonella*

Five samples are needed, because harmful microorganisms may not be spread evenly throughout a batch (lot).

Table 1: Microbiological Limits for UCFM Products as specified in Food Standards Code Standard 1.6.1 and corresponding Schedule 27

Microorganism	n	c	m	M
Coagulase positive *staphylococci* /g	5	1	1000	10 000
E.coli /g	5	1	3.6	9.2
Salmonella/25 g	5	0	0	-

Where:
n = number of samples examined from a lot of food
c = maximum number of samples allowed to have results greater than 'm' but less than 'M'
m = acceptable microbiological level in a sample
M = maximum level which when exceeded in one or more samples would cause the lot to be rejected

Routine sampling and testing of the validated process

Testing does not need to be carried out on every batch.

As a guide, tests should be done on every 10th batch, but the frequency can be set by the operator based on other factors such as:

- the level of production;
- the number of different types of products;
- the history of performance.

This can become less frequent if test results are consistently satisfactory.

You will need to check how much sample will be required with the laboratory.

Five samples must be taken as above, but not all microorganisms need to be tested for. The tests must include *E. coli*.

The product sampling programme should be designed by a competent person with microbiology knowledge. Consider seeking advice from a qualified food consultant.

What if there is a problem?

If the final product testing detects an unacceptable level of harmful microorganisms then the batch of product must either be destroyed or otherwise disposed of as agreed with your verifier.

Any product that has been sent for sale elsewhere must be traced and recalled.

Contact your Risk Management Programme (RMP) verifier or Food Control Plan verifier for advice.

Any products made since the final product tests were submitted can be stored but must not be sold, until further product testing confirms that the product conforms with the Food Standards Code, Standard 1.6.1 and corresponding Schedule 27.

Investigate how the unacceptable results could have happened and take steps to make sure that they can't happen again

Write it down

Write down on each Batch Record Sheet (page 32) the reference numbers of casings / sticks sampled for testing so that results can be traced to the correct batch.

Complete the laboratory submission form clearly identifying your product so that it can be traced to the batch (page 29).

File your laboratory test results and report with the relevant Batch Record Sheet (page 32).

Write down any corrective actions taken.

! Validate this step

When validating a process or group of products for the first time, samples from the first three batches are required to be tested for *E. coli*, coagulase-positive *staphylococci* and *Salmonella*.

This means that five samples are required to be taken from each of the first three batches (i.e. 15 samples of each product type).

Ensure water activity, pH and nitrite are also checked by the laboratory.

UCFM Safe Processing: Checking the Finished Product –Water Activity and pH

Goal	Why?
• To ensure that the finished product is safe to eat and has met the Standard.	• A product that has not been made in accordance with the requirements of the Standard and the Food Standards Code could contain harmful microorganisms or toxins that can make consumers ill.

How this is done

What checks do I need to do?

After making every batch of product, review the **Batch Record Sheet** (page 32) to check that the recipe has been followed correctly and the pH and water activity (or weight loss) requirements have been met.

Checking the Batch Record Sheet

- All ingredients and their weights have been measured and recorded.
- All required times, temperatures, pH measurements and other validated criteria (e.g. relative humidity, air flow) have been measured and recorded.
- Fermenting has been carried out at the proper temperature for the correct time.
- The product was smoked at the proper temperature for the correct time.
- The product was dried at the proper temperature for the correct time.
- The % weight loss has been calculated.
- The final product meets the validated criteria for pH and water activity.
- Any corrective actions have been recorded and completed.
- The product has been labelled correctly, and the batch identification is on the batch record sheet.
- Samples have been sent to the laboratory for testing (if required). See *Finished Product - Microbes* (page 23).
- The batch record sheet is signed to confirm that the product has been made according to the validated process and may be sold.
- Records are kept for four years.

What if there is a problem?

If the final product is too heavy, drying can be continued until the % weight loss (and therefore water activity) is reached.

Take appropriate action if the required pH is not achieved within 48 hours, e.g. dispose sticks from the batch.

Contact your RMP verifier or FCP verifier for advice.

The reason for any variation arising during processing must be investigated and fixed. If this leads to a change in the recipe, you will need to re-validate the UCFM process.

Review staff training.

Write it down

Sign off the **Batch Record Sheet** (page 32).

UCFM Safe Processing: Validating Process Lethality Using the Meat and Livestock Australia *E. coli* inactivation model (*Tom Ross Model*)

Goal	Why?
• To check that the recipe will consistently produce a safe product.	• The Standard requires UCFM processes to be validated. • An unvalidated process could make a product that is not safe to eat.

How this is done

Validation

When you are developing your recipe, the time and internal temperatures of the product collected throughout processing are entered into the *Tom Ross Model*. The *Tom Ross Model* will calculate the process lethality (the number of *E. coli* the process will kill). This must equal or exceed log 2.0 (or other value based on test results from your meat supplier).

Using the *Tom Ross Model*

Step 1. Log on to the website: http://www.foodsafetycentre.com.au/fermenter.php

Step 2. Go to the bottom of the screen and click on:
Download *the E. coli* Inactivation Model Excel file (916 KB).
– You can save this for future use on your computer.

Step 3. Open file and click 'enable editing' below the main Excel toolbar.

Step 4. Go to the bottom of the page and click on "Click to Continue".

Step 5. Select the "Advanced" model if you have room or product temperature variations and/or are smoking your product.

Step 6. Enter your temperatures and times for each step of the process.
In the example table below, the first temperature is 4°C and is the product start temperature (which is why there is no time entered in the "Time since measurements started" column). Enter all your temperatures and corresponding times (in hours) from the start of the process. You can see below that, after the first 12 hours, the temperatures have been taken every 12 hours. Make sure you put in your actual product temperature and the exact accumulated time.

Temperature (°C)	Time (hours) since measurements started	This is the process used for these records (Your process will not be the same as this).
4.0		
10.0	6	Process is fermenting at 22°C for 72 hours
17.0	12	
22.0	24	
21.0	36	
21.5	48	
21.0	60	
22.0	72	
26.0	84	Process is smoking at 30°C for a further 36 hours (72 + 36 = 108 hours)
30.0	96	
26.0	108	
22.0	120	Process is drying at approximately 20°C for a further 228 hours or 9.5 days (108 + 228 = 336 hours)
20.0	144	
20.0	336	

Step 7. The model then creates a graph of time versus temperature, and at the top of the page the inactivation log is calculated.

	2.48	Total Predicted Inactivation (log CFU)

This number means that the process is capable of killing log 2.48 *E. coli*. Because this is a greater number than the log 2.0 number on the incoming raw meat, (see *Checking Meat Quality* (page 10)), then this is an acceptable process.

Step 8. If the result is a number less than log 2.0 or other value based on test results from your meat supplier, the process lethality is too low to comply with the Standard, and you will need to change it.

This can be done by:
- fermenting at a higher temperature (provided the starter culture can cope); and/or
- drying at a higher temperature or for a longer time.

What if there is a problem?

If product does not reach the log 2.0 (or other value based on test results from your meat supplier) then the drying time or temperature may need to be extended.

Use the *Tom Ross Model* to help calculate effective fermentation and drying times and temperatures.

Write it down

Print the page from the *Tom Ross Model* with the times and temperatures taken for the batch and log result.

Label it with the batch type and number and file with the matching Batch Record Sheet (page 32).

! Validate this step

Fermentation and drying (including smoking) at ambient temperature means that validation must be undertaken using:
- the worst-case temperatures and time to achieve inactivation; or
- the time and temperatures of the product can be entered into the inactivation model every time the product is made and the process adjusted (e.g. extending the drying time) to ensure the required inactivation is met.

"Quick" Model

If you do not have a temperature controlled room or cabinet, you can enter the ambient temperatures into the "Quick" model.

If you use the "Quick" model, the product must be at the fermentation temperature before timing starts.

Enter the ambient temperature and total time for your fermentation and maturation process, and the expected inactivation log kill of *E. coli* will be calculated.

Calibration and Sampling:

Thermometer Calibration Procedure and Record

Checking the thermometer

This should be done at least every three months to ensure the thermometer is working correctly (that is, providing accurate readings). Thermometers for measuring temperatures of fermenting / smoking / drying rooms or cabinets should be calibrated against a reference thermometer

Ice point check

This check is to be done if the thermometer is used for checking cold foods and equipment.

1) Scrape some ice from the inside of your freezer into a glass (half filled).
2) Add a small amount of water (until it is visible at the bottom of the glass).
3) Insert the thermometer into the mixture, leave until the temperature display is steady.
4) Do not let the thermometer touch the sides or bottom of the glass.

The readings in iced water should be between –1°C to +1°C, if outside this range, the thermometer should be replaced or returned to the supplier to be recalibrated.

5) Record the result in the table below. If the result is outside this range, write down the action taken in the table.

Thermometer calibration record

Thermometer	Date	Reading in iced water	Checked by	Corrective action taken
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		
		°C		

Calibration and Sampling: pH Meter Use and Calibration Procedures

pH meter calibration

This should be done before each day's use or as recommended by the manufacturer.

Before using a pH meter, it needs to be calibrated. The manufacturer will provide information about the way this is done for your model of pH meter.

1. Temperature correction. Some models will measure temperature by itself; others need the temperature to be measured separately by other means and then enter using dials or buttons.

2. Buffering. Rinse the electrode with distilled water before immersing it into new pH 7.00 buffer solution. Take care to not hit the bottom of the beaker with the electrode. Wait for the reading to stabilise.

3. Neutral calibrating. Modern pH meter models in calibration mode can recognise the buffer automatically and recalibrate themselves

4. Acid calibration. Rinse the electrode and move it to the second buffer of pH 4.00. pH meter will act by itself to recalibrate automatically.

Consult the instruction manual to be sure how to proceed and how to maintain the electrode.

1. Direct measurement using direct-contact (or spear probes) into UCFM casing / stick

1) Calibrate pH meter
2) Carefully sanitise probe with alcohol wipes.
3) Insert probe into casing / stick.
4) Wait for the reading to stabilise and record.
5) Re-sterilise probe with alcohol wipes after use and before next sample.

2. Measurement of a sample taken from a casing

1) Mince a representative portion of the UCFM stick from a batch.
2) Place in a clean stoppered bottle with twice its weight in water.
3) Stopper the bottle and shake at five-minute intervals for 30 minutes.
4) Calibrate pH meter.
5) Measure the pH of the liquid in the bottle at 20^{o}C. See above regarding temperature correction.

Purchase of buffers from reputable sources and ensure it is within shelf life.

Calibration and Sampling: pH Meter Calibration Record

pH meter:	Year:

Dates	pH buffer checked	Checked by	Corrective action taken

Calibration and Sampling: The Laboratory

Laboratory contract

1. You can contact MPI to identify an accredited laboratory in your area that is competent to do the testing required for your type of product.
2. Confirm that the laboratory will notify you immediately, by email or telephone, of the results of your testing.

Testing and test methods

1. Confirm that the laboratory is approved to test and has suitable test methods for *E. coli*, *Salmonella* and coagulase-positive *staphylococci* for UCFM product.
    - *E. coli* counts must be done by a method that has a detection limit of less than 3.6/g
2. Number of samples per batch:
    - Five random samples per batch from across the batch must be sampled and tested to meet the requirements of Standard 1.6.1 of the Food Standards Code. Confirm with the laboratory that this will happen.
    - Because microorganisms are not evenly spread throughout the product being tested, supplying only one sample means that the chance of finding contamination is reduced and a "not detected" result becomes meaningless and is not a true reflection of the safety of the product.
3. Composite testing versus individual sample testing:
    - Compositing must be done by the laboratory.
    - The five *Salmonella* samples per batch can be composited by the laboratory and tested as one (5 x 25 gm = 125 gm sample). Composting is allowed because testing for *Salmonella* is a "presence absence" test. No level of *Salmonella* is acceptable.
    - Five individual tests are required for *E. coli* and coagulase-positive *staphylococci* tests. Compositing is not acceptable because specific counts are required. Five samples are needed because microorganisms are not evenly spread throughout the product.
    - You can find the limits in schedule 27 of the Food Standards Code. Note that in the code -
        - n = number of samples examined from a lot of food;
        - c = maximum number of samples allowed to have results greater than 'm' but less than 'M';
        - m = microbiological limit that separates good quality from marginally acceptable quality;
        - M = microbiological limit above which sampling results are unacceptable.

Sampling and transport

1. Confirm how much product needs to be sampled to complete the tests.
2. Confirm that the laboratory can supply sterile sample bags, sampling instructions, sample storage instructions and sample submissions forms.
    - See also next procedure *Microbiological Sampling of UCFM Casings / Sticks* (page 30).
3. Confirm notification and transport requirements for your sample so that delivery and testing can be undertaken as soon as possible and the sample arrives in good condition.

Procedures and Records: Microbiological Sampling of UCFM Casings / Sticks

MPI has published fact sheets and a video to explain how to take sterile samples. See the MPI website http://www.foodsafety.govt.nz/science-risk/programmes/hazard-risk-management/listeria.htm

If you need more information on this, you could contact your laboratory or a food consultant.

Preparation

1. Get together the sampling equipment:
    - chopping board;
    - knife;
    - tongs or other utensils to pick up the sample;
    - sterile bags from the laboratory (preferred) or clean unused plastic bags;
    - alcohol wipes for sterilising surfaces and equipment or, alternatively, 70 percent alcohol (not methylated spirits) with gauze and tongs.
2. Label the bags with the batch code, date and product so that it is traceable to your batch records.
3. Wash and sanitise your hands.
4. Select samples – five casings / sticks from the same batch.
5. Wash and sanitise with alcohol wipes:
    - a work surface area (bench);
    - chopping board;
    - knife;
    - tongs or utensils.

Sampling procedure

1. Wash and sanitise your hands again, before taking samples – do not handle the samples.
2. Prepare the plastic bag and open.
3. Place first selected casing on sterile chopping board.
4. Cut off approximately 100 grams (or amount specified by the laboratory).
5. Remove casing carefully, using knife and tongs if possible.
6. Place the product sample carefully in the plastic bag, using the sterile tongs or utensils. Do not let the product touch anything else.
7. Seal plastic bag securely (in the way described by the laboratory or with ties or tape).
8. Clean and sanitise the knife, tongs, utensils and chopping board before cutting the next sample.
9. Repeat steps 1 to 8 for each sample.
10. Put sealed samples in rigid container (or container supplied by the laboratory) to protect them from damage.
11. Fill in the laboratory sample submission form, if supplied.
12. Store samples in a cool place (e.g. fridge, chilly bin)
13. Send samples to the laboratory within agreed time (e.g. 24 hours).

It is very important that you do not accidentally contaminate a sample – for example, by touching it or letting it touch an unsanitised surface. If the sample touches anything else then do not send it to the laboratory. Cut another piece or select another casing.

Procedures and Records: UCFM Supplier Records

You must know the *E. coli* count to the 98th percentile, either from your supplier or from NMD records for all meat used to make UCFM product. See *Sourcing Meat for UCFM* and *Checking Meat Quality* (pages 9 and 10). Suppliers that do this are as written below. If necessary attach supporting information.

Slaughter

Supplier business name:

Risk Management Programme for slaughter and dressing of meat.
Registration number:

Contact person:

Phone:

Fax:

Address:

Lead time for placing an order
(e.g., Mon for Wed)

Delivery day(s)

Mon Tue Wed Thu Fri Sat Sun

Goods supplied

Comments

Other meat supplier

Supplier business name:

☐ Registered Risk Management Programme

☐ Approved Food Control Plan

NMD plant reference
Import microbiological standard reference

Contact person:

Phone:

Fax:

Address:

Lead time for placing an order
(e.g., Mon for Wed)

Delivery day(s)

Mon Tue Wed Thu Fri Sat Sun

Goods supplied

Comments

Procedures and Records: Batch Record Sheet

Product:	Batch ID:	Date and time batch mixed:

Weight and volume of ingredients			
Meat		Starter culture	
Fat		Herbs and spices	
Nitrite – premix or pure		Other (e.g. alcohol)	
Salt		Amount of reworked compliant product	
Sugar			
Date and time mixed product placed in chiller		Chiller temperature reading	
Date and time casings / sticks filled		Product temperature	

Weight loss (a_w) Validated weight loss and water activity criteria For casing size……Weight loss ……% = …… a_w

For casing size……Weight loss ……% = …… a_w

Casing	Casing size	Weight when filled	Weight when dry	Weight loss	Weight loss (%)	Meets criteria ✓/ ×
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Fermentation	Validated criteria ……°C for ……hours	Final pH ……

Date	Time	Product temperature	Room temperature	pH	Relative humidity (%)
Start					
Finish					

Smoking	Validated criteria ……°C for ……hours		
Date	Time	Product temperature	Smoker temperature
Start			
Finish			

Maturation / drying	Validated criteria ……°C for ……hours	Air velocity ……

Date	Time	Product temperature	Room temperature	Relative humidity (%)
Start				
Finish				

a_w confirmation – reweigh dried sticks	Enter weights and calculate loss in table	Meets criteria / Does not meet criteria
Final product pH check		Meets criteria / Does Not meet criteria

Corrective actions and other comments noted during the process	
Samples sent to lab as required (five per batch)	Yes/No
Confirmation that lab results have been received	Signature and date
Confirmation that product conforms to the validation process	Signature and date

Procedures and Records: Validation Summary Sheet / Establishment of Processing Criteria Record

Product	Casing size	*Tom Ross Model* (advanced / basic)	98th Percentile *E. coli*	Required *E. coli* log reduction	Fermentation			Smoking			Drying			Moisture loss (%)	Water activity (< 0.95)	pH (< 5.2)	Nitrite (< 500)
					Time (hours)	Air temp min/ max (°C)	Product Temp (°C)	Time (hours)	Air temp min/ max (°C)	Product Temp (°C)	Time (days)	Air temp min / max (°C)	Product Temp (°C)				
Example, Venison	*80mm*	*Advanced*	*National NMD*	*2.0*	*48*	*18/22*	*25*	*36*	*30/36*	*25*	*21*	*20/25*	*25*	*25*	*0.92*	*5.1*	*235*

Procedures and Records: Cleaning Schedule

Item and Areas to be Cleaned	Frequency of cleaning [✓]					Method of Cleaning (including manufacturer's instructions for chemical use)	Who is responsible
	After use	Every Shift	Daily	Weekly	Other		