Ministry for Primary Industries
Manatū Ahu Matua

Food Notice

Requirements for Food Control Plans and National Programmes

- Self-supply water
- Significant amendments to food control plans
- Requirements for preparing and manufacturing low acid canned foods
- Processing and handling requirements for national programme operators

24 April 2023

Issued under the Food Act 2014

New Zealand Government

TITLE

Food Notice: Requirements for Food Control Plans and National Programmes

COMMENCEMENT

This Food Notice comes into force on 30 June 2023

AMENDMENT AND CONSOLIDATION

This Food Notice revokes and replaces the Food Notice: Requirements for Food Control Plans and National Programmes, issued on 25 May 2017.

ISSUING AUTHORITY

This Food Notice is issued under section 405 of the Food Act 2014, for the purposes of sections 39 and 44 of that Act.

Dated at Wellington, 24 April 2023

[Signed and dated]

Paul Dansted
Director Food Regulation
New Zealand Food Safety
Ministry for Primary Industries
(acting under delegated authority of the Director-General)

Contact for further information
Ministry for Primary Industries (MPI)
New Zealand Food Safety
Food Regulation
PO Box 2526
Wellington 6140

Email: foodactinfo@mpi.govt.nz

Contents

Introduction

This introduction is not part of the notice but is intended to indicate its general effect.

Purpose

This Notice sets requirements for businesses required to operate under a food control plan or national programme, and supplements the Food Regulations 2015 (the Regulations) to ensure the safety and suitability of food.

Background

The Food Act 2014 (the Act) sets requirements to achieve the safety and suitability of food for sale, maintain and improve confidence in New Zealand's food safety regime and provide for risk-based measures that minimise and manage risks to public health.

The Act applies to all food business operators trading in food. Most businesses are required to operate under a food control plan or a national programme (levels 1, 2 or 3).

The Regulations set requirements for safety standards for food made under a food control plan or national programme.

Who should read this Notice?

The following persons should read this Notice:

- Operators of food businesses operating under a food control plan or a national programme;
- Territorial Authorities;
- verifiers;
- evaluators of food control plans.

Why is this important?

Operators of food businesses are responsible for keeping food safe and suitable, and meeting the requirements set by the Act, Regulations and relevant Food Notices.

A person who does not comply with the requirements of this Notice may commit an offence under the Act.

Document History

Version Date	Section Changes	Change(s) Description
25 May 2017	N/A	New Food Notice
21 December 2022	Introduction, Parts 1, 2, 3,4 and Schedule 1	• Removed application clause from Part 1 and added individual application clauses to each part • Removed definition of clean water from clause 1.1 and introduced reference to the Water Services Act 2021 • Removed Clause 1.3 and 1.4 • Changed Part 2: – minimum contact time of chlorine changed in 2.3 (1)

Version Date	Section Changes	Change(s) Description
		– added guidance to 2.1 and changed the wording in this section – added bullets a) b) and c) to 2.3 (1) and changed the guidance to reference the Water Services Act 2021 – separated out the options in 2.3 (4) – added in b), c) and d) bullets to 2.3(5) – removed guidance in 2.3 (6) • Changed Clause 3.1: - added i) and ii) to (1)a) - (1)b) changed to (1)c) and added in reference to change to key staff in (1)c)ii) - removed (1)d) • Removed Clause 3.2.2 • Changed Clause 4.1.5 (2)ii) from 20°C to 21°C • Changed name of Schedule 1

Other information

Businesses operating under the Act may also be subject to other relevant requirements under the:

- Animal Products Act 1999, and the relevant Animal Products Act Notices; and
- Wine Act 2003, and the relevant supplementary Notices.

Part 1: Preliminary

1.1 Definitions

(1) In this Notice:

finished food product means a food, whether packaged or not, in the form in which it is intended to be sold

ISO/IEC 17025 means the international standard AS/NZS ISO/IEC 17025:2005 - General Requirements for the Competence of Testing and Calibration Laboratories as amended from time to time

low acid canned food means any food other than an alcoholic beverage that:

a) has both a pH value greater than 4.6 and less than 7.0 after heat processing and a water activity greater than 0.85; and
b) is processed by heat to ensure preservation, whether before or after being sealed in a container

MPI means the Ministry for Primary Industries which is the Ministry responsible for administering the Food Act 2014

operator means the operator of a food business

potentially hazardous food means:

a) food that meets one of the following criteria:
    i) the food may contain and will support the growth of harmful microbes; or
    ii) food that must be kept under temperature control to prevent toxins forming due to microbial growth; or
b) food that meets one of the criteria in (a) as a result of it being modified or altered or exposed to air (example: dry custard powder is not potentially hazardous, but becomes potentially hazardous when mixed with milk or water, a can of beef stew is not potentially hazardous, but becomes potentially hazardous after opening, etc.)

ready-to-eat food means food that can be eaten in the form in which it is sold and that it does not require further preparation, such as washing or rinsing, by the consumer before consumption

Registered drinking water supply means a supply of drinking water registered in accordance with the Water Services Act 2021

Regulations means the Food Regulations 2015

scope of the plan includes (without limitation):

a) the type of food to which it applies; and
b) the nature of the food business or businesses covered by the plan; and
c) the trading operations under the plan

self-supply water means water obtained directly by the operator from sources such as bore water, rainwater, surface water, or ground water.

thermal processing means applying the combination of temperature and time required to eliminate a desired number of microorganisms from a food product; and thermally processed has a corresponding meaning

(2) All terms used in this Part of this Notice and that are defined in the Food Act 2014 (the Act) or Food Regulations 2015, but not defined in this Part of this Notice, have the same meaning as in that Act or Regulations.

Part 2: Requirements for using water at places used to make and sell food

(1) Part 2 of this Notice applies to operators of registered food control plans and operators subject to a national programme who use water for the purpose of processing and handling of food.

2.1 Requirements for water used in the processing and handling of food

(1) An operator must use either:

a) water from a registered drinking water supply; or
b) self-supply water that meets the requirements of clause 2.3.

Guidance

- The Water Services Act 2021 sets out the requirements of a registered drinking water supply. This may include, for example, a Council's town water supply.

2.2 Design and installation of water systems

(1) An operator must ensure that:

a) the system for carrying water through the place of food business is designed, installed and operated to prevent:

i) dead ends (where water does not circulate but remains static), unused pipes and back flow; and
ii) contamination of water; and

b) hot water is available, where necessary, to facilitate cleaning and personal hygiene.

2.3 Requirements for operators using self-supply water

(1) An operator using self-supply water must ensure that the water does not exceed the criteria specified for each test in Table 1 Testing Requirements for Self-supply Water below when using it for:

a) adding to or use as, food;
b) personal hygiene; and
c) cleaning of surfaces

Table 1: Testing requirements for self-supply water

Test	Criteria
E. coli	Less than 1 in any 100ml sample
Turbidity	Must not exceed 5 Nephelometric Turbidity Units (NTU)
Chlorine (when chlorinated)	Minimum of 0.2 mg/l (ppm) free available chlorine with a minimum of 30 minutes contact time
pH (when chlorinated)	6.5 – 8.0

Guidance

- For more information refer to the 'Water Services (Drinking Water Standards for New Zealand) Regulations 2022'.

(2) An operator must determine whether it is reasonably likely that there are chemical hazards in the water supply. The operator must identify and control these hazards to ensure the safety and suitability of the water.

(3) An operator must carry out tests to determine that self-supply water meets the criteria in Table 1 Testing Requirements for Self-supply Water, at the point of use, when making:

a) an initial assessment when there is no record of the quality of the self-supply water; or
b) a re-assessment:

i) whenever an operator obtains water from a new source; and
ii) as soon as practicable, and not later than 1 week of carrying on business operations, after the operator becomes aware of a change to the environment or activities in or around a water source that may affect the safety and suitability of water from that source.

(4) Tests for *E. coli* must be:

a) performed at a laboratory accredited in accordance with:

i) ISO/IEC 17025 *General Requirements for the competence of testing and calibration laboratories*, or
ii) IANZ Level 2 Criteria to perform tests on drinking water supplies, or

b) approved by the Chief Executive under section 291 of the Act.

(5) If at any time self-supply water does not meet the requirements of Table 1 Testing Requirements for Self-supply Water above, the operator must:

a) stop using that self-supply water for the activities set out in clause 2.3(1);
b) assess whether any food or food contact surfaces may have become directly or indirectly contaminated by that self-supply water;
c) take appropriate remedial action where contamination may have occurred; and
d) not use that self-supply water for the activities set out in 2.3(1) until the self-supply water meets the requirements of Table 1 Testing Requirements for Self-supply Water above.

(6) An operator must keep a record of:

a) the test results of self-supply water; and
b) the action(s) taken when any test result did not meet the criteria set out in Table 1 Testing Requirements for Self-supply Water, including:
i) to restore water so it meets the criteria;
ii) in relation to any food or food contact surfaces that may have become contaminated from that water or as a result of persons having contact with that water.

Part 3: Requirements for businesses operating under a food control plan

3.1 What constitutes a significant amendment to a food control plan

(1) The following amendments to a food control plan must be treated as 'significant amendments' for the purposes of sections 45 and 46 of the Act:

a) an amendment to the physical address or location of the food business identified in the plan or, in the case of mobile premises, the nominated home base identified in the plan, including:

i) changing from a single-site plan to a multi-site plan; or
ii) adding or relocating to a new place of food business (except where this is already permitted for mobile businesses);

b) any change to the scope of the plan or the procedures identified in the plan that may have an effect on the safety and suitability of food traded under that plan including (without limitation) the hazards and other factors that are reasonably likely to occur or arise; and

c) any other changes that introduce new risk factors or that have an adverse effect on existing risk factors, including:

i) major alterations to facilities or equipment; or
ii) changes to the nature of the business or key staff as a result of the merger of two or more food businesses or the reorganisation of one or more food business.

(2) Clause 3.1(1)(b) does not include changes made to the scope of the plan by introducing a type of food or a procedure, or by changing the type of food or a procedure identified in the plan where:

a) the following requirements are met:

i) the change results in a type of food or procedure that is similar to an existing type of food or procedure identified in the plan; and
ii) the operator has carried out, and documented, an assessment of the hazards and other factors that are reasonably likely to result from the change; and
iii) that assessment indicates that there is no significant impact on the safety and suitability of food traded under the plan; or

b) in the case of a food control plan based on a template issued under section 39 or section 40 of the Act, the new type of food or procedure is covered by another component of the template that can be added to the plan.

Guidance

Under sections 45 and 46 of the Act:

- If a significant amendment is made to the food control plan, the operator must apply to the appropriate registration authority to register the amended food control plan.
- If an amendment is made to the food control plan and it is not a significant amendment, the operator must notify the appropriate registration authority of the amendment but does not have to apply to register the amended plan.
- If a significant amendment is made to a custom food control plan, the registration authority may require the amended food control plan to be evaluated (including an on-site evaluation) before registering the plan.

3.2 Requirements for preparing or manufacturing low acid canned foods

3.2.1 FCP operators that prepare or manufacturer low acid canned foods

(1) Clauses 3.2.1(2) – (4) apply to an operator that prepares or manufactures low acid canned foods and who operates under a registered food control plan.

(2) An operator's food control plan must specify that any persons responsible for the day-to-day supervision of thermal processing operations for the thermal processing of low acid canned food must meet at least one of the following competency requirements:

a) Principles of Thermal Process Control, Acidification and Container Closure Evaluation, Massey University, New Zealand;
b) Retort Supervisors Certification Course, DWC FoodTech Pty Ltd, Australia; or
c) New Zealand Retort Supervisors and Process Control School, Food Processing Specialists Pty Ltd, Australia; or
d) any other course that the Chief Executive accepts as equivalent to any one of the courses specified in clauses 3.2.1(2)a) - c).

(3) The thermal processes for low acid canned food specified in an operator's food control plan must be in accordance with the principles detailed in the current edition of the following Codes of Practice:

a) Code of Hygienic Practice for Low and Acidified Low Acid Canned Foods as published by the Codex Alimentarius Commission (CAC/RCP 23-1979); and
b) The United States Food and Drug Administration Requirements for Thermally Processed Low-acid foods Packaged in Hermetically Sealed Containers as contained in 21 CFR Part 113, and Acidified Foods as contained in 21 CFR Part 114.

(4) An operator must ensure that thermal processes for low-acid canned food are developed by, or under the supervision of, a qualified person who meets at least one of the following competency specifications, as appropriate to the nature of the operation:

a) Qualified Cannery Persons (Thermal Processing) Course, Western Sydney University (Hawkesbury), Australia;
b) Approved Persons Course for thermally processed low-acid foods, DWC FoodTech Pty Ltd and CSIRO, Australia;
c) Approved Persons Course for UHT Processing and Aseptic and Packaging, DWC FoodTech Pty Ltd, Australia; or
d) Introduction to the Fundamentals of Thermal Process Evaluation, Massey University, Palmerston North, New Zealand; or
e) any other course that the Chief Executive accepts as equivalent to any one of the courses specified in clauses 3.2.1(4)a) – d).

Part 4: Requirements for national programme businesses

4.1 Receiving, storing or displaying, preparing, or transporting potentially hazardous food

(1) Part 4 of this Notice applies to operators subject to national programmes. Specifically:

a) clause 4.1 applies to operators that are subject to national programmes and that receive, store or display, prepare or transport potentially hazardous food, including operators of vending machines that contain and supply potentially hazardous food;
b) clause 4.1.4 only applies to food businesses providing food service to pre-school children (including children under 5 years of age) in a centre-based service setting operating under a national programme level 2;
c) clause 4.2 applies to operators of food businesses who operate under national programmes and who carry out pasteurisation, acidification or fermentation, concentration or drying; or
d) clause 4.3 applies to all operators of food businesses who carry out cold plasma processing, electromagnetic processing; high pressure processing, hydrodynamic processing, or ultrasonification.

4.1.1 Receiving food

(1) When potentially hazardous food is received by a food business, the operator must ensure all of the following:

a) packaging is free from damage and the food is not visibly contaminated;
b) the food is not past its use-by date; and
c) frozen food is frozen solid.

(2) The operator must not use or sell potentially hazardous food unless when the operator receives the food it is at a temperature:

a) of or below 5°C; or
b) above 60°C; or
c) specified by the manufacturer or supplier of the food.

(3) The operator must keep a record of occasions when food has not been accepted because it is not at the required temperature.

4.1.2 Storage and display of potentially hazardous food

(1) The operator must ensure that potentially hazardous food is stored or displayed in a way that maintains it in the state specified in clause 4.1.1(1)(c) or at one of the temperatures specified in clause 4.1.1(2)(a) – (c).

(2) Potentially hazardous food that has been stored or displayed at temperatures between 5°C and 60°C for a total of more than 4 hours must not be sold, or used in the processing of food, for human consumption.

(3) If potentially hazardous food has been stored or displayed at temperatures between 5°C and 60°C for a total 4 hours or less the operator must comply with the requirements in column 2 of the following table during the time period specified in column 1 of that table:

Table 2: Time limits and action when potentially hazardous food is in the temperature danger

Total time potentially hazardous food stored or displayed between 5°C and 60°C	What must be done
Less than 2 hours	Refrigerate, use, sell or dispose
Between 2 and 4 hours	Use, sell or dispose

(5) This clause 4.1.2 does not apply to freshly cooked potentially hazardous food.

Guidance

- The requirements for dealing with freshly cooked potentially hazardous foods are set in clause 4.1.5.

4.1.3 Vending machines

(1) The operator must ensure that all potentially hazardous food that is to be dispensed from a vending machine is:

a) not able to be dispensed after its use-by date; and
b) delivered to the vending machine, and stored within the vending machine, at a temperature:

i) of or below 5°C or of not less than 60°C; or
ii) at a temperature specified by the manufacturer or supplier of the food.

4.1.4 Cooking and food processing

(1) This clause only applies to food businesses providing food service to pre-school children (including children under 5 years of age) in a centre-based service setting operating under a national programme level 2.

(2) When processing and handling potentially hazardous food, the operator must ensure that:

a) food preparation surfaces are clean and, where necessary, sanitised before use; and
b) contamination of ready-to-eat and cooked foods is prevented by:

i) using different food contact surfaces and utensils for preparing raw, and ready-to-eat foods or cooked foods; or
ii) food contact surfaces and utensils used for preparing both raw, and ready-to-eat foods or cooked foods being thoroughly washed and then sanitised between use; and

c) when cooking potentially hazardous food, that the food is thoroughly cooked.

(3) For poultry, poultry products and liver to be thoroughly cooked as required in clause 4.1.4(2)(c) they must be cooked either:

a) for the time and at the temperature specified by the manufacturer or supplier; or
b) the internal temperature of the poultry, poultry product or liver in all parts must meet one of the following time and temperature combinations:

Table 3: Cooking poultry, poultry products, liver and processed meat: time-temperature combinations

Internal Temperature	Minimum Time to maintain internal temperature
65°C	15 minutes
70°C	3 minutes
75°C	30 seconds

Guidance

- It is unnecessary to temperature probe diced or thinly sliced poultry (such as in a stir-fry). This is because smaller pieces are more likely to cook through to the middle more easily and it is difficult to get a representative reading.

(4) For products made of minced or ground meat, such as meat patties or sausages, to be thoroughly cooked as required in clause 4.1.4(2)(c):

a) the meat must reach an internal temperature in accordance with the table in clause 4.1.4(3)b); or
b) the meat must reach a temperature in all parts for a time specified by the manufacturer or supplier.

(5) The operator must keep a record of the cooking temperatures and times achieved when cooking poultry. The record must state all of the following:

a) the product;
b) the date cooked;
c) the temperature the product was cooked to and the time held at this temperature;
d) if the product is not thoroughly cooked as required by this Notice, why it happened and what was done with the food.

4.1.5 Handling freshly cooked potentially hazardous food

(1) Once cooked, potentially hazardous food must be:

a) used or sold immediately; or
b) held at or above 60°C; or
c) cooled in accordance with clause 4.1.5(2).

(2) When cooling freshly cooked potentially hazardous food, the operator must:

a) protect the food from contamination; and
b) cool the food in accordance with the following requirements:

i) from 60°C to 21°C within 2 hours; and
ii) from 21°C to 5°C within another 4 hours.

Guidance

- If the operator wants to use an alternative to the method in clause 4.1.5(2), the operator must elect to operate under a food control plan. This allows the operator to choose how to manage the risks associated with cooling potentially hazardous food and have that process evaluated as part of registering the food control plan.

(3) If freshly cooked potentially hazardous food which is being cooled has been at more than 5°C and less than 60°C for more than 6 hours the operator must ensure that it is not sold, or used for processing, for the purposes of human consumption.

(4) The operator must keep a record of the time it took for freshly cooked potentially hazardous food to meet the temperatures specified in clause 4.1.5(2). The record must state all of the following:

a) the food;
b) the date the food is cooled; and
c) the time that it took to cool the food to the temperatures identified in clause 4.1.5(2) above.

4.1.6 Reheating potentially hazardous food

(1) When reheating potentially hazardous food that has been cooked and cooled, the operator must ensure that the temperature reaches a temperature of at least 75°C in all parts and it is then dealt with in accordance with clause 4.1.2 Storage and display of potentially hazardous food.

Guidance

- If the operator wants to use an alternative to the method in clause 4.1.6 Reheating Potentially Fazardous Food of this Notice, the operator must elect to operate under a food control plan. This allows the operator to choose how to manage the risks associated with cooling potentially hazardous food and have that process evaluated as part of registering the food control plan.

4.1.7 Transporting potentially hazardous food

(1) When potentially hazardous food is transported, it must be transported under conditions that ensure that:

a) it is delivered at a temperature of below 5°C or at a temperature of above 60°C; or
b) it remains frozen if intended to be delivered frozen.

(2) Irrespective of clause 4.1.7(1), if potentially hazardous food is going to be used or eaten within 4 hours of being under temperature control it may be transported and delivered at a temperature of between 5°C and 60°C.

4.2 Requirements for national programme businesses carrying out specified processes

(1) An operator who carries out a process specified in column 1 and described in column 2, must ensure that the relevant criteria and requirements in column 3 are met:

Table 4: Specified processes

Column 1	**Column 2**	**Column 3**
Process	**Description of the process**	**Criteria and requirements**
Pasteurisation	A partial-cooking process used for the primary purpose of killing harmful micro-organisms by using specific temperature/time combinations that compromise the desirable characteristics of the food to the least possible extent	(1) The finished food product must have been heated throughout to ensure that all parts of it have been heated: a) to a temperature of not less than 75°C for 15 seconds; or b) to a temperature of not less than 72°C for 60 seconds; or c) to a temperature of not less than 71°C for 2 minutes; or d) to a temperature of not less than 69°C for 5 minutes; or e) in accordance with a temperature/time combination for pasteurisation approved by the Chief Executive in clause 4.2(2).
Acidification or fermentation (other than for the purpose of enhancing flavour, or in relation to an alcoholic beverage or leavening)	**acidification** means a process used for the purpose of controlling harmful micro-organisms by increasing the acidity in a food by adding a substance to lower the pH of the food	(1) The finished food product must have: a) a pH throughout that must have stabilised at 3.6 or less; or b) both: i) a pH throughout that must have stabilised at between 3.6 and 4.6; and

Column 1	Column 2	Column 3
Process	**Description of the process**	**Criteria and requirements**
	fermentation means a process that increases acidity in a food through a biological action to lower the pH of the food	ii) the product must have been subject to a pasteurisation process, or a thorough cooking process.
Concentration or drying	**concentration** means a process used for the purpose of controlling harmful micro-organisms by lowering the amount of unbound water in food to reduce water activity **drying** – means an evaporative process used for the purpose of controlling harmful micro-organisms by lowering the amount of unbound water in food to reduce water activity	(1) The water activity throughout the finished food product must be less than 0.85 (0.85a_w.)
Thorough cooking process	A process used for the purpose of killing harmful micro-organisms that would survive pasteurisation, by using specific temperature/time combinations	(1) The finished food product must have been heated throughout to ensure that all parts of it have been heated: a) to a temperature of not less than 75°C for 30 seconds; or b) to a temperature of not less than 73°C for 60 seconds; or c) to a temperature of not less than 70°C for 3 minutes; or d) to a temperature of not less than 68°C for 5 minutes; or e) to a temperature of not less than 65°C for 15 minutes; or f) to a temperature of not less than 63°C for 31 minutes; or g) in accordance with a temperature/time combination for a thorough cooking process approved by the chief executive in clause 4.2(2).

(2) The Chief Executive may approve an alternative temperature/time combination for pasteurisation or a thorough cooking process, if satisfied that it achieves an equivalent level of food safety to those listed in the Table to clause 4.2(1).

Guidance

- The Regulations:
  - require operators to have procedures that identify where it is essential to prevent or eliminate a hazard, or reduce it to an acceptable level; and
  - set out the criteria that must be met to do this; and
  - set out the reason for each criterion.

- Table 4 Specified Processes sets out criteria and requirements for operators using specified processes to make food safe under a national programme. The operator may use any processing method, provided the criteria in column 3 of Table 4, are met. MPI also provides a list of equivalent thermal processing criteria for pasteurising at www.mpi.govt.nz. Note: an operator who wants to make commercially sterilised canned, bottled, or aseptically packaged food products will need a food control plan.
- If an operator wants to use alternative criteria to those described for a process in column 3 of Table 4, the operator may elect to operate under a registered food control plan. This allows the operator to choose how to manage the risks associated with the process and have that process evaluated as part of registering the food control plan.
- For example, the manufacturer of a fermented kombucha drink decides to market a product with a pH of 4.2. The operator may either:
  - keep the pH at 4.2 and pasteurise or thoroughly cook the product; or
  - modify their process to lower the pH of the finished product to 3.6 or below; or
  - elect to operate under a food control plan and show how they make a safe product using their own criteria.

4.3 Other processes

(1) An operator must not, for the purpose of controlling microbiological hazards to ensure the safety of a food, carry out a process, under a national programme, listed in the Table Other Processes Not Allowed Under a National Programme in Schedule 1.

Guidance

- An operator who wishes to carry out the restricted processes in Schedule 1 may elect to do so by operating under a registered food control plan.
- Electing to operate under a registered food control plan allows the operator to explain how they will identify and manage the risks associated with the process and have that process evaluated as part of the registration process.

Schedule 1: Other processes not allowed under a National Programme

Other process	Definition
Cold plasma processing	A process that uses partially ionised cold gasses to disinfect surfaces, food and packaging.
Electromagnetic (pulsed electric field, radio frequency, ultraviolet processing etc.) processing	A process that uses non-convective non-ionising radiation sources to specifically inactivate microorganisms.
High pressure processing	A technique by which food products are subjected to a high level of isostatic pressure transmitted by water to inactivate pathogenic microorganisms.
Hydrodynamic processing	A process that uses hydrodynamic cavitation to inactivate microorganisms.
Ultrasonification	A process that uses high intensity soundwaves (ultrasound) alone, or in conjunction with thermal processing, to inactivate microorganisms.