

Appendix 1

The use of time as a control for potentially hazardous food

A food business is required to maintain the temperature of potentially hazardous food either at or below 5°C or at or above 60°C during transport, storage and display unless the food business can demonstrate that maintaining food at another temperature for a specific length of time will not adversely affect the microbiological safety of the food.

Clause 25 of Standard 3.2.2 specifies ways in which a food business can demonstrate the safety of its alternative temperature system, see page 116. This appendix provides advice, based on documented sound scientific evidence, on the use of time to control the growth of food-borne pathogens in potentially hazardous food.

It is safe for potentially hazardous food to be between 5°C and 60°C for a limited time because food-borne pathogens need time to grow to unsafe levels.

The maximum time a potentially hazardous food can be safely at temperatures between 5°C and 60°C will depend on the temperature of the food. Food poisoning bacteria grow at the fastest rate at temperatures around 40°C. Hence if the food is at 40°C, the time that the food can be safely at this temperature is much less than if it is at 20°C. Advice is provided below on the maximum time that potentially hazardous food can be outside temperature control, based on a worst-case scenario.

As a general rule, the **total time** that a ready-to-eat potentially hazardous food can be at temperatures between 5°C and 60°C is 4 hours. This is the limit specified within the US Food Code and the UK Food Safety (Temperature Control) Regulations 1995. The 4-hour limit is based on a worst-case scenario. After this time the food must be discarded. The total time is the sum of the time the food is at temperatures between 5°C and 60°C after it has been cooked or otherwise processed to make it safe. For example, if raw meat is cooked, count the time the food is at temperatures between 5°C and 60°C after it is cooked. The cooked food may have been at temperatures between 5°C and 60°C when it was transported, prepared and served.

If the food is to be re-refrigerated, the total time a food can be at room temperature and then be safely put back in the refrigerator to use later is 2 hours. This 2-hour limit is based on advice provided in the UK's guidance notes on its Temperature Control Regulations. This advice states that 'in normal circumstances, a single limited period of up to 2 hours outside temperature control is unlikely to be questioned'.

The '4-hour/2-hour rule' is summarised below.

Any ready-to-eat potentially hazardous food, if it has been at temperatures between 5°C and 60°C:

- for a total of less than 2 hours, must be refrigerated or used immediately;
- for a total of longer than 2 hours but less than 4 hours, must be used immediately; or
- for a total of 4 hours or longer, must be thrown out.

If a food business wishes to maintain potentially hazardous food between the temperatures of 5°C and 60°C for time periods longer than the 2 hours and 4 hours specified above, it will need to be able to demonstrate that the extension in time will not compromise the safety of the food. For example, if a potentially hazardous food will be stored at a maximum temperature of 15°C, it will be able to be safely kept at this temperature for longer than 4 hours. However, food businesses will need to be able to justify this extension on the basis of sound scientific evidence, as the amount of time that is safe will vary depending on the type of food and the pathogens of concern.

Use of time as a control for potentially hazardous food that has been cooked and cooled

Food businesses may still utilise the '4-hour/2-hour rule' for potentially hazardous food that has been cooked and cooled, provided the business can demonstrate that the food was cooled in accordance with subclause 7(3) of Standard 3.2.2. If potentially hazardous food has not been cooled safely, it may not be safe for this food to be outside temperature control. If the food is cooled safely, pathogens that survive the cooking process will not be able to multiply during the cooling process and when this food is removed from refrigeration it will still take over 4 hours for the pathogens to multiply to dangerous levels.

A food business cooks and cools chickens for use in sandwiches. It then displays these sandwiches at ambient temperature over the busy luncheon period. In order to demonstrate that this practice is safe, the business:

Example

- establishes and documents a cooling process for the chickens that ensures the cooling temperatures and times specified in Standard 3.2.2 subclause 7(3) are complied with;
- records the time when the cooled chicken is removed from refrigeration; and
- records the time at which the chicken sandwiches must be discarded (this is 4 hours from the time the chickens are removed from refrigeration).

Food that has been cooked or otherwise processed for safety by another business

If a food business wishes to utilise the '4-hour/2-hour rule' for potentially hazardous food it has not itself cooked or otherwise processed to ensure its safety, the business will need to know the temperature history of the food. The business will need to know whether, following the cooking or other process step, the food has spent any time at a temperature between 5°C and 60°C. If any of the available time has been 'used up' before the business receives the food, this time must be counted. If the business does not know the temperature history of the food and is not able to obtain this information, it cannot make use of time to control the growth of food-borne pathogens and must keep the food at or below 5°C or at or above 60°C.

Example

A food business purchases precooked and chilled chicken. It uses this chicken in sandwiches that will be displayed at ambient temperature over the busy luncheon period. In order to demonstrate this practice is safe, the business receives, in writing, from the business that cooks and chills the chicken, advice that the purchased chicken is cooled in accordance with Standard 3.2.2 subclause 7(3), and spends less than 30 minutes between 5°C and 60°C from the time it is removed from refrigeration until the time it is delivered to the business. The business then demonstrates that this chicken spends less than 3½ hours outside temperature control before it is sold.

Appendix 3

Cooling of meats after cooking — Report by Campden & Chorleywood Food Research Association

The Department of Health, London, funded the Campden & Chorleywood Food Research Association to identify safe rates of cooling for meat products, which because of their size and shape are inherently slow to cool. The findings of this work are reported in the document outlined below.

Gaze JE, Shaw R & Archer J, *Identification and Prevention of Hazards Associated with Slow Cooling of Hams and Other Large Cooked Meats and Meat Products*, Review no. 8, Project no. 16286, Campden & Chorleywood Food Research Association, 1998.

This document can be purchased from:

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The document makes the following recommendations for cooling cured and uncured cooked meats.

Uncured products

For a typical uncured cooked meat product, made from good quality raw material under hygienic conditions and with sound process controls, the document recommends the limitations set out in the table below for cooling time from completion of the cooking process.

| Temperatures | Good practice (time in hours to achieve temperature specified) | Maximum (time in hours to achieve temperature specified) |
|--------------------------|--|--|
| To 50°C | 1 | 2.5 |
| From 50°C to 12°C | 6 | 6 |
| From 12°C to 5°C | 1 | 1.5 |
| Total time to 5°C | 8 | 10 |

Cured products

For products which are cured (defined as minimum 2.5% salt on water phase and 100 ppm nitrite in-going), the document recommends the limitations set out in the table below for cooling time from completion of the cooking process.

| Temperatures | Good practice (time in hours to achieve temperature specified) | Maximum (time in hours to achieve temperature specified) |
|-------------------|--|--|
| To 50°C | 1.25 | 3.25 |
| From 50°C to 12°C | 7.5 | 7.5 |
| From 12°C to 5°C | 1.25 | 1.75 |
| Total time to 5°C | 10 | 12.5 |

Note that the document states that if the product may be expected to contain high levels of spores (for instance if significant levels of untreated herbs and spices are distributed throughout the product), the above cooling times may not be safe and advice should be sought.

Appendix 4

Cleaning and sanitising surfaces and utensils

This appendix includes information on cleaning and sanitising eating and drinking utensils and food contact surfaces. *This information is provided for guidance only and businesses are not legally obliged to clean and sanitise at the temperatures and times specified.*

Cleaning and sanitising are separate procedures, and sanitising is distinct from sterilising.

Cleaning in the food industry is a process that removes visible contamination such as food waste, dirt and grease from a surface. This process is usually achieved by the use of water and detergent. During the cleaning process, microorganisms will be removed but the cleaning process is not designed to destroy microorganisms.

Sanitising is a process that destroys microorganisms, thereby reducing the numbers of microorganisms present on a surface. This is usually achieved by the use of both heat and water, or by chemicals.

Sterilising is a process designed to destroy all microorganisms including microorganisms that have formed a protective coat — these protective coats are called spores. Eating and drinking utensils and food contact surfaces do not need to be sterilised.

Cleaning and sanitising should usually be done as separate processes. A surface needs to be thoroughly cleaned before it is sanitised as sanitisers are unlikely to be effective in the presence of food residues and detergents.

Cleaning

The thorough cleaning of eating and drinking utensils and food contact surfaces is a critical step before sanitising for the following reasons:

- any food residue or other soil left after the cleaning process will protect the bacteria from the sanitation step;
- any food residue or other soil left after the cleaning process will react with the sanitiser, making the sanitiser less effective against microorganisms;
- thorough cleaning will physically remove most of the microorganisms present — the US National Sanitation Foundation⁵ (NSF) reports that dishwashers can remove greater than 99.9% of the bacteria with the removal of food residue and other soil; and
- the heat used to clean is critical in contributing to the total heat needed to effectively sanitise (by heat) the utensil or food contact surface.

5 The National Sanitation Foundation is a United States organisation founded in 1944. It is an independent not-for-profit organisation whose principal functions include standards development and maintenance and third-party certification of products and equipment.

A food business must use a cleaning process that ensures the utensil or food contact surface looks clean, feels clean and smells clean. Thorough cleaning can be achieved by:

- pre-scraping the utensil or surface to remove most of the food residue present;
- using warm water (see comments below), detergent and agitation to remove food residue; and
- rinsing the detergent and food residue away.

The NSF has found that the temperature of the wash water is extremely significant in providing effective heat-sanitising as the heat accumulated by the utensil during the washing stage contributes to the total heat needed for sanitising. However, the water temperature needed to effectively clean a utensil or surface will depend on the type of food residue to be removed from the utensil or surface.

Warm to hot water will be needed for cleaning if grease is to be removed but the temperature should not be so hot that it impedes the cleaning process by baking food residue onto the surface. The NSF found that the best temperature for washing utensils in the food service industry was between 54°C and 60°C and that higher temperatures tended to bake food residue on (Mallman et al. 1947). Therefore, if hot water is used to sanitise the utensil or surface, the water temperature for cleaning should not be lower than 54°C to ensure that enough heat is accumulated during washing for effective sanitising to take place.

The detergent used should be appropriate for the task. Ordinary household detergents will usually suffice for manual washing in the food service industry but food manufacturers may need special detergents depending on the food residue to be removed. Mechanical dishwashers need to use detergents that are appropriate to the equipment.

Detergents containing sanitisers are not required. If such detergents are used, they are unlikely to be able to clean and sanitise a surface to the standard required. If they are used, a separate sanitising step is still likely to be needed. Advice on whether a detergent that contains a sanitiser can adequately clean and sanitise to the standard required should be sought from the manufacturer or supplier of the product.

Agitation to help remove food residue and other soil is either achieved manually through the use of brushes, scourers etc. or mechanically through the use of dish- or glasswashers. Mechanical dishwashers rely on the pressure of the water as well as the overall design of the unit to provide the agitation necessary to remove food residue and other soil.

There may be circumstances where cleaning without water is necessary. This is allowable provided the outcome is achieved, that is the utensil or surface is clean to touch and free of extraneous visible matter and objectionable odour.

Sanitising

Sanitising eating and drinking utensils and food contact surfaces can be achieved through the use of hot water, chemicals or other processes. These are described separately on the following pages.

Hot water

Hot water is the most common method of sanitising eating and drinking utensils and food contact surfaces. Hot water sanitising can be achieved manually or mechanically through the use of a dish- or glasswasher.

The temperature needed to destroy infectious diseases present on an eating or drinking utensil or a food contact surface is not clearly indicated in the literature. The NSF has conducted many studies on the use of hot water for sanitising in the food service industry.

The first comprehensive studies on mechanical dishwashing processes were sponsored by the NSF and carried out by Dr WL Mallman at Michigan State University. The first research report was published in 1947. Further work was carried out and in March 1964 the NSF published a summary report on the study of dishwashing machines.

Commercial dishwashers

The work of the NSF has been used to specify comprehensive and prescriptive requirements for the manufacture of dishwashers in the US and has also been used by other countries such as Canada. In Australia, the requirements specified in the previous New South Wales Food (General) Regulation (1997) for cleaning and sanitising eating and drinking utensils were based on the NSF studies.

The findings of the NSF's work show that sanitising utensils using hot water is complicated and that it is not simply a matter of prescribing a hot water temperature for effective sanitising to be achieved. The main findings of the NSF work can be summarised as follows:

- thorough cleaning before sanitising is critical to enable effective sanitising to take place;
- effective sanitising by hot water is achieved by the total heat accumulated by the utensil during the cleaning and rinsing stages of a wash cycle;
- the volume, pressure and temperature of the water are significant factors for effectively cleaning and sanitising utensils in a dishwashing machine; and
- the overall design of the dishwashing machine is important in ensuring that all surfaces of the utensils are exposed to the cleaning and rinsing action of the machine for effective cleaning and sanitising to take place.

The NSF has produced two standards for dishwashers and glasswashers:

1. NSF 26-1980 *Pot, Pan, and Utensil Commercial Spray-Type Washing Machines*, NSF International Standard.
2. ANSI/NSF 3-1996 *Commercial Spray-Type Dishwashing and Glasswashing Machines*, American National Standard/NSF International Standard.

Copies of these standards can be purchased from NSF International or from Standards Australia.

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Ann Arbor, Michigan 48113-0140 USA

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Fax: +1 734 769-0109
E-mail: info@nsf.org
Internet: <http://www.nsf.org>

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While the two NSF Standards specify comprehensive criteria for the manufacture of dishwashers and glasswashers, it is not certain whether machines built to these standards remove or destroy all infectious diseases that may be present on a utensil. It is ANZFA's understanding that the studies that were used to develop the design criteria specified in these standards were the studies conducted by the NSF in the 1940s and 1960s. The machines are required to have water temperatures and time cycles that produce a cumulative heat factor that is twice as great as the time-temperature standard for pasteurising milk (Bryan & DeHart 1975). The studies did not cover the destruction of food-borne viral pathogens such as hepatitis A as there were no testing methods for these viruses at the time.

The most heat-resistant infectious disease that may be transmissible through an eating or drinking utensil appears to be hepatitis A. Hepatitis A is highly resistant to heat and chemicals. The exact temperature necessary to destroy hepatitis A is not known but the Therapeutic Goods Administration in Australia has advised (verbally) that preliminary work being conducted in Germany suggests that a temperature of over 90°C may be necessary. Sodium hypochlorite can be used to destroy hepatitis A but very high concentrations are needed (5000 ppm or a 1:11 dilution) (Block 1991).

Until further studies are conducted on the destruction of hepatitis A, there is no absolute evidence that dishwashers and glasswashers designed to NSF Standards or any other current standards will destroy hepatitis A. However, it should also be noted that there is no evidence either that hepatitis A survives current cleaning and sanitising processes as there have been no known outbreaks (to ANZFA's knowledge) attributed to hepatitis A from cleaned and sanitised eating and drinking utensils. The cleaning and rinsing phases may be effectively removing or diluting the hepatitis A to safe levels and hence destruction may not be necessary.

Manufacturers and suppliers of commercial dishwashers need to ensure that the dishwasher achieves the outcomes of this clause, that is, that it so thoroughly cleans and sanitises the utensil that infectious diseases are not transmitted. However, in recognition of the lack of certainty in this area, dishwashers and glasswashers that either meet the NSF Standards or the previous New South Wales regulations are considered to meet the requirements of this clause.

Dishwashers and glasswashers that do not meet these requirements may still be used, but the supplier or manufacturer of the machine should provide evidence as to their efficacy.

All eating and drinking utensils and food contact surfaces should be thoroughly dry before being reused. If these utensils or surfaces are used while still wet there is a greater chance that any microorganisms remaining on the utensil or surface will be transferred to food or a person's mouth.

Domestic dishwashers

Domestic dishwashers are occasionally used by smaller food businesses that only generate a small volume of dirty eating and drinking utensils. In such situations the installation of a commercial-type dishwasher may not be cost-effective. How effective domestic dishwashers are at cleaning and sanitising is uncertain. However, Bryan and DeHart conducted a study in the US in 1975 to determine whether domestic dishwashers available in the US could meet the same cleaning and sanitising outcome as commercial dishwashers. This study recognised that it is seldom economical or practical to use either commercial dishwashers or hand washing for food service operations in child care centres, family day care, nursing homes and other small food businesses serving food once a day or serving food three times a day to only a few people (Bryan & DeHart 1975).

This study concluded that domestic dishwashers that met certain criteria could provide the same cleaning and sanitising outcome as a commercial dishwasher. These criteria were that:

- (a) dishwashers should have properly functioning temperature-activated sanitising cycles that have to sense a temperature of 65.6°C or higher before the machine advances to the next step; or
- (b) dishwashers with either no sanitising cycle or a time-controlled sanitising cycle and forced airflow drying should only be operated with inlet water temperature above 68°C.

Domestic dishwashers that met the above criteria were able to provide an equivalent outcome because, although they operated at lower temperatures, their cycles were much longer — about one hour.

ANZFA is not aware of any other published studies that have been conducted on the efficacy of domestic dishwashers in terms of the removal and/or destruction of pathogenic microorganisms. It is recommended that further studies be conducted on domestic dishwashers available in Australia, particularly modern models. Until these studies are carried out, domestic dishwashers that meet either criterion (a) or (b) above are permissible. Note that it is not expected that domestic dishwashers would normally be installed in food premises. Most food businesses within the food service sector will need to install commercial dishwashers because of the volume of dirty eating and drinking utensils.

Domestic dishwashers that do not meet the above criteria may also be acceptable if the suppliers or manufacturers of the machines provide evidence as to their efficacy.

Manually sanitising with hot water

Manually sanitising eating and drinking utensils and food contact surfaces is very difficult with hot water. To achieve an adequate level of sanitation, a temperature of 77°C is likely to be needed and the utensils or surfaces need to be in contact with water at this temperature for at least 30 seconds. A temperature of 77°C for a period of 30 seconds for manual washing is required in the US Food Code and was also previously specified within the New South Wales Food (General) Regulation 1997.

To ensure that utensils or food contact surfaces are in contact with hot water at a temperature of 77°C for 30 seconds, hot water would need to be delivered to a sink at or above 77°C and the sink would need to have a heating element in it to maintain the temperature of the water at least at 77°C.

However, manually sanitising at this temperature raises occupational health and safety concerns. To avoid burns, rinsing baskets would need to be used to immerse the utensils or equipment, and care would need to be taken to ensure burns did not occur from splashing.

While manual sanitising may be able to be carried out at lower temperatures, a longer contact time would be necessary to ensure that an equivalent sanitising outcome was achieved. However, this still requires the sink to contain a heating element to ensure the temperature of the water is maintained at a minimum temperature.

Due to the above difficulties, it is recommended that food businesses do not manually sanitise using hot water but instead use dishwashers or chemical sanitisers.

Chemicals

Chemical sanitisers can be used to sanitise eating and drinking utensils and food contact surfaces. This can be achieved through sanitising manually or by the use of dishwashers that use chemical sanitisers for sanitising instead of hot water.

Advice on chemical sanitisers that are suitable for use for eating and drinking utensils and food contact surfaces must be obtained from the supplier or manufacturer of the sanitiser. The supplier or manufacturer should be able to provide information on what the sanitiser can be used for and what the sanitiser can achieve in destroying microorganisms when it is used correctly.

Sanitisers will not work correctly if the surface to be sanitised has not been thoroughly cleaned first. If the surface is not clean, the sanitiser will react with the soil left on the surface, reducing the effectiveness of the sanitiser. Food residue and other soil left on a surface will also provide protection to microorganisms.

Sanitisers will only work correctly if they are used in the correct concentrations and the instructions are followed. The effectiveness of chemical sanitisers can be directly affected by the temperature, pH, concentration of the sanitiser solution used (too little or too much) and the hardness of the water (US Food Code 1999). Instructions should always be read and followed. If they are not clear, further advice should be sought from the supplier or manufacturer of the chemical.

Some of the most commonly used chemical sanitisers in the food industry are chlorine-based compounds. While advice on using chlorine-based sanitisers should be provided when purchasing the sanitiser, the information in the table opposite has been provided for guidance and to illustrate the importance of following instructions when using chemical sanitisers.

The table indicates the minimum concentration of a chlorine solution to use, depending on the pH and temperature of the water.

After the sanitiser has been applied for the necessary time, the instructions should indicate whether the sanitiser needs to be rinsed off.

After the sanitation process is completed, the eating and drinking utensil or food contact surface should be thoroughly dry before it is reused. Air drying is preferable. If towels are used they must be clean and dry.

| Minimum concentration (mg/L or ppm) | Minimum temperature (°C) for water at pH 10 or less | Minimum temperature (°C) for water at pH 8 or less |
|-------------------------------------|---|--|
| 25 | 49 | 49 |
| 50 | 38 | 24 |
| 100 | 13 | 13 |

Source: US Food Code 1999.

Other processes

Processes other than heat and chemicals may be used to sanitise eating and drinking utensils and food contact surfaces, for example dry steam cleaning and ultraviolet radiation. Technological advances are also being made in this area and other processes, such as irradiation, pulsed electric fields and microwaves, may be able to be used successfully in the future.

