

# Australian Cold Chain Guidelines 2017

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For the handling, storage and transport of refrigerated fresh, chilled and frozen foods for sale in retail and food service outlets or export customers.

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This document is intended as a guide only: legal requirements are contained in the Australia New Zealand Food Standards Code and other applicable State and Territory Food or Health laws as relevant to the jurisdiction within which goods are traded.

The information in this document should not be relied upon as legal advice or used as a substitute for legal advice. You should exercise your own skill, care and judgement before relying on this information in any important matter.

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# AUSTRALIAN COLD CHAIN GUIDELINES 2017

## SECTION 1

The Cold Chain Guidelines are intended to maintain the safety and quality of food products as they are handled, transported and stored in their journey from producer to consumer.

Minimising food illness and waste is critically important to consumers, regulators, the food industry and the Australian economy. It has been estimated that contaminated food caused approximately 5.4 million cases of gastroenteritis annually in Australia<sup>1</sup>. Australians are also throwing away food which is worth \$5.2 billion a year, including more than \$1.1 billion worth of fruit and vegetables and \$872.5 million worth of fresh meat and fish.<sup>2</sup> One contributing factor for food illness and waste is poor Cold Chain management.

Proper Cold Chain practice in Australia is also critical for our exports. The USA FDA, for instance, will assess the safety of Australian Cold Chain when deciding whether to allow perishable food to be imported, and exports to Asia are likewise partly determined by the quality of the Australian cold chain operations.

### 1.1 What is the Cold Chain?

**The Cold Chain consists of a series of businesses engaged in manufacturing, transporting, storing, retailing and serving fresh, chilled and frozen foods.**

Over the last two decades, the distance that foods travel from paddock to plate has increased. The average food is moved in and out of refrigeration control 14 times before consumption. In one South Australian study, broccoli took 39 steps along the Cold Chain – having as many as 23 operators and 21 stages involved on the way – to reach consumers<sup>3</sup>.

The effectiveness of the Cold Chain in maintaining the safety, shelf life and quality of foods relies on controlling product temperature through each and every step. All the operations that form the links in the Cold Chain must understand the need to follow the cold chain rules.

### 1.2 The Cold Chain Guidelines 2017

**The *Australian Cold Chain Guidelines for Food 2017 (the Guidelines)* provide best practice recommendations for transport, logistic and safety requirements to ensure the safety and quality of chilled and frozen foods.**

They do not cover in detail all manufacturing practices that occur prior to the manufactured product being placed into cold storage or final handling by the customer.

**The Guidelines are advisory only.** They provide an industry consensus on best practice, but do not substitute for compliance with any overriding domestic or international legislation, nor are they intended as a complete food safety plan or system. Customers may have additional or over-riding specific transport standards as well. These Guidelines are intended

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<sup>1</sup> [Estimating foodborne gastroenteritis, Australia, circa 2000 \(Hall & Kirk 2005\)](#)

<sup>2</sup> [http://www.ces.org.au/Other%20stuff/Australia Institute What a waste of food.pdf](http://www.ces.org.au/Other%20stuff/Australia%20Institute%20What%20a%20waste%20of%20food.pdf)

<sup>3</sup> [www.foodprocessing.com.au](http://www.foodprocessing.com.au)

only to work alongside such documents and illustrate Cold Chain issues that need to be addressed.

### 1.3 Implementation

Those involved in the Cold Chain should:

- plan how the Cold Chain Conditions for a food can be met by talking with contractors, customers and suppliers, including in relation to record keeping, logs and process documentation;
- implement an ongoing program of training for personnel in Cold Chain handling, covering housekeeping, hygienic discipline and process control requirements, management training in safety and quality, and retraining and refresher courses to reinforce knowledge; and
- continuously review policies and operating procedures as part of Hazard Analysis Critical Control Points (HACCP) and internal Food Safety Programs.

### 1.4 Record Keeping

Why is proper record keeping so important?

The first reason is that record keeping is an essential part of the mandatory food safety plan requirements for food businesses throughout Australia. Failure to keep proper records to demonstrate adherence to a food safety plan can be a criminal offence.

Secondly, records are used by independent food auditors to assess whether food safety and/or food quality standards are being met. Failing an audit has significant consequences for customer contracts.

Thirdly, proper records and logs help deal with situations where things have gone wrong. It is vital to know the times and temperatures to which goods have been subjected in order to make appropriate decisions as to what to do next.

Finally, records are the quickest way to ensure that Cold Chain conditions for a food remain intact. This is important because some spoilage due to heat stress can take place even at very low temperatures. For example, enzymatic activity, which can develop off-flavours in some foods, only ceases at about -18°C, and so a food might be spoiled even though it has been kept “frozen” (ie below 0°C) throughout its journey. Only by keeping accurate records will you be able to tell whether or not such enzymatic activity might have taken place. Bad record keeping, on the other hand, provides no assurance that spoilage has not occurred, and of itself could be grounds for rejecting goods.

Typically two years minimum retention is required by auditors and for the purpose of being able to rely on a due diligence defence with food safety regulators domestically and internationally in case of exports.

## 1.5 Export Standards

Goods for export must comply with any controls and requirements specified in the *Export Control Act 1982*, and related Regulations and Orders. Information on these requirements can be found on the website of the Department of Agriculture and Water Resources.

Goods will also be required to meet any conditions imposed by the importing country.

While export and import requirements are unlikely to directly conflict with these Guidelines, compliance with regulations is mandatory and will overrule these Guidelines if a conflict does arise.

## SECTION 2 COLD CHAIN RULES

### 2.1 The Cold Chain

The **Cold Chain** consists of the series of businesses engaged in manufacturing, transporting, storing, retailing and serving chilled and frozen foods.

For a particular food, **Cold Chain conditions** will be set relating to maximum (and sometimes minimum) temperature requirements and the period of time that a food can be allowed to remain unrefrigerated. The effectiveness of the Cold Chain in maintaining the safety, shelf life and quality of foods depends on each business managing and recording compliance with the Cold Chain conditions.

A Cold Chain that maintains the integrity of its Cold Chain conditions ensures that food is safe to eat when it reaches the consumer, and is of the quality and has the shelf life intended by its manufacturer or producer. Any break in the Cold Chain conditions may affect the quality of the food, the length of its shelf life or in the worst case, make the food unsafe to eat.

### 2.2 The Cold Chain conditions

The Cold Chain conditions are set out in three rules:

- **NEVER WARMER THAN** rule, which is about temperature (Section 3)
- **MAXIMUM “OUT OF REFRIGERATION”** rule, which is about time (see Section 4)
- **FIRST EXPIRY FIRST OUT** rule, which is about stock rotation (see Section 5)

In addition to these three rules, the Cold Chain Guidelines provide assistance for dealing with breaks in the Cold Chain (Section 6) and for managing heat transfer issues (Section 7).

To support these three rules, a number of guidelines have been developed (see Sections 8 to 15) to show how they can be applied, and to identify issues to watch out for, at various stages in the Cold Chain such as manufacturing, warehousing, transport, retail displays, home delivery and catering.

### 2.3 Setting the Cold Chain conditions

**It is the responsibility of the manufacturer or producer, in consultation with its clients, to set the Cold Chain requirements for any particular food.**

Cold Chain requirements established as a result of these requirements must be clearly spelled out in all documents relating to the transportation, storage, handling and sale of the food, and should be referenced in the food safety plan of each Cold Chain business.



In some cases, standards and regulations for specific products may exist, for example in regard to regulated industries such as fresh meat, or in relation to food for export<sup>4</sup>. Such regulated requirements must be observed and take precedence over these Guidelines.

Temperatures below +5°C slow the natural deterioration and spoilage of fresh foods and the growth of microbes, but **refrigeration does not kill microbes**, and some bacteria capable of causing illness are able to grow under normal refrigeration temperatures. There are limits on how long foods can be safely held even when refrigerated. Cold chain businesses should pass foods through the Cold Chain as quickly as possible to minimise these risks.

## 2.4 Breaks in the Cold Chain conditions

Any break in the Cold Chain conditions – whether caused by failure to follow established procedures or faulty equipment – can result in food which is likely to spoil more rapidly, resulting in food that may be unsuitable and potentially be unsafe for consumption.

Where there is a break in the Cold Chain, such as a failure to comply with the MAXIMUM OUT OF REFRIGERATION TIME LIMIT, it is essential that the break be identified, corrective actions undertaken and records kept to show what happened and what was done. See Section 6 for more information.

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<sup>4</sup> <http://www.daff.gov.au/aqis/export>

## SECTION 3 “NEVER WARMER THAN” RULE

### 3.1 The Rule

The **NEVER WARMER THAN** rule is a **temperature** rule: it states the maximum temperature at which a food should be transported, stored and handled. In the case of CHILLED foods, it may be accompanied by a **KEEP ABOVE** temperature to ensure that the food is not damaged by becoming frozen.

The manufacturer or producer is responsible for setting any **NEVER WARMER THAN** temperature and, for CHILLED FOODS, any **KEEP ABOVE** temperature (see section 1.3 above). These temperatures must be specified in all documents that accompany the food and be communicated from each link in the Cold Chain to the next link.

### 3.2 The Guidelines

While the manufacturer can set any **NEVER WARMER THAN** and **KEEP ABOVE** temperatures that they consider necessary for the safety and quality of their product, these Guidelines strongly recommend that two temperatures be used as far as is possible:

- CHILLED FOODS must be transported, stored and handled at temperatures **NEVER WARMER THAN +5°C**; and
- FROZEN FOODS (including ice creams) must be transported, stored and handled at temperatures **NEVER WARMER THAN -18°C**.

These Guidelines also recommend that CHILLED FOODS be stored and transported according to the recommendation **KEEP ABOVE 0°C** so that the products do not freeze and be damaged by ice crystal formation.

An example where a different **NEVER WARMER THAN** might be specified by the producer is export meat, which is often transported at -12°C,

The rule applies to the temperature of the product being transported, so you may need to adjust thermostat settings on refrigeration equipment if you know there is a difference between thermostat setting and food temperature – you may, for example, set a thermostat to -1°C when transporting CHILLED FOODS if you know that this ensures the food remains in the window of 0°C - 5°C.

### 3.3 Chilled food variations

It must be remembered that the temperature rule of **NEVER WARMER THAN +5°C** is a guideline for general use. The manufacturer may have good reason to set a higher or lower temperature.

#### Colder Storage items:

Some chilled foods may require refrigeration for safety and quality reasons at temperatures slightly colder than 0°C.

Examples include:

- Some varieties of fish and shellfish and products using these items as ingredients;
- Modified atmosphere packaged meat products; and
- Value added fresh produce (e.g. alfalfa sprouts, washed and packed salads).

### **Warmer Storage items:**

Other chilled foods should not be stored or transported at temperatures as cold as +5°C for quality reasons as the foods may be easily damaged from being too cold, or may suffer problems from high moisture condensation.

Examples include:

- A wide variety of fresh / tropical produce can incur increased spoilage from moisture that condensates in packaged produce, when refrigeration temperatures are lower than the reference distribution temperatures for these fresh produce lines;
- Fermented or cured meats, such as some prosciutto hams and salami-style products, which, by nature of the ingredients and processing conditions may be safe to store even at ambient temperatures, but which may be kept cold to prolong eating quality;
- Processed and mature cheese keeps best at its ripening temperature, usually around 12 - 15°C. However, many fresh and soft cheeses need to be stored colder. Some cheeses require a higher humidity; otherwise they can quickly dry out. There is more moisture in soft cheeses than hard varieties;
- Confectionery, particularly chocolates, can be particularly sensitive to too low a temperature, which along with high refrigerator moisture and humidity levels can lead to sugar or fat bloom and off-flavors;
- Specific thaw-baked pastry products can be temperature sensitive; and
- Table spreads may have specified storage temperature requirements.

## **3.4 Record Keeping**

Each link in the Cold Chain must, record –

- The temperature of the food on receipt and how it was determined;
- A temperature log of the environment in which the food is transported, stored or handled (eg the varied internal temperatures of refrigerated transport) and how that log was generated; and
- The temperature of the food on delivery and how it was determined.

### 3.5 The Problem of Heat Transfer

Even when in a refrigerator, heat can transfer to a Cold Chain product from other foods, personnel and equipment. This problem of “heat exchange” applies at all stages of the Cold Chain and needs to be carefully managed. See Section 7 below.

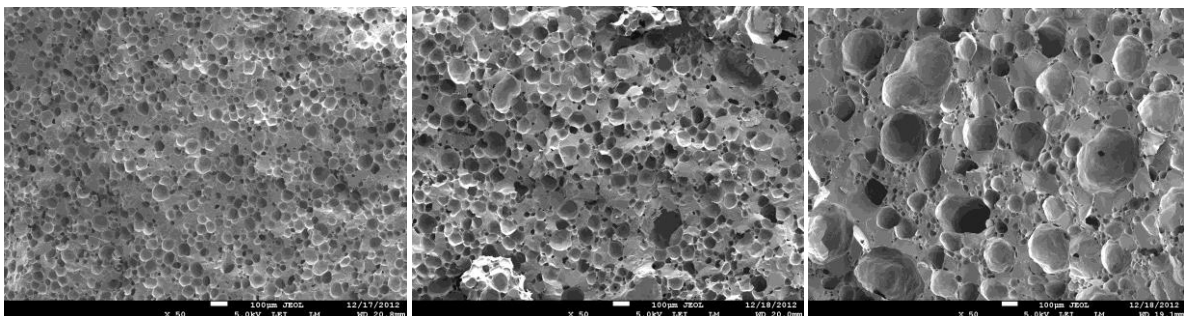
#### “NEVER WARMER THAN” RULE:

- All products must be kept at temperatures **NEVER WARMER THAN** the manufacturer’s or producer’s recommended maximum temperature.
- In most cases, keep **CHILLED FOODS** at a temperature between 0°C and +4°C to ensure the product temperature is **NEVER WARMER THAN +5°C**.
- In most cases, keep **FROZEN FOODS** and ice cream **NEVER WARMER THAN -18°C**.

### 3.6 Example - ice cream and similar products

Ice cream, reduced fat ice cream, ice confection and ice cream and ice confection products are particularly heat sensitive and at risk of quality defects due to fluctuating or elevated storage temperatures above -18°C, and should preferably be stored between -22°C and -30°C.

The smooth texture of ice cream comes about in part due to the presence of tiny ice crystals formed when the product is whipped and quickly frozen, and in part due to a mixture (called an emulsion) made up of milk solids, sugar, water and dairy fats. If the ice cream temperature rises above -18°C, two things happen: the ice crystal size increases (see images below), and the emulsion breaks down, separating in two layers of fat and water. The smoothness of the product is lost, creating an icy, grainy, layered texture instead of a smooth one. These changes are called “heat shock” and are permanent: bringing the temperature back down to -18°C or below does not undo the damage. This is why ice cream must be handled and stored in strict accordance with these Guidelines and the manufacturer’s specifications.



*Increased crystal size and emulsion separation as ice cream is subjected to heat shock*

## SECTION 4 MAXIMUM “OUT OF REFRIGERATION” RULE

### 4.1 The Rule

The **MAXIMUM “OUT OF REFRIGERATION” TIME LIMIT** is a **time** rule: it states the maximum period a Cold Chain food can be outside a temperature controlled environment (eg an open loading dock) without breaking the Cold Chain conditions.

Like the **NEVER WARMER THAN** rule, the **MAXIMUM “OUT OF REFRIGERATION” TIME LIMIT** is established by the manufacturer or producer in consultation with its customers– see section 1.3 above. **MAXIMUM “OUT OF REFRIGERATION” TIME LIMIT** times must be specified in all documents that accompany the food and be communicated from each link in the Cold Chain to the next link.

### 4.2 The Guidelines

While the actual time limit is set by manufacturers or producers, these Guidelines recommend some time periods as being appropriate

#### For Chilled Foods

- Where CHILLED FOODS are being un-loaded or dispatched in either **ambient** (room temperature) or in **+5°C to +15°C air conditioned ante-room** conditions, the **MAXIMUM “OUT OF REFRIGERATION” TIME LIMIT** is **20 minutes**.
- Chilled foods unloaded or dispatched in **0°C to +5°C refrigerated ante-rooms** are usually still meeting their **NEVER WARMER THAN** Cold Chain condition and so no time limit is necessary.

#### For Frozen Foods

- Where FROZEN FOODS are being un-loaded or dispatched in **ambient** (room temperature) conditions, the **MAXIMUM “OUT OF REFRIGERATION” TIME LIMIT** is **20 minutes**;
- Where FROZEN FOODS other than ice cream are being un-loaded or dispatched in **+5°C to +15°C air conditioned ante-room** (air conditioned temperature zone) conditions, **MAXIMUM “OUT OF REFRIGERATION” TIME LIMIT** is **60 minutes**;
- Where FROZEN FOODS other than ice cream are being un-loaded or dispatched in **0°C to +5°C refrigerated ante-room** (chilled temperature zone) conditions, the **MAXIMUM “OUT OF REFRIGERATION” TIME LIMIT** is **90 minutes**;
- ICE CREAM and ICE CONFECTION and similar products respond more rapidly than other frozen food to temperatures above **-18°C**, and should be **loaded last and unloaded first direct from/to storage freezers** whenever

possible. The **MAXIMUM “OUT OF REFRIGERATION” TIME LIMIT** for ice cream is **20 minutes**, irrespective of the unloading or dispatch environment.

### 4.3 Record Keeping

Each link in the Cold Chain must record –

- The time the food left refrigeration;
- A record –
- stating the environment in which the food was held while out of refrigeration;
- providing a log of the temperature within that environment (eg the internal temperature of an air-conditioned receiving bay, or, ambient temperature); and
- stating how that log was generated;
- The time the food re-entered refrigeration; and
- The elapsed time out of refrigeration.

#### **MAXIMUM OUT OF REFRIGERATION TIME LIMIT GUIDES:**

- Maximum of 20 minutes for all CHILLED FOODS if no refrigeration controls exist at receipt docks
- Maximum of 20 minutes for ICE CREAM, ICE CONFECTION and similar products, whether received into air-conditioned (+5°C to +15°C) and chilled anterooms (0°C to +5°C) - do not store at room temperature even temporarily
- Maximum of 60 minutes in +5°C to +15°C air-conditioned anterooms for FROZEN FOODS other than ice cream, ice confection and similar products; or
- Maximum of 90 minutes in 0°C to +5°C chilled anterooms for FROZEN FOODS other than ice cream, ice confection and similar products.

## SECTION 5 THE FEFO STOCK ROTATION RULE

### 5.1 The Rule

**Correct stock rotation is based on the ‘first to expire is first out’ (FEFO) rule**, ensuring that stock which has been in the system longest is moved first. This stock rotation principle is applied in many cold chains internationally to minimise wastage. While sounding simple, the problem is that without a proper inventory management system, it is usually the most recently arrived stock that is most accessible, and so the first used – and this can be the exact opposite of FEFO.

FEFO may seem to be the same as “first in, first out” (FIFO), in that the product that has been in storage the longest will probably have the soonest expiry date. However, this is not always the case, as variations in stock supply and rotation earlier in the Cold Chain can mean that products arrive out of expiry date sequence. It is the expiry date, rather than arrival date, that drives selection for dispatch.

### 5.2 Implementing the Rule

To implement an inventory management system requires three things:

- A **product identification** marking or markings on shipping cartons (eg barcode, RFID tag, on pack printing, etc) to identify the product, its durable life “expiry” date and its received date (this may be a manufacturer applied marking or one applied at the facility);
- A system for recording and monitoring **product location** within a handling facility;
- A **product handling** system that applies the FEFO principle, knowing what products are in the facility, each product’s expiry date, when they were received and where they are located, so that soonest expiry product is selected first for dispatch.

There are third party inventory management systems available ranging from off-the-shelf computer programs through to full automated receipt, storage and dispatch systems. However, for small companies a simple pen and paper system might be enough.

#### THE FEFO RULE:

**Products with the soonest expiry date should be selected first for dispatch or use.**

## SECTION 6 WHEN THINGS GO WRONG - WHAT TO DO IF THE COLD CHAIN IS BROKEN

### 6.1 Contact information

Manufacturers and producers must include in product documentation a contact person for Cold Chain queries and notifications, and can also indicate in the documentation what initial measures can be taken if the Cold Chain is broken to minimise any further damage to the products.

Cold Chain businesses must educate their staff of the importance of notifications, and have in place procedures to encourage notifications (eg by making it clear that notifications are treated positively and that job security is not threatened by notifications).

### 6.2 Actions

If any break in the Cold Chain conditions takes place, the person or people detecting the break must –

- Notify their business owner of the nature of the break in Cold Chain conditions (ie whether it is a break of the NEVER WARMER THAN and/or of the MAXIMUM “OUT OF REFRIGERATION” TIME LIMIT rule) and any circumstances relating to the break;
- Notify, or arrange for someone else to notify, the manufacturer or producer of the nature of the break and any circumstances relating to the break;
- Take the action, if any, specified in the product documentation for the break in conditions; and
- Take such further action, if any, communicated by the business owner or by the manufacturer or producer.
- Make a record of –
  - the nature of the break in Cold Chain conditions and any circumstances relating to the break;
  - the time and date of notifications to the business owner and the manufacturer (including the name of the person contacted and the person making the contact); and
  - what action was taken, when and by whom, and who was consulted or authorised actions.



### 6.3 Holding Action

If there are no specific instructions in relation to a break in Cold Chain conditions, the following actions should be taken -

- Separate out the affected products and return them to a refrigerated area or freezer according to the product's **NEVER WARMER THAN** rule as soon as possible; and
- Mark the containers (eg placing a large X on them using a large red marker pen) and attach a visible sign stating "DO NOT MOVE OR USE: AWAITING INSTRUCTIONS".

## SECTION 7 MANAGING HEAT TRANSFER

### 7.1 Hotter products warm colder products

Heat is a form of energy, which means it can flow in three different ways –

- a) conduction: a warmer product will heat up a cooler product that is in direct contact with it;
- b) convection: a warmer product can heat up the air around it, which in turn can heat up other products in the area; and
- c) radiation: just like a griller in your oven, a warmer item heats up surrounding cooler items simply by “shining” heat into them.

Where items at different temperatures are stored or transported together, heat transfer is an issue that needs to be considered and managed to ensure all products meet their **NEVER WARMER THAN** Cold Chain Condition.

### 7.2 Storing mixed products

All products in the same storage environment should have the same temperature, and in time this is what will happen. However, when new products are introduced into the storage area, they may be either hotter or cooler than the environment and will need to cool down (or in some cases warm up) to the surrounding temperature. This means that care needs to be taken to make sure that surrounding products stay within their required Cold Chain Conditions as the new product moves to the storage environment temperature.

The following guidelines help achieve mixed product storage in a safe manner-

- If possible, have a ‘settling in’ space using insulated partitions or cartons to separate incoming products from the remainder of the environment until their temperature has stabilised.
- If no ‘settling in’ space is possible, -
- Use separation as a barrier by storing newly introduced products as far away as you can from other products;
- Use temperature loggers on nearby products to ensure localized temperatures do not exceed any **NEVER WARMER THAN** Cold Chain Condition; and
- Store new products near the least heat sensitive products you can: avoid storing newly arrived product next to things like confectionery, ice cream or heat sensitive fresh products until temperatures have stabilised.

### 7.3 Transporting mixed loads

The ideal goal is that only products with the same Cold Chain conditions are transported or stored together, and logistical planning should be used to make this happen as far as is possible. In reality, it is not always possible, and mixed loads can be transported and stored safely provided the following guidelines are observed –

- Transport vehicles should only be required to maintain product temperature, not reduce it, and so Cold Chain products must only be loaded if already chilled or frozen to meet the specified **NEVER WARMER THAN** temperature.
- Product temperature separation should be used wherever possible. For example, use insulated partitions or cartons to separate products with different Cold Chain requirements, or from non-Cold Chain products. Locate frozen products adjacent to evaporators and, where possible, use dual temperature vehicles and separate compartments when transporting frozen foods and/or chilled foods with non-Cold Chain foods.
- Beware of food safety issues arising from mixed loads, especially when raw products (e.g. uncooked meats) are stored or transported with fully processed ready-to-eat products. Stacking raw product that may leak (e.g. cartons of fresh meats or poultry) on top of ready-to-eat product or fresh foods that may never be cooked can lead to cross-contamination and potentially to serious illness. Keep raw product segregated using sealed containers and other barriers to minimize these risks.
- Think about how products are stacked to minimize heat transfer problems. Organise the load according to products' **NEVER WARMER THAN** rules, so that the products with the lowest required temperature are in the most insulated/refrigerated part of the vehicle and working outwards, with any ambient temperature products furthest away.
- It may not always be possible to transport some mixed loads. If a vehicle does not allow for product segregation, the requirements to protect temperature sensitive FROZEN FOODS might damage fresh ambient products. In such cases, appropriate alternative transport arrangements may need to be considered.
- Fresh foods like herbs, fruits and vegetable can be vulnerable to incorrect temperature control -
  - too cold temperature settings can cause freezer burn or affect respiration of fresh foods damaging the outer product (e.g. browning of bananas); and
  - too warm temperature settings can increase respiration rates of fresh fruits and vegetables leading to faster enzymatic and other deterioration processes, leading to loss of product at retail and consumer levels (e.g. wilting lettuce from hot delivery means high leaf wastage pre-sale or post-sale).

Vehicles used to carry mixed fresh ambient and chilled goods should have compressors set to **no warmer than +4°C and no cooler than +2°C** to protect the chilled products. To avoid heat transfer problems, ambient temperature foods must be loaded pre-chilled to the same temperature range of between +2°C and +4°C, if possible to do so without compromising the quality of the ambient temperature food. Non-food items may be transported with refrigerated foods provided that there are effective layers of protection and segregation between food and non-food items. Avoid potentially

dangerous non-food items, such as household cleaning chemicals or gardening products (such as fertilizer and potting mix) being transported in the same load as food items.

- Garbage and waste should NEVER be transported with Cold Chain foods. Under certain circumstances, food product being returned from customer premises (eg damaged or out-of-date stock) may be transported in the same vehicle as Cold Chain foods, provided they are clearly marked (eg with a large red X) and isolated onto different pallets or into different zones to avoid being confused with the Cold Chain food. Returned goods must be accompanied by appropriate return approval documents on collection and receipted back at the cold store facility into an approved quarantine storage area for assessment. All refrigerated transport assets must be kept in a hygienic state including appropriate wash-outs.

**Recommended thermostat setting used for mixed loads.**

Frozen food -18°C or less	Chilled food 0°C to +4°C	Fresh food +5° to +7°C	Confectionery approx +15°C	Ambient goods +15°C to 30°C	Thermostat setting
			X	X	+15°C (all runs)
		X	X	X	+5°C (all runs)
	X	X	X	X	+2°C (run > 2 hr) +4°C (metro run)
	X	X			+4°C (all runs)
X	X			X	-22°C (all runs)

**Metro run** = run that has frequent delivery stops and distribution centre within 2 hours.  
 Confectionery includes chocolate and chocolate coated products including biscuits.

**NOTE 1:**

The temperature thermostat settings can and may need to vary based on the volumes of different food types being carried. The above is a guide only and may not be suitable under specific circumstances.

**NOTE 2:**

Other options may be applied but must be validated to ensure the settings protect frozen foods and protect fresh foods. Options may include thermal protective devices using shrink-wrapping, pallet covers or other segregation options.

**7.4 Example: Confectionery**

Storage and transport of confectionery over an extended time at temperatures below +5°C can be detrimental to confectionery items as they are particularly sensitive to temperature

(too high, too low, or large/fast temperature variations) and humidity (excessive humidity or dampness can lead to sugar or fat bloom and off-flavours). Consequently some confectionery needs to be stored, handled and distributed in temperature and air humidity controlled conditions. Confectionary manufacturers and importers should take care to specify appropriate transport conditions for their products and whether or not the product will stand mixed load conditions. Chocolate ideally transported at 12-14°C.

## SECTION 8 MANUFACTURING

Control of quality and safety of foods destined for the Cold Chain starts with the growers and manufacturers. The first stage consists of the harvesting, selection, receipt, and preparation, handling and processing of raw materials.

These Guidelines begin with recommendations for the packing and refrigeration of finished food products at manufacturing level (not growing level), as Cold Chain controls at harvest may differ from product to product.

### 8.1 Setting Cold Chain Conditions

The manufacturer carries primary responsibility for setting the Cold Chain Conditions, and in particular –

- Establishing the appropriate **NEVER WARMER THAN** temperature for the product to ensure product safety and quality through the cold chain
- If appropriate, setting a **KEEP ABOVE** temperature to ensure product quality
- Establishing the appropriate **MAXIMUM OUT OF REFRIGERATION** time for the product to ensure product safety and quality
- Establishing appropriate procedures to identify and, if safe to do so, rectify breaks in the Cold Chain, including procedures to deal with calls from Cold Chain operators asking for assistance.

Each of these needs to be documented in materials that accompany or are associated with the product as it travels through the Cold Chain.

Manufacturers need to set the Cold Chain conditions in consultation with their customers and with their Cold Chain logistics suppliers to ensure that the Cold Chain conditions for a product are practical and achievable.

When setting conditions, the manufacturer or producer should take into account -

- a microbiological risk assessment and HACCP-based risk management strategy for the food;
- physical tests examining time / temperature effects on food quality; and
- an assessment of the impact of time / temperature effects on the shelf life of the product.

The goals to be achieved by the Cold Chain conditions can be ranked in order of priority –

- (1) Safety – the most important and overriding issue is that foods delivered to consumers are safe to consume
- (2) Quality – at the end of the Cold Chain, products should retain as much as possible of their qualities from the start of the Cold Chain

- (3) Practicality – Cold Chain conditions should be achievable and practical using current logistic and monitoring technologies.
- (4) Standardisation – where possible, the standard Cold Chain conditions identified in sections 3 to 5 should be used.

Manufacturers must also conduct appropriate shelf life trials, including where Cold Chain conditions are maintained and where they are broken. Shelf life trials where product is heat stressed provides insight into appropriate actions when the Cold Chain may be broken.

To effectively implement these Guidelines, verify your operations by conducting random checks, frequently monitoring temperatures, confirm staff training, inventory controls and storage procedures are remaining effective.

## 8.2 Packaging and Identification

Manufacturers should select packaging materials (both primary and secondary) designed to:

- minimise the risk of microbial, chemical and physical contamination, including from the packaging itself
- provide effective insulation
- minimise product dehydration
- be food-grade compliant, testing against either EU, USA or Australian standards
- minimise the air space within the carton
- have sufficient structural strength for the demands of Cold Chain storage, handling, and transport taking into account the temperature and humidity conditions anticipated through the cold chain handling steps.

Marking the product with a recognisable and prominent pack size, lot id, date code and bar code enhances the efficiency of Cold Chain operators in relation to traceability, record keeping and effective stock rotation. It may be useful to include the Cold Chain conditions explicitly on transportation packaging. All this information should appear on two adjacent sides or two opposite sides of the packaging.

GS1 is the global organisation dedicated to the design and implementation of global standards for unique identification of logistic units (SSCCs) and consignments. Traceability is paramount from a food safety perspective. These standards are available from [GS1 Australia \(www.gs1.org\)](http://www.gs1.org).

For consumer packs -

- display the word 'frozen' or 'chilled' (or a specific holding temperature) and the product name in a prominent place on consumer packs
- include simple instructions clearly indicating the temperature below which the product must be stored

- state any necessary handling or storage instructions necessary to ensure durability, quality and safety of their products after purchase (for example, whether products should only be removed from refrigeration immediately prior to use)
- in particular, provide specific instructions in relation to thawing frozen products, such as whether the product is suitable to be cooked directly from being frozen (including whether any packaging needs to be removed), or whether it should first be brought to room temperature either at ambient temperature or in refrigeration.
- provide instructions for handling of unused goods, for example any usage requirements for opened products, whether thawed goods can be refrozen, etc.



## SECTION 9 DISPATCH AND DELIVERY

The second stage of the Cold Chain involves the control of dispatch and delivery process of chilled and frozen foods to their destinations. This can occur multiple times through the Cold Chain as a food transfers from one operator to another, for example from manufacturer to transport operator, from transport operator to warehouse, from warehouse to another transport operator and from transport operator to retailer.

The transfer of product from one Cold Chain operator to another is a critical time to closely monitor Cold Chain conditions because the product is usually out of refrigeration for at least some time during the process, and so is vulnerable. It is worth repeating that spoilage can occur quickly and even while a product is still frozen.

### 9.1 Dispatch operations

BOTH the dispatching operator and the transport operator should work to achieve maintenance of the Cold Chain conditions for goods at point of dispatch.

The guidelines relating to dispatch are -

- The dispatcher should make sure that the product has already achieved its **NEVER WARMER THAN** condition prior to dispatch. Transport vehicles are not intended to chill product down to a temperature but rather, to maintain the existing product temperature when loaded.
- The transport operator should pre-chill the transport vehicle's storage to at least the **NEVER WARMER THAN** temperature. This removes excess heat from insulated walls and avoids heat transfer issues (see Section 7). Check the vehicles' temperature and arrange maintenance if the equipment is not operating in accordance with specifications.
- The transport operator should turn off the vehicle's refrigeration plant when the doors are open (these can be automated using door sensors or engine ignition devices), and ensure it is turned on when loading is completed (again, this can be automated using door sensors or engine ignition devices).
- The dispatcher should note the time that the product leaves refrigeration and the time that the **NEVER WARMER THAN** temperature is regained in the transport vehicle. If this is longer than the **MAXIMUM OUT OF REFRIGERATION** time, institute corrective action (see Section 6).
- Both dispatcher and transport operator should complete product load movements as quickly as possible to minimize the out of refrigeration time. For example, avoid delays in cross-docking operations and do not take product out of refrigeration ahead in anticipation of transport vehicle arrival.
- The dispatcher should record the dispatch date, and record the temperature of each consignment by checking the temperature on two to three pallets across the entire load, for example the front, middle and or rear pallets of the load. Record temperatures as product leaves refrigeration and as it is loaded.

Temperatures should be cross-checked by transport operators and both dispatcher and transport operator should retain records as required by operator procedures.

- The dispatcher should provide the transport operator with logistics documentation including:
  - an accurate description of the loaded cargo, including gross weight
  - the applicable Cold Chain conditions relating to **NEVER WARMER THAN** and **KEEP ABOVE** temperatures, and **MAXIMUM OUT OF REFRIGERATION** time for the product
  - clear instructions about what to do in the event of a break in the Cold Chain.

## 9.2 Receiving / Delivery guidelines

BOTH the transport operator and the receiving operator should work to achieve maintenance of the Cold Chain conditions for goods at point of delivery.

The guidelines relating to delivery are –

- The transport operator should provide to the receiving operator the original or a copy of –
  - the load-in documentation showing product temperatures at pallet loading
  - in-transit temperature logs and/or manual records of temperature checks
  - the applicable Cold Chain conditions relating to **NEVER WARMER THAN** and **KEEP ABOVE** temperatures, and **MAXIMUM OUT OF REFRIGERATION** time for the product
  - clear instructions about what to do in the event of a break in the Cold Chain.
- Remember that ice cream is especially sensitive to heat shock and should be given priority in unloading and taken straight to a freezer area to minimize the out of refrigeration time.
- The receiving operator should identify goods and enter details into the receiving operator's system for stock management, including batch identification and date markings.
- The receiving operator should check the vehicle for hygienic storage, and in particular check for damaged packaging or potential contamination from other products (eg household chemicals).
- The receiving operator should note the time that the product leaves refrigerated transport, its temperature (ideally the temperature of the actual goods, not the air temperature or the temperature of the packaging) and the time that the product is returned to refrigerated storage according to its **NEVER WARMER**

**THAN** temperature. If the elapsed time is longer than the **MAXIMUM OUT OF REFRIGERATION** time, institute corrective action (see Section 6).

- Both transport operator and receiving operator should complete product unload movements as quickly as possible to minimize the out of refrigeration time.
- The receiving operator should move product from the receiving dock to refrigerated storage appropriate to the product's **NEVER WARMER THAN** temperature as soon as possible.
- BOTH transport and receiving operators should retain records as required by operator procedures.

### 9.3 Measuring temperatures at dispatch / receiving docks

Temperature measuring using non-destructive surface temperature devices and core temperature testing methods are discussed in Appendix 3 – Temperature Measurement.

Other non-destructive testing may include additional Cold Chain monitoring devices such as:

- Wireless based tags to monitor temperature fluctuations; and
- Heat Sensitive film on cartons or packaging that may indicate any cumulative product temperature abuse.

## SECTION 10 TRANSPORTATION

Transportation of Cold Chain Goods, whether by air, road, rail or sea, needs to be undertaken using vehicles and/or equipment designed and maintained for that specialised task. This goes beyond simple refrigeration, and can include elements such as corrugated floors to promote good/even air circulation, trailer insulation, door seals, brakes, insulated walls to create heat transfer barriers, and so on.

Like any physical asset that is hard working, assets have optimum efficient working life. The thermal efficiency of trailers, containers, diminishes with years of use, until operator replaces it with a more modern unit. It is therefore not surprising that there is often considerable temperature variation throughout any operating trailer, such that actual product temperatures differ significantly, to trailer/container return air temperatures. These product excursions can be microbiologically significant over delivery time. Ambient temperatures and journey durations, are also relevant to product cold chain compliance.

Beyond the mechanical considerations of the refrigerated asset above, are also the human operator considerations, including product load-out temperatures, load line compliance, keeping unit running at all times – sleep times, etc.

### 10.1 Transportation Guidelines

The guidelines for transportation operations are -

- Equipment maintenance is critical. Establish efficient defrost cycles for refrigeration units and insulated walls, floors and ceilings using thermostat devices. Manual defrost of a refrigeration unit should only be undertaken after unloading. Undertake regular calibration checks on refrigeration and sensor units. Check and maintain door seals regularly according to operator procedures.
- Transport vehicles are NOT expected to significantly reduce product temperatures. Products should be loaded at or near their transport temperature. Loading warmer products at best may create heat transfer issues (see Section 7) and at worst may create a microbiological hazard (if the transport vehicle's refrigerator, for example, is not able to bring the temperature down quickly enough to prevent spoilage).
- Place a temperature data logger or thermometer at the warmest part of the refrigerated space (usually at the top of a wall nearest the door). If using a thermometer, carry out periodic temperature verification checks as requested by operator procedures and manually record observed temperatures. Record observed temperature after product has been unloaded at each drop. (Wireless thermometers and data loggers are preferred as they do not require the refrigerated space to be opened in order to conduct temperature checks, and can usually sound an alarm, if a nominated temperature is exceeded. Multiple data loggers help measure through load temperature variability, which can exceed 5°C particularly in older assets.
- If the product temperature is higher than the owner's specification, take corrective action to maintain product safety and quality (see Section 6). Do

NOT assume that simply bringing a product's temperature back down is enough. Make contact with the manufacturer to identify whether further action needs to be taken.

- When loading products, be conscious of the need for excellent air circulation. Do not overload the refrigerated compartment and never load above the compartment's load line.

## 10.2 Distribution Vehicles

Distribution vehicles are used for the final delivery to the retail and or food service point of sale location. Such vehicles are often used for multi-delivery work and products may be at great risk of being subjected to temperature variation.

The additional guidelines for distribution vehicles are –

- Vehicles should be designed and operated with adequate refrigeration capacity to ensure that the temperature of products are maintained, taking into account the thermal mass of the load, the maximum loading and the air circulation space.
- Partitions should be provided to minimise the effect of product temperature drops and manage heat transfer issues in mixed loads.
- In general, loads should be organized to avoid intermingling of fresh, frozen and chilled food products on the same pallets during distribution runs. The exception to this is where validation tests have shown that the faster unloading of mixed pallets prevents more out-of-refrigeration-time issues (because doors are open for less time) than are created by the heat transfer risks of mixed pallets.
- Plan drop offs with a view to allowing sufficient time between drops for product to regain its **NOT WARMER THAN** temperature. While minimising the overall distance might seem more efficient, frequent stopping for deliveries poses significant risks of unnecessarily increasing refrigeration compartment air temperature.
- Keep compartment doors closed as much as is possible. For example, do not leave the doors open when wheeling product into stores. Close the door first and then wheel the product into store.
- Plastic strips, insulated containers and secondary doors are also good measures to reduce heat-gain in sensitive goods during door openings.

## 10.3 Unrefrigerated Vehicles

Vehicles not designed to carry Cold Chain goods are not recommended to distribute fresh, chilled or frozen foods. However, it is not always possible for small businesses in particular to have such vehicles for distribution of their Cold Chain products.

If any business uses an unrefrigerated vehicle for the transport of chilled and frozen products (for example, for quick runs between sites) then it must be established that this does not compromise the safety or quality of the product. In particular -

- The product must be at or below the **NEVER WARMER THAN** temperature prior to dispatch
- The trip time must not exceed the **MAXIMUM OUT OF REFRIGERATION** time limit
- The product should be transported in an insulated container
- Where possible, temperatures around the product should be logged and recorded by data loggers or using a manual thermometer
- The product must be returned to appropriate refrigerated storage as soon as possible at its destination.
- Records of the journey should be kept noting the starting temperature and the time when the **NEVER WARMER THAN** temperature was recovered at the destination. (which is NOT the time of delivery, but the time the product has cooled down after being returned to refrigerated storage).

## SECTION 11 STORAGE AND WAREHOUSING

The key issues for Cold Chain products during storage are air circulation, temperature control and record keeping. Each requires procedures that must be continually validated and audited to make sure they are achieving their intended effect of maintaining store Cold Chain product within their assigned Cold Chain conditions.

Staff training is a critical issue to ensure staff are able to correctly respond to alarms, identify issues and institute corrective action (see Section 6). Warehouse staff should be encouraged to be proactive in checking and providing information about storage conditions to the relevant personnel within the business.

### 11.1 Air Circulation Warehousing

The guidelines for proper air circulation are –

- Do not over-pack the storage area. Cold storage operators should always follow operator policies and equipment recommendations to allow adequate air circulation around packed product on floor stacks, in ante-rooms and/ or on racking to ensure the even distribution of cold air, and control of product temperature. The default rule is that **products should be kept a minimum distance of 15 centimeters from walls and floors and 60 centimeters from ceilings.**
- Never store product in direct physical contact with walls, floors or ceilings.
- Where product is located underneath refrigeration compressors, adequate measures should be in place to protect stock from damage due to water from defrost systems.

### 11.2 Temperature Control

Achieving and controlling the appropriate temperature is essential when storing chilled foods. Accurate thermometers or data loggers (+/-1°C) placed in the warmest part of the facility (usually near doors) should be used to help maintain the proper environment in the cold store or warehouse. All thermometers should be calibrated regularly (at least annually). See Appendix 3 - Temperature Measurement for more information.

To control cold store temperatures effectively:

- Minimise air temperature variation to avoid reduction in quality and reduction in useable shelf life of product;
- Minimise door openings and/ or traffic movement in and out of the cold store;
- Take prompt steps to reduce the product temperature should any increase occur;

- Ensure defrost cycle systems are adequately designed and that alarms are in place and will be triggered to ensure prompt and auditable corrective action will be taken;
- Conduct regular checks to ensure alarms, compressors, defrost cycles, thermostats and cooling towers are running safely and in good working order;
- Ensure that any damaged walls and door seals that could leak cold air out and allow hot ambient air in are promptly repaired; and
- Ensure optimum stacking patterns and floor layout to facilitate airflow.

### 11.3 Record keeping

Continuous data logging from calibrated sensors is the preferred approach for cold storage. In less critical, short term or smaller business operations, monitoring must be sufficiently frequent to detect trends, and in particular malfunctions, in temperature control. At a minimum, temperature readings must be at least twice daily.

Records of cold store temperatures must be retained for later reference according to operator procedures.



## SECTION 12 RETAIL OUTLETS

A key stage of the Cold Chain is the management of chilled and frozen foods on the premises of the retailer when selling to consumers. Retailer loading docks and cold storage should be maintained according to Sections 9 and 11. This section relates to the preservation of Cold Chain conditions at point of sale to consumers.

End of Cold Chain businesses such as retailers and caterers will also need to include in their food safety plans appropriate measures to ensure the microbiological safety of the food, bearing in mind the food legislation offence provisions, the mandatory requirements in Standard 1.6.1 of the Australia New Zealand Food Standards Code and the commodity advisory limits in the User Guide to that Standard.

A point that is perhaps obvious is that chilled and frozen Cold Chain foods must NOT be sold from ambient (unrefrigerated) displays. Along the same lines, non-frozen foods must not be placed in freezer displays due to heat transfer concerns (see Section 7).

### 12.1 Managing Refrigerated Food Retail Display Cabinets

Retail-refrigerated display cabinets may not be as effective as dedicated cold stores in the maintenance of product temperature due to frequent movements of ambient air into the units and more frequent defrost cycles.

#### Display Cabinets

The guidelines for refrigerated retail display cabinets are –

- All refrigerated food display units (typically called coffins and/ or display cases) must be marked with a maximum holding product load line. This applies whether the food display unit is horizontal (bin or chest type) or vertical in design
- Products must NEVER be stocked in excess of the load line limitation, and excess stock should be returned to the cold room in the original outer container. Loading products above the load line will seriously affect product temperature, impact on efficiency of defrost cycle systems and quickly prejudice product safety and quality
- Loading of product in freezers or refrigerator cabinets should take into consideration the need to facilitate even air circulation within the cabinet to maintain product temperature and to provide ease of access to product for customers
- Display cabinet doors should be self-closing as far as possible – night covers can help reduce energy costs
- Display cabinets must have a temperature display (and ideally a manual backup thermometer) placed in the warmest part of a display (usually near the door) with an alarm to indicate if temperatures have exceeded the set maximum

for more than a set time (to prevent the alarm sounding every time the door is opened!)

- The design of retail display cabinets should allow for cleaning, maintenance access and the potential for product spillage and breakage. Product spills and breakage are a potential source of contamination of other products in the cabinet, and liquids spilled in the cabinet have the potential to block drainage holes and reduce the efficiency of the unit.

### Loading display cabinets

Consumer packs are very sensitive to temperature. To avoid potential safety or quality concerns, products must be placed into display cabinets as soon as possible after leaving the cold store. In particular –

- Retail display cabinets maintain temperatures but are not designed to significantly lower them, so have product at or below its **NEVER WARMER THAN** temperature prior to removing it from cold store
- Product **MUST NOT** be left unattended when loading retail display cabinets
- Any price marking should take place in the cold store rather than on the shop floor
- Do not pick temperature sensitive foods, such as frozen foods and ice creams, together with ambient or chilled foods, but selected only a small load to be transfer directly to the display cabinet to prevent severe quality loss
- Frozen foods, and particularly ice cream and ice confection should be picked and placed in the frozen display cabinet directly to ensure **MAXIMUM OUT OF REFRIGERATION** limit of 20 minutes is maintained and to adhere to **NEVER WARMER THAN** rule -18C
- Put chilled 'high risk' potentially hazardous foods (e.g. pre-mixed salads, sprouts, dips) into retail display cabinets immediately to ensure the loading does not breach the **NEVER WARMER THAN** rule
- Use stopwatches on pallets or trolleys to ensure applicable **MAXIMUM OUT OF REFRIGERATION** time limits are observed from the time the product leaves the cold store until it is loaded into the display cabinet.

### Location of display cabinets

Cabinet manufacturers publish strict guidelines for retailers on where to locate and how to maintain refrigerated food retail display cabinets. Properly designed and positioned display cabinets are more efficient, maintain more consistent temperatures, and reduce electricity costs.

Display cabinet manufacturers need to be consulted when

- Setting the optimum defrost management systems
- Setting air intake threshold levels during operation
- Developing alarm management and corrective procedures.

Check:

- The intended design and location for an open display cabinet has accounted for the 'worst case' relative humidity and ambient air temperature conditions (i.e. most display units are built only to support maintenance of product where air temperature reaches a maximum of +25°C and a maximum relative humidity of 65 per cent);
- The intended location is not subject to draughts from nearby docks or door entries and or abnormal heat radiation from electrical equipment or other compressors; and
- Product temperature is being adequately maintained throughout the whole day, and thereby quality and safety is not compromised during planned cabinet defrost cycles.

Avoid:

- Draughts and air currents that can be created by open doors, ventilation or air conditioning grills;
- Excessive radiant heat that can be created by direct sunlight and heating appliances; and
- Placement of signs, tags, debris and stock handling practices that could restrict airflow at inlet and outlet vents of the cabinet.

It is desirable to locate refrigerated display cabinets so as to encourage customers to make chilled and frozen products their last purchases.

## 12.2 Further Processing

Further processing must be included as part of the food safety program which typically incorporates HACCP principles for all products and processes. If the temperature of the product has risen after the further processing is completed, re-cool the product to +4°C as quickly as possible, preferably in a cool room, prior to placing in the retail display cabinet.

If **chilled foods** are subjected to further processing at the retail level (for example slicing, decanting, portioning or repacking), they should be handled at +4°C or colder to ensure that the product temperature is NEVER WARMER THAN +5°C during the further processing stage.

Where **hot foods** are being cooled for the purpose of storage and/or transport for later reheating, consideration must be given as to whether the food is able to support the rapid growth of microbes associated with food borne illness. Such foods are required to be cooled-

- Within two hours – from +60°C to +21°C; and
- Within a further four hours – from +21°C to +5°C.

If using a cold room to achieve this chilling process –

- The chilling process must be validated and confirmed to ensure that the cold room can effectively meet these requirements, or if alternatives such as the use of a blast cooling tunnel are needed.
- Consideration must also be given to the heat transfer issues and the potential impact on other foods inside the cold room (see Section 7)
- The risk of liquid leaking during the chilling process should be addressed by using suitably designed trays to capture any leaked fluids and prevent cross-contamination (metal trays will help to cool product faster than plastic trays).

The AIFST's Cook Chill for Foodservice and Manufacturing: Guidelines for Safe Production, Storage and Distribution (Blue Book) provides detailed information on good practice for cook-chill operations.

When **frozen food is thawed**:

- Follow the manufacturer's instructions carefully
- Thaw in a refrigerator at a temperature at or colder than +4°C to ensure that the product temperature is NEVER WARMER THAN +5°C
- Use appropriate drip trays to avoid cross-contamination that could lead to food safety or quality concerns in surrounding food.

### 12.3 Surveillance issues

Retail staff and managers should be trained to identify and manage any indications of a breach in the Cold Chain conditions. Retailers should have clear procedures in place to deal with potential safety and quality issues, such as removing product from sale for assessment (see Section 6).

Always use written procedures as a basis for regular staff training. Procedures should especially document the appropriate actions and record keeping in relation to emergency procedures such as retail display cabinet failures, power failures or other unforeseen circumstances.

As described in Section 6, manufacturers should be consulted about the continued acceptability and safety of the product if and when any breach in the Cold Chain Conditions occurs.

## SECTION 13 RETAILER HOME DELIVERIES

Where customer home delivery or collection is provided by a retail outlet, Cold Chain operations must continue through the delivery process. In particular –

- (1) Pickup or collection areas should be treated as dispatch areas (see Sections 7 and 11) and observe **MAXIMUM OUT OF REFRIGERATION** time conditions
- (2) Delivery trucks should be treated as transport vehicles (see Sections 7 and 9)
- (3) Packing should observe the following rules –
  - Frozen foods should be packaged separately, insulated from the environment, and marked with the storage condition **NOT WARMER THAN -18° C**
  - Chilled foods should be packaged separately, insulated from the environment and marked with the storage conditions **NOT WARMER THAN 5° C and KEEP ABOVE 0° C**
  - Potentially hazardous non-food items, such as household chemicals, should always be separated from food packages into specially marked bags.
- (4) Times and temperatures should be logged and recorded in relation to –
  - Collection area receipt of goods, including receipt temperature and any out of refrigeration time
  - Collection area temperature logs for freezer and refrigerated area spaces
  - Collection area dispatch of goods time and any out of refrigeration time
  - Delivery vehicle temperature logs
  - Delivery vehicle departure time and delivery times.

Retailers should detail the above steps in their handling procedures, validate their efficacy, train operating staff in cold chain handling and undertake audits to check compliance. Training in particular should address procedures to be used in the event that a breach in Cold Chain Conditions is detected or suspected.

## SECTION 14 FOOD SERVICE INDUSTRY

Food service involves the preparation of food for immediate consumption out of home or at home (take away). Typical food service outlets include canteens, hospitals, airlines, restaurants, kiosks, sandwich and salad bars, and quick service restaurants.

Food service operators need to include in their food safety plans some measures to ensure the microbiological safety of the food, bearing in mind the mandatory requirements in Standard 1.6.1 of the Australia New Zealand Food Standards Code and the commodity advisory limits in the User Guide to that Standard. Some jurisdictions require key food service businesses providing food to the vulnerable groups to document and implement food safety programs, which include issues related to the Cold Chain.

### 14.1 Food Service Guidelines for Cold Chain Foods

Food service operators need to consider –

- Delivery guidelines (Section 11)
- Storage guidelines (section 10)
- Meeting Cold Chain Conditions (Sections 2-5)
- FEFO stock rotation rules (section 5)

Tips for food service operators include –

- Storage facilities should have sufficient space to allow control and rotation of stock.
- Allow sufficient air circulation around refrigerated facilities (including inside cold rooms and display cabinets) to ensure effective temperature control is maintained at all times. Overcrowding creates significant risks of heat transfer (see Section 7).
- Chilled and frozen foods should be well wrapped and sealed before being placed in, or returned to, storage.
- Be vigilant in storing cooked or ready to eat foods away from any contact with uncooked foods, including drips. Store the cooked food high and the raw food low.
- Never display chilled or frozen foods outside refrigerated cabinets.

All refrigerated storage facilities should ideally be equipped with BOTH temperature loggers (or manual recording procedures) and an easy-to-read thermometer, with at least one linked to an alarm system. Ensure the accuracy of thermometers through annual (or more frequent as instructed) calibration, and record calibration dates. Retain temperature logs for an appropriate period (at least 3 and ideally 12 months).

When looking at refrigerated storage and freezers, remember to:

- Locate any temperature sensing element in the *warmest* part of each facility (often near the entrance doorway) and check and record the temperature frequently;
- Avoid excessive build-up of frost, and use defrost cycles recommended (protect product during defrosting and, if necessary, move contents to another appropriate facility so the temperature control is maintained);
- Remove from storage only the amount of food required for immediate use;
- Minimise the time a product spends outside refrigerated temperatures – this must be determined as part of a food safety program typically based on HACCP principles for the product; and
- Isolate any product identified as no longer meeting the safety and/ or quality standards for assessment and possible rejection.

Each refrigerated food display cabinet must have a means by which the temperature can be monitored and recorded, and it is wise (and in some cases required) to have a working backup thermometer.

Never load products into a refrigerated display cabinet if cabinet temperature is warmer than:

- +4°C for chilled foods to ensure the product temperature is NEVER WARMER THAN +5°C unless otherwise specified; and
- -18°C for frozen foods and ice cream.

If chilled foods are subjected to further processing in foodservice (for example slicing, decanting, portioning or repacking), maintain the product temperature at +4°C or colder to ensure that the product temperature is NEVER WARMER THAN +5°C during this further processing stage. **Further processing must be included as part of the food safety program which typically incorporates HACCP principles for all products and processes.**

## 14.2 Corrective Actions

If the temperature of the product has risen above its NEVER WARMER THAN Cold Chain Condition, including during further processing, refer to Section 6.

## 14.3 Thawing Frozen Food

Frozen food should be thawed:

- According to the manufacturer's instructions;
- In a refrigerator at a temperature at 0°C to +4°C to ensure that the product temperature is NEVER WARMER THAN +5°C; or

- In a microwave oven or in conventional cooking equipment where thawing is immediately followed by cooking.

## SECTION 15 CONSUMER EDUCATION

Consumers play an important, but often overlooked role in maintaining Cold Chain Product safety and quality.

Cold Chain participants should, to the extent possible and practicable, educate and encourage consumers to –

- select frozen and chilled products last during their shopping;
- process frozen and chilled products first at checkouts (whether full or self-service);
- pack frozen and chilled products into separate insulated “cooler” bags or containers, and keep separate from ambient temperature goods;
- minimise time from checkout to home storage (eg have a cup of coffee before grocery shopping, not afterwards);
- unpack frozen and chilled foods first on arriving home;
- set home refrigerators to +3 to +4°C and freezers at -18°C;
- use simple thermally sensitive temperature strips or freezer thermometers to verify temperature in actual operation, and adjust settings each season;
- minimise the frequency and duration of opening fridge or freezer doors (this will save energy costs far more than using a higher temperature setting as well as minimise temperature fluctuations); and
- follow manufacturer instructions relating to durable life, storage, handling (especially in relation to thawing of frozen goods) and usage.

The US FDA has published a chart for the home storage of perishable foods that can be downloaded from:

<http://www.fda.gov/Food/FoodborneIllnessContaminants/PeopleAtRisk/ucm109156.htm>



# APPENDICIES

## APPENDIX 1: Useful Links

### Foods Standards Australia New Zealand (FSANZ)

FSANZ is a bi-national Government agency responsible for the development of the Australian New Zealand Foods Standards Code. The Code lists requirements for foods such as additives, food safety, labelling and genetically modified foods. Enforcement and interpretation of the Code is the responsibility of state and territory departments and food agencies.

<http://www.foodstandards.gov.au>

### Microbiological Standards

Standard 1.6.1 of the Food Standards Code specified Microbiological Limits for Food.

<http://www.comlaw.gov.au/Series/F2008B00630>

### Predictive Microbiological Models

For detailed analysis of specific foods and potential spoilage or food poisoning expert advice should be sought. References and predictive models available include:

- ComBase - <http://www.combase.cc/index.php/en/>
- Pathogen Modeling Program - <http://www.ars.usda.gov/services/docs.htm?docid=6786>
- Growth Predictor & Perfringens Predictor - <http://www.ifr.ac.uk/safety/growthpredictor/>
- Seafood Spoilage Predictor Software, Danish Institute for Fisheries Research <http://sssp.dtuaqua.dk/>
- Sym'Previous - <http://www.symprevious.net/> .

### International Food Safety Regulatory references for Australian Export Food compliances – US FDA, FSMA/STFA

- <http://www.fda.gov/Food/GuidanceRegulation/FSMA/ucm383763.htm>

### Food Allergy Risks and VITAL

The Food Industry Guide to *Allergen Management and Labelling* guide provides advice on allergen management with specific reference to storage, distribution and manufacturing process controls and should be taken into account when considering risks associated with cross contact.

These controls include management of allergenic materials upon receipt at plants requiring segregation and prevention of cross-contamination where spoilage or damage occurs. In manufacturing, the use of VITAL 2.0 (Voluntary Incidental Trace Allergen Labelling) risk-based assessment methodology tool should be adopted to ensure good manufacturing practices, monitoring systems and scheduling production runs take into consideration all elements of allergen cross contamination.

[www.allergenbureau.net](http://www.allergenbureau.net).

### **Crisis Management and Product Withdrawal / Recall**

The protection of the health and safety of consumers is a fundamental requirement and a legal obligation of all companies involved in the production and sale of food and grocery products. Suppliers and retailers must take every precaution to ensure products are safe, of the highest quality, and that labelling information assists consumers in making an informed choice. However, on rare occasions, problems sometimes occur which require the recall or withdrawal of products which fail to meet these requirements.

The notification of recalls and withdrawals with key trade partners and regulators is an essential element of any integrated recall plan. The method of formal notification of recalls and withdrawals is a decision determined by the recipients, options available include:

The AFGC has developed a Crisis Management Guide to assist companies in developing their own specific crisis plans and integrated recall plans.

Crisis Management Guideline [www.afgc.org.au](http://www.afgc.org.au)

GS1 Recall [www.gs1au.org/our-services/recall](http://www.gs1au.org/our-services/recall)

Recall /Withdrawal Form [www.afgc.org.au](http://www.afgc.org.au)

### **Logistics Delivery Safety - Chain of Responsibility (CoR)**

Businesses that consign, pack, load or receive goods can be held legally liable for breaches of road transport laws. This is the 'Chain of Responsibility' (CoR).

The aim of CoR is to make sure everyone in the supply chain shares equal responsibility for ensuring breaches of road transport laws do not occur. Under CoR laws if you exercise (or have the capability of exercising) control or influence over any transport task, you are part of the supply chain and therefore have a responsibility to ensure road transport laws are complied with. This includes –

- Mass (distributed weight of goods on trucks);
- Dimensions (truck design);
- Load restraint (how goods are protected so as not to be damaged and travel safely);
- Driver fatigue mitigation (using Safe Trip Plans); and
- Vehicle maintenance requirements.

For further information visit:

National Heavy Vehicle Regulator <https://www.nhvr.gov.au/>

Australian Logistics Council <http://austlogistics.com.au/>

Refrigerated Warehouse and Transport Association of Australia <http://www.rwta.com.au/>

### **Dangerous Goods – Road and Rail**

The Australian Dangerous Goods Code sets out the requirements for transporting dangerous goods by road or rail. The National Transport Commission (NTC) publishes the Code known as ADG7.

<http://www.ntc.gov.au>

## Dangerous Goods – Maritime

The International Maritime Organisation (IMO) is the United Nations specialised agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships. The IMO developed the International Maritime Dangerous Goods (IMDG) Code as a uniform international code for the transport of dangerous goods by sea covering such matters as packing, container traffic and stowage, with particular reference to the segregation of incompatible substances. <http://www.imo.org>

## APPENDIX 2: Microbiological Growth Supplementary Information

*Standard 1.6.1 – Microbiological Limits for Food* - lists the maximum permissible levels of foodborne microorganisms that pose a risk to human health in nominated foods, or classes of foods. This Standard includes mandatory sampling plans, used to sample lots or consignments of nominated foods or classes of foods, and the criteria for determining when a lot or consignment of food poses a risk to human health and therefore should not be offered for sale, or further used in the preparation of food for sale.

<http://www.comlaw.gov.au/Details/F2012C00862>

The microbiological tables below illustrate how microbial growth rates vary according to storage temperature and the difference that only 1°C can make to the growth rates of microorganisms. Minimum temperatures at which food pathogens are known to grow are provided for further information.

**Table 1: Indicative minimum temperatures for microbiological growth**

MICRO-ORGANISM	INDICATIVE MINIMUM TEMPERATURE (°C)
<i>Yersinia enterocolitica</i>	-1.8*
<i>Listeria monocytogenes</i>	0
<i>Clostridium botulinum</i>	3.0
<i>Bacillus cereus</i>	4 – 5
<i>Aeromonas species</i>	<5
<i>Escherichia coli</i>	7 – 8
<i>Salmonella species</i>	7
<i>Staphylococcus aureus</i>	7
<i>Vibrio cholera</i>	<10*
<i>Shigella species</i>	10*
<i>Clostridium perfringens</i>	6
<i>Campylobacter jejuni</i>	30.5

Source: *Foodborne Microorganisms of Public Health Significance, 6<sup>th</sup> Edition*, March 2003, published by the Food Microbiology Group of the Australian Institute of Food Science and Technology (AIFST) Inc.

The indicative minimum temperatures specified in Table 1 vary by both the strain of organism and the food matrix. Even within a single species, there can be variations in minimum growth temperatures. Foods with preservatives added, or with reduced water activity, or at reduced pH levels will allow growth at minimum temperatures that are a little higher than those indicated.

**Table 2: Growth Characteristics of Cold Tolerant Pathogens**

	TEMP °C	DOUBLING TIME (HRS)
<i>Aeromonas hydrophilia</i>	1	-
	3	10.594
	4	8.404
	5	6.726
	7	4.424
<i>Clostridium botulinum</i>	1	-
	3	-
	4	23.143
	5	16.028
	7	8.106
<i>Listeria monocytogenes</i>	1	37.968
	3	24.052
	4	19.335
	5	15.646
	7	10.452
<i>Yersinia enterocolitica</i>	1	13.808
	3	10.068
	4	8.654
	5	7.470
	7	5.640

The data presented in Table 2 is derived from the mathematical modelling program, based on growth conditions with a sodium chloride content of 0.5 per cent, a water activity of 0.995, a pH of 6.5, a carbon dioxide content of 5 per cent.

<http://www.combase.cc/index.php/en/>

This data is provided to demonstrate that for all of the organisms at the static temperatures above, the number of hours required to double in number diminishes rapidly above +4°C.

## APPENDIX 3: Temperature Measurement

Food safety programs should include clear guidance on the measurement methods and techniques; calibration; critical control points; equipment usage and corrective action for the safe and accurate measurement of product and processes along the Cold Chain.

All industry sectors need to be aware of their own industry's regulations before they implement a temperature-testing regime.

*“A food business must, at food premises where potentially hazardous food is handled, have a temperature measuring device that –*

- (a) is readily accessible; and*
- (b) can accurately measure the temperature of potentially hazardous food to +/- 1°C”*

*Source: Standard 3.2.2 Food Safety Practices and General Requirements in Division 6, clause 22*

Due to the importance of temperature control for the protection of product safety and quality, the accuracy and implementation of temperature measurement techniques are crucial. The following are some considerations:

- Suppliers should consult the customer to ensure that product can meet in-house temperature specifications at the customer's site
- Outer carton surface temperature must not be relied upon to determine the temperature of the product contained inside e.g. outer packaging can rise to a higher temperature after removal from cold storage or outer packaging exposed to a burst of colder air could register a lower temperature.
- Critical control points along the supply chain, such as receipt of goods, should be documented and quality systems implemented accordingly,
- Non-compliance with stated temperature requirements should result in further action
- Trained operators with knowledge of the required techniques to correctly use measuring devices should conduct the procedure,
- Where the Cold Chain has not been maintained, more samples and more stringent techniques may be necessary. This could include opening and testing of more products and assessing core temperatures with temperature probes.
- Businesses should have documented procedures or routines that allow for primary and additional checking where necessary.
- Always use calibrated, reliable, accurate thermometer with a short response time.

- Always ensure that the thermometer being used for core temperatures is cleaned and sanitized (such as using anti-bacterial wipes), so that the temperature testing process does not itself contaminate the food.

### Temperature Measuring Technology

The Guidelines call for the measurement of ‘temperatures’ and ‘times’ and the responsible recording of same, for immediate or later action, or, subsequent Auditing – internal or external, domestic or export.

A simple hierarchy of technology approaches to this critical task is detailed to help facilitate ones compliance with the Guidelines, and, continuous improvement of product safety, wastage, recall outcomes, for ultimate consumers’ cold chain products. The listing is not exhaustive or prescriptive, but aims to provide directional framework for appropriate technology selection, for situations.

#### Steps:

- |   |                              |
|---|------------------------------|
| 1. Measurement versus Monitoring  | eg. Spot reading vs. history |
| 2. Asset level, or Product level, or Both   | Trailer/Container or Product |
| 3. Domestic, and/or Export  | Product to go export/FDA     |
| 4. Product or Solution – manual or automatic  | Hardware or +software        |
| 5. Time/Temperature Indicator (qualitative), or, Temperature Measurement (quantitative) |                              |
| 6. Returnable/recalibrate, or, non-Returnable-single trip                               |                              |
| 7. Responsiveness – post product delivery; in-transit – near real-time                  |                              |

#### Parameters:

- Temperature – accuracy, precision, reliability, ruggedness
- Time/date
- Identity – traceability – GS1
- Alerts, early recalls
- Location history
- Data storage, retrievability – records
- Data interface with enterprise ERP/WMS

#### Relevant Technology Trends to more:

- Wireless interfaces – easier downloads
- Connectedness – internet - online
- Responsiveness – real time
- Collaboration with cold chain partners, insurance settlements
- Databases and Data Mining, Analytics

#### Some examples:

**Data Loggers** - A range of temperature data-logger devices are available. Such devices are flexible in their operation, recording and some providing information direct to an alarm management system.

**Digital Thermometers** - A flat blade or needle probe is sometimes the selected temperature-measuring device

**Bi-metal Thermometers** - A bi-metal dial thermometer may be suitable.

**Glass Thermometers** - Mercury-in-glass or alcohol-in-glass thermometers pose a potential hazard due to possibility of glass contamination.

**Infra-red (non-contact) Surface Temperature Thermometers** - can be a fast way to take spot product surface temperatures without having to open the case or damage product. Be aware that measuring the temperature of outer packaging is indicative only of the temperature of the product inside, and they can suffer from abuse and calibration issues

**Data devices from new technologies** – Emerging technologies includes active or passive RFID tags to monitor product temperature fluctuation history. Higher end, robust and reliable, wireless sensor network based, online monitoring solutions embracing product traceability, are available

**Time Temperature Indicators (TTIs)** are available that provide ‘indication’ rather than quantitative measurement, which can be helpful, particularly at package monitoring level. Typically these are based on heat sensitive film on packaging that highlight cumulative temperature abuse

## Calibration

Calibration is the procedure whereby equipment used for measurement is checked to ensure it provides accurate readings.

*“Temperature measuring devices’ states that ‘A food business must, at food premises where potentially hazardous food is handled, have a temperature measuring device that can accurately measure the temperature of the potentially hazardous food to +/-1°C.”*

*Source: Standard 3.2.2 – Food Safety Practices and General Principles in clause 21*

Where a business relies on the accuracy and consistency of equipment to measure a process that is critical to the trade of those goods, it is necessary that the measuring instrument is accurate. This applies to the temperature of goods along the value chain.

Periodically calibrate temperature measuring equipment including:

- Product data loggers, digital thermometers, infra-red surface thermometers;
- Freezer and chiller time and temperature recorders;
- Fixed thermometers in chillers, freezers, trucks and display cabinets, and portable units;
- Asset Compressor units, including vehicles’ Partlow recorders – return refrigerated air temperatures should not be used, as accurate indicators of actual product temperatures. Depending on many human and equipment factors, product temperatures regularly vary by >5 °C, with asset return air temperatures.

Businesses should have corrective action plans to deal with product test problems and instructions outlining how to initiate prompt repairs, replacements or alternate temperature testing equipment. Records of calibration should be kept as proof that the equipment was working accurately at all times.



**CRITICAL CONTROL POINT RECORD**

**CCP #:**

**CHECK TEMPERATURE HISTORY:**

**CRITICAL LIMIT:** Acceptable temperature to maintain product safety as established in GMP/GDP/Guidelines

**CORRECTIVE ACTIONS:** Report deviation to supervisor

Date	Time	Recorded temp. °C	Corrective Action/s	Verified/Name	QA Supervisor / Initials

**Reviewed By:**

**Date:**

## APPENDIX 4: Glossary of Terms

<b>Food Standards Australia New Zealand</b>	The federal body responsible for developing national food laws
<b>Audit</b>	A systematic examination of a system to determine whether procedures that have been introduced are being followed and to ensure that the system achieves its aims.
<b>Chain of Responsibility</b>	Heavy Vehicle Transport regulations are nationally being developed across Australia with state authorities to set the agreed standards on Mass, Dimensions, Load Restraints, Driver Fatigue and Vehicle Maintenance.
<b>Chilled Food</b>	Cold Food (less than +5°C), but not frozen.
<b>Cold chain</b>	A series of interdependent operations engaged in manufacturing, transporting, storing, retailing and serving refrigerated food.
<b>Cold store</b>	A food storage premise used for storing refrigerated food (chilled or frozen).
<b>Control Point (CP)</b>	Any point in a process where an aspect of the process can be controlled. See also Critical Control Point.
<b>Corrective action</b>	The action to be taken when the results of monitoring indicate a loss of control, or a step taken to correct a process and bring it and the product back under control.
<b>Critical Control Point (CCP)</b>	A point, step or procedure at which control can be applied and a food safety hazard can be prevented, eliminated or reduced to acceptable limits. A point in a process where loss of control may lead to a food safety problem and harm to the consumer. Auditable
<b>Critical limit</b>	The criterion, which separates acceptability from unacceptability. The tolerance limit that must be met to ensure the food is produced safely.
<b>Dangerous Goods</b>	Dangerous Goods handling is covered under the Australian Dangerous Goods Code (version 7 called ADG7). This provides requirements for Transporting of dangerous/hazardous goods using placard signage where the transport of such goods from warehouses to retail outlets has manifests that exceed aggregate quantity of 2000kg(L) of dangerous chemicals' in total on the delivery. See Chapter 7.3 of ADG7 Code for Retail Distribution Loads information
<b>Export Foods</b>	The Guidelines are relevant to Australian food products sent into its valuable and growing export markets. This is particularly so given Australia's 'clean/green' competitive

advantage, and, the food safety consciousness, of its international consumers, and their Governments' regulatory barriers to entry, of ANY unsafe foods. As the quality of all Australian export food is ultimately a direct function of its cold chain integrity, these Guidelines require adherence, and continuous improvement,

<b>Food</b>	A substance or matter used or capable of being used as food or drink, or intended for or represented for human consumption, including drinks, food additives, processing aids and any other substance regulated by the Food Standards Code.
<b>Food business</b>	A business carrying on a food operation for the purpose of sale of food.
<b>Food premises</b>	Premises, including vehicles, kept or used for a food operation.
<b>Food Standards Code</b>	The collection of Standards adopted into legislation in State, Territory and in part by New Zealand, governed through the Commonwealth of Australia Food Standards Australia New Zealand Act 1991 (the FSANZ Act). The standards contained in the <a href="#">Australian New Zealand Food Standards Code</a> are legally binding to all food premises in Australian jurisdictions.
<b>Frozen Food</b>	Food at a temperature of less than or equal to -18°C.
<b>Hazard Analysis and Critical Control Point (HACCP)</b>	An internationally recognised prevention-based risk management system that identifies, evaluates and controls hazards for food safety outcomes.
<b>HACCP audit table</b>	The plan that lists in one table all the process steps, the control measures, critical limits, monitoring and corrective actions of a HACCP plan.
<b>HACCP plan or Food Safety Program</b>	The whole plan for making safe food that incorporates and applies the seven principles of HACCP. This includes the HACCP audit table, flow charts, raw material and product specifications and other supporting information.
<b>Hazard</b>	The potential to cause harm. Any microbial, chemical or physical property that can pose a risk to food safety.
<b>Perishable food</b>	Food liable to perish or be subject to decay or deterioration. (Fresh food sometimes used to describe - retailers)
<b>Potentially hazardous food</b>	Food that has to be kept at certain temperatures to minimise the growth of any pathogenic microorganisms

that may be present in the food and to minimise the formulation of toxins in the foods. Almost all food contains low levels of such microorganisms, their growth only ‘controlled’ by good cold chain practice.

**Product Recall**

If the cold chain is broken with potential microbiological food borne illness for the ultimate consumer, it is important to take appropriate Product Recall action as early as possible – pre-retail sale, is always less expensive in reputation and dollars, than post sale and recovery. See the FSANZ website and GS1 Recall-net for more information.

**Product Withdrawal**

Product withdrawal means halting and reversing distribution of goods through the supply chain, without notifying or recalling product from consumers, for reasons other than health and safety. Poor cold chain handling can trigger a product withdrawal if the quality of goods has been compromised.

**Quality (food)**

Desirable characteristics in food that may not be related to food safety issues. For example, colour, size, texture, nutrition and weight.

**Ready-to-eat**

Food that is ordinarily consumed in the state in which it is sold.

**Refrigerated**

Stored at or below a temperature of +5°C. Frozen foods would also fall into this category for the purposes of these Guidelines.

**Safe food**

Food that will not cause harm to a person who consumes the food when it is prepared, stored and / or eaten according to its intended use.

**Sale**

Supply for human consumption, including bartering, supplying for sale, giveaway’s, selling for money or gratuities, and so on.

**Stored**

Food or other items put away as a supply for future use.

**Traceability**

Traceability of all food consignments is paramount in all international food safety protocols, down to product level, at least. GS1 is the most universally accepted traceability coding systems.

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