Manual on Food Packaging

for Small and Medium Size Enterprises in Samoa

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for Small and Medium-Size Enterprises in Samoa

Prepared with the cooperation of the
Small and Medium Food Enterprises in Samoa
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About this manual

This manual was prepared under funding support by FAO Technical Cooperation Programme project TCP/SAM/3203. It is based on consultation with a number of small and medium size enterprises (SMEs) in Samoa during July 2012.

The layout is such that specific packaging information is included in the first chapter, while the second chapter relates to findings in Samoa and highlights points where there is common ground. The third chapter builds on chapter two and suggests strategies for consideration by SMEs.

It has been the intention to include a number of areas where quality can be improved and maintained inexpensively and with it a closer match between packaging, shelf-life and consumer expectation. The ultimate aim is to enable processors to select the most appropriate packing for their products and thereby become more profitable and successful in both local and export markets.

It is to be recognised that the packaging industry is very dynamic and new combination of components are becoming available on a frequent basis and thus this only reflects the current state of packaging and would need periodic updating.

All comments and feedback are welcome and should be sent to dirk.schulz@fao.org and beyer@connect.com.fj.

Acknowledgements

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Thanks to all the overseas packaging suppliers who responded to requests for information although they have universally avoided committing their companies to costs without formal requests for quotations – unfortunately this aspect must be left to the SME operators. Those responding have been listed in the text. In addition gratitude is extended to those who gave their time to attend the feedback workshop (tabulated on page 4) and who contributed to the refinement of this manual.

Finally, many thanks to the FAO Sub-Regional Office for the Pacific Islands for initiating and supporting the work, in particular the Food Safety and Nutrition Officer, Dirk Schulz for technical comments throughout the project, as well as editing this manual.

Glossary

BO	Biaxially oriented film that is simultaneously stretched in two directions as they are extruded
Codex Alimentarius	International food code, including food standards, guidelines and codes of practice to protect the health of the consumers and ensure fair practices in the food trade
FAO	Food and Agriculture Organization of the United Nations
FSANZ	Food Standards Australia and New Zealand
HACCP	Hazard Analysis of Critical Control Points
ISO	International Standards Organisation
Laminate	Flat sheet of plastic material that may contain one or multiple components
LDPE	Low density polyethylene
Metallised	Aluminium added to an existing film
Monomers	Single chemical units that make up polymers
PES	Polyester
PET	Polyethylene terephthalate
PE	Polyethylene
Polymer	A substance that is comprised of long chains of chemical units that give plastics their sheet structure
PP	Polypropylene
PS	Polystyrene
PVDC	Polyvinylidine chloride
PVCVC	Polyvinyl chloride – vinylidine chloride
SAME	Samoa Association of Manufacturers and Exporters
Saran	PVDC with a range of monomers incorporated
SMEs	Small and Medium Size-Enterprises
SROS	Scientific Research Organisation of Samoa

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Chapter 1
General Aspects of Packaging

1.1 Introduction

We encounter packaging every day but rarely consider its importance or the reason for its existence. In many cases, packaging – especially flexible packaging – is very carefully designed to undertake a number of tasks designed to present food to us in an attractive, safe and convenient way.

As long as civilisation has existed, packaging and storage of food has been integral to survival. Glass, wood and earthenware pots have been used for thousands of years and over the last two hundred years, steel and tin coated steel have been used not only for containing food but also to preserve it.

Only over the last century with the advent of mineral oil fractionation plastics have become available for use in the food industry. In comparison with rigid containers, plastics are light, often transparent and nowadays can be made to match some of the characteristics of rigid containers. Some can be used in microwave ovens and some combinations are heat-proof. Some packages are self-heating and some are two or three components all performing slightly different functions so that multiple component foods can be prepared by consumers in a matter of seconds (e.g. ice cream and hot chocolate sauce at the point of consumption).

Such a range of materials now available has enabled food manufacturers to fulfil the requirements of packaging summarised here. This document is designed to assist processors to choose the packaging that best suits their existing portfolio and perhaps those planned for the future. The choice of packaging material however is dependent on the required shelf life of the product, its chemical composition – each factor is interdependent. As a start, here is a summary of all the factors involved in packaging. More detail is given in Appendix 2.

1.2 Summary of the Functions of Packaging

A. Contain

- portion control (profitability)
- consistency
- company reputation
- consumer expectation
- consumer convenience

B. Protect

- contamination
- maintain quality
- legislation (Codex, local legislation)
- product consistency
- company reputation

C. Inform (labelling)

- nature of the contents
- legislation, Codex, and other codes
- nutrition
- instructions for use
- elimination of fraud
- storage requirements

D. Attract

- advertise that this product is satisfying and fun and healthy

1.3 Food Composition and Packaging Choices

The choice of packaging for foods produced in Samoa depends very much on the nature of food. Foods are complex mixtures of chemicals that include water, fats, sugars, complex carbohydrates (starches and fibre) protein, minerals and vitamins and many other organic chemicals. The composition varies in each food and gives the food its major characteristics. Fruits for example are largely composed of water, sugars, fibre small amounts of protein and vitamins and minerals. Meats are composed of proteins, variable amounts of fat, water, some minerals and vitamins with little carbohydrate. The composition of each food determines how well it withstands attack by bacteria, moulds, viruses. Chemicals such as oxygen in the air and humidity affect deterioration. Many fruits for instance have a waxy coat (e.g. tomatoes, apples) and will last longer than fruits without (e.g. strawberries).

Foods deteriorate for two reasons:

i) normal life processes (e.g. banana colour progresses from green to yellow to black);
ii) attack by microorganisms.

Normal life processes

During harvesting of plant foods, life processes such as respiration and ripening continue. It is possible to slow these processes down by chilling and altering the gasses around the plant (controlled atmos-

phere). Seed foods such as cereals and nuts are designed to last from one season to another so they will keep well if they are kept dry and cool.

During slaughter of animal foods, life processes stop almost immediately and the tissue ceases to have a defence mechanism – especially where internal tissues are exposed. Because muscle proteins are not soluble in water, the fluids present are excellent media for bacterial attack especially at the cut surface. Hence the shelf lives of meat and fish are very short. The shell of eggs provides some protection but it is permeable to both oxygen and water vapour and so eggs will not keep indefinitely.

Attack by microorganisms

Most foods are susceptible to microbial attack. As microorganisms attack foods they produce chemicals (metabolites) that will make the food unpleasant to taste or they will cause illness. In some instances the microorganisms themselves infect consumers causing illness and occasionally death. There comes a point at which the food becomes unacceptable and possibly dangerous. Mould is much easier to see, so mouldy food is often discarded. The rate at which growth occurs depends on the factors listed here and the steps we take to stop these processes. Generally the rate at which microorganisms grow on foods depends on:

a) temperature
b) acidity
c) available moisture (water activity)
d) nutrients available in food
e) presence of preservatives such as sugar, salt and chemical preservatives

High Risk Foods

High risk foods have high available moisture levels, have low acidity and contain many nutrients. Such items include fish, eggs, dairy products (including ice-cream mixes) and meat and they are very susceptible to growth of microorganisms at temperatures common in Samoa. Sausages and hamburgers are particularly high risk because the meat chopping process releases extra moisture from the muscle tissue and distributes bacteria through the product. Friction during chopping process may cause the temperature to rise - again increasing the risk.

Lower Risk Foods

Lower risk foods are the fruits and vegetables because they have protective skins and are often higher acid. However, they often deteriorate by losing moisture (wilt) or because of the continuing life processes described above and loss of moisture to the surrounding air. They are more prone to support mould growth than bacteria and moulds can be seen easily.

Low Risk Foods

The seed foods including cereals and nuts have evolved over the millennia to survive unfavourable seasons and so have naturally long shelf lives provided they are kept cool and dry.

Preservation

In order to preserve foods the life processes must be stopped and bacteria growth must be stopped. There are two common strategies to enable this:

i) altering the environment in which we keep the food must stop life processes and prevent bacteria growing;
ii) packing food in containers that prevent microbial invasion later to destroy microorganisms while within the package usually by heating.

Altering the environment to make it unsuitable for microbial growth

This can be done by:

- freezing
- drying or dehydration
- adding salt
- adding sugar
- adding acid
- adding a chemical preservative
- or by altering a combination of all of these factors (e.g. bacon and jam)

The choice of packaging depends on the method used to preserve food. Once sufficient water has been removed, dried foods must be kept in packages that do not allow moisture to get back into the food. Dry foods are however susceptible to continuing chemical reactions especially if exposed to light and moisture - the packaging chosen must ensure that these reactions are slowed down so that the product shelf life is extended.

Packing food in containers that prevent microbial invasion later to destroy microorganisms while within the package usually by heating

Wet foods must in packaged in materials that are impervious to microorganisms (hermetic). These foods must be treated in such a way that bacteria are destroyed within the container – usually by heating. This is the principle of canning.

The choice of packaging also depends on how long the food is to be kept. Whatever the choice of packaging, foods will continue to deteriorate no matter what means are used to preserve it. The issue of shelf life depends on:

- the chemical make-up of the food;
- the environment in which the food is kept, and;
- the barrier properties of the packaging.

Each factor affects the other.

The choice of packaging depends on:

- the chemical composition of the food;
- the method chosen to preserve it and
- how long the food must remain in wholesome condition (shelf life).

There are two main groups of Packaging Materials.

1.3.1 Rigid Containers

i) Rigid Containers: During shipping, containers must protect the contents from physical damage during transport and distribution which may be rough and unsympathetic to quality maintenance. They are commonly fabricated from wood, plastic, metal or card-board, and come in the form of crates, barrels, drums and sacks for ultimate transport in shipping containers.
ii) They are designed to withstand rough and impacted handling but – with the exception of cans - rarely suitable for consumer convenience or attractive retail display.
iii) Plastic Containers: Retail containers or consumer units that protect, attract, contain and inform consumers in convenient quantities for retail sale and home storage and use.

Figure 1 Traditional Cardboard (Fibreboard) Carton Outer

The most basic container used in Samoa (Figure 2) is the woven coconut leaf basket (*ato fue umu*), which is still commonly used to transport, display and sell commodities such as root crops, *esi* (papaya) and *niu* (drinking coconuts) and *kuikui* (sea urchins)**.** Foods are exposed to the air, to sources of contamination (e.g. soil and wind-blown dust, animal droppings) and the weight of the contents is variable.

Textiles and Wood

Textile containers have poor gas and moisture barrier properties and as such are not suitable for high-speed filling and are not particularly attractive. Woven jute sacks are which are chemically treated to prevent rotting and reduce flammability are non-slip and have a high tear resistance, have low extensibility and good durability. They are frequently used a number of times and are used to transport root crops, flour, sugar and salt. In Samoa, woven polypropylene (PP) sacks are used for coffee and cocoa bean export. These materials occasionally find their way as retail packs but they are usually confined to those used in shipping. This group offers little protection from microbial invasion and normal life processes continue.

Figure 2 Woven Coconut Leaf Basket

Figure 3 Single Use Wooden Crates for Export of Delicate Items

Wooden shipping containers are still used extensively as a protective outer package for bottles and other delicate items and enjoy increasing use for single-use field crates. They remain in common use for wine, tea and beer. Wooden chests have high impact resistance and are stackable. They are also relatively inexpensive. High impact-resistant plastic crates are superseding wood as the container of choice because they can be used for many cycles.

Figure 4 Multiple Use Polystyrene Field Crates

Plastic crates are being used increasingly in fields during harvest of such items as root crops, fruits and vegetable. They prevent bruising which will assist in retaining quality because bacteria will attack bruised fruits and vegetable first.

Metal Cans

Globally, metal cans have been used for two hundred years or so. They offer total protection of the contents and are convenient for ambient storage. They are tamper-proof but the technology required for canning is expensive. Cans are heavy and bulky and importing transport costs for empty cans is high in the Pacific. Tin is relatively expensive so that the coating used on cans is very thin and susceptible to scratching and ultimately rusting. Cans for pale coloured fruits are traditionally not lacquered on the inside and this allows the fruit acids to attack the tin. The reducing environment so created prevents discolouration of natural colours including anthocyanins (often red) and carotenoids (orange) but it can increase the tin content of the product. Tin-free steel (using a chromium-steel alloy) cans are extremely durable and withstand corrosion more effectively than tin coated steel.

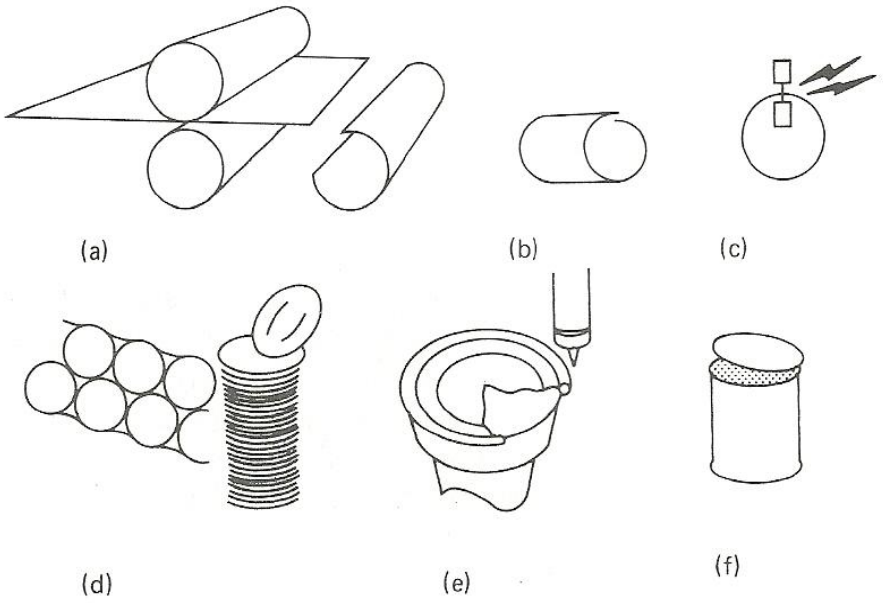
Cans are completely impervious to oxygen, carbon dioxide, moisture and other aroma compounds. Food remains in good condition for several years although the shelf life is commonly set at two years. During storage even canned foods will deteriorate. Most commonly the food attacks the inside of the can stripping the tin from the can. Many cans now have lacquers to prevent this. The effect of interaction of food with the lacquers is not well documented.

If cans are stored badly, they can rust and eventually deteriorate to the point that pinholes occur which will allow microorganisms and other contaminants to enter the can.

Some modern cans are often fabricated by stamping (more accurately 'deep drawing') and these cans have only two components – the body and the lid. There is no seam at the bottom of the can. These two-piece cans are used for fish, soft drinks and beer and often are equipped with a ring-pull opening device. The traditional three piece can with a lid and a base attached to a cylinder are much more common.

They are heated to the extent that they are commercially sterile usually in a pressure vessel known as a retort. The coldest part of the coldest can must reach a temperature of 121^{o}C for 2.54 minutes (this is sufficient to reduce the theoretical load of *Clostridium botulinum* spores by a factor of 10^{12}).

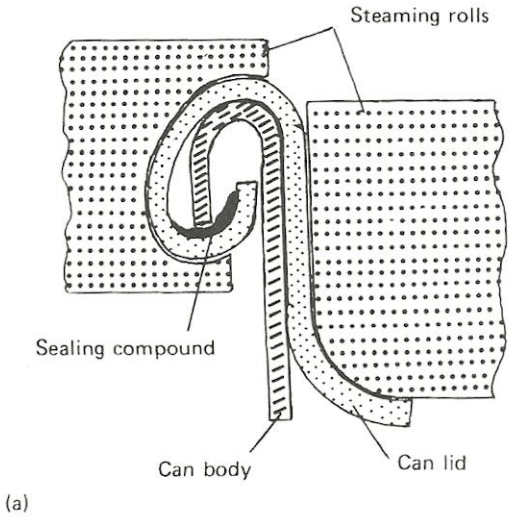
Figure 5 Diagrammatic Depiction of Can Formation



(a) Steel is heat treated and coated with tin or polyurethane lacquer
(b) The steel is cut and rolled into a cylinder
(c) The side of the cylinder is welded
(d) Lids are stamped often from the same tin-coated steel
(e) One end is seamed on the cylinder

The disadvantage of such severe heat treatment causes the contents to suffer considerable heat damage and is not ideal for all products. Furthermore, canning requires significant amounts of energy and large throughput volumes, both factors which can make it not viable in the Samoan context, except for a certain products for which flexible packaging is less appropriate. Krissy are now marketing canned Samoan coconut milk. Cans are also used in Samoa for soft drinks and beers. Cans will not allow bacteria to enter and the heat process is sufficient to stop all life processes so that canned food is shelf stable and is often given a 'best before,' date of up to three years. Occasionally, some foods attack the interior surface of the can changing the metal content but modern cans have a lacquer that prevents this

Figure 6 Double Seam is Created as the Can Ends are added



Plastic Retort Pouches

More recently plastic pouches have been used and because they are slimmer than cans and heat can penetrate the pack more efficiently and the product does not suffer the same heat damage. Heat processing costs are lower. They have the same functionality as cans but can be imported much more cheaply than empty cans because they are trans-shipped collapsed (See Figure 7).

Figure 7 Retort Pouch (GBK Exports Ltd, New Zealand)

1.3.2 Flexible Films

Plastic containers have emerged during the last century to be the most dominant form of food packaging. Building blocks for polymers are extracted from the distillation of mineral oil. They are then chemically treated so that they form long chains which may be cross linked to form sheets. Because there are so many chemicals extracted from oil, there are a great many types of chains that can be formed. If they are made from just one component they are called single component polymers. For the past 50 years, approximately 13 single polymeric films have been used for packaging either used as single sheets or in combination with each other to give an enormous range of protective properties. The industry is dynamic however, and new components and combinations are being developed continuously.

1.3.3 Single Component Films

Single polymer films are made by extrusion, in which pellets of the polymer are melted and extruded under heat and pressure as a sheet or tube. Alternatively some sheets are formed by *callandering* in which the polymer is passed between heated rollers to form the sheet with thickness defined more accurately. The most widely used films are listed here and their properties summarised in Table 1. The table does not include paper because this is most commonly used for street and ready-to-eat foods.

The single polymeric films are:

- Cellulose
- Polypropylene (PP)
- Polyester (PES)
- Polyethylene terephthalate (PET)
- Polyethylene (PE)
- Low density polyethylene (LDPE)
- High density polyethylene (HDPE)
- Polyvinylidine chloride (PVDC)
- Polyvinyl chloride – vinylidine chloride (PVCC)
- Polystyrene (PS)
- Nitrocellulose
- Polyamides
- Aluminium foil (metallisation)

The polymers all have slightly different characteristics and because they are quite thin, some of the will let air, moisture and gasses through.

Even though foods have been treated to stop life processes are stopped and foods have been treated so that they will not be attacked by microorganisms, about 20% of the air around us is made up of oxygen which is a very reactive gas. It is among a number of other factors that will cause food to deteriorate. In the case of high-fat foods the oxygen will attack the oil – particularly vegetable oil and cause it to oxidise and develop unpleasant flavours (rancidity). But the damage is not confined to fat, pale carbohydrates such as those found in the starchy staples (taro, kumala, cassava, potato and yam) can darken and proteins become tough. It is therefore, often important to protect foods by using a film (Table 1) or a combination of films (Table 2) to prevent oxygen reaching the food.

Moisture or water vapour is another component of the air around us and varies from day to day. If the water vapour in the air is high then we describe the atmosphere as humid. If raining then the relative humidity of the air is 100%.

Water is often removed from foods to preserve them. This is the case during fry-drying where the water is removed during high temperature heating – frying. In other cases foods such as biscuits and dried fruit slices heated air during baking, dehydration occurs during baking - moisture is removed. If left exposed to humid air these products will re-absorb moisture and they will soften. Without protection, sufficient water may be absorbed to allow mould to grow. This can not only make the product commercially useless but may pose a threat to public health. It may be important to prevent moisture from gaining access to the food by choosing the correct films from Table 1 or Table 2. Obviously wet products such as ice-cream, sauces, popsicles and juices are not at risk from water uptake. But if the moisture in the food is

high then they can lose moisture and become tough so moisture barrier properties may be equally important.

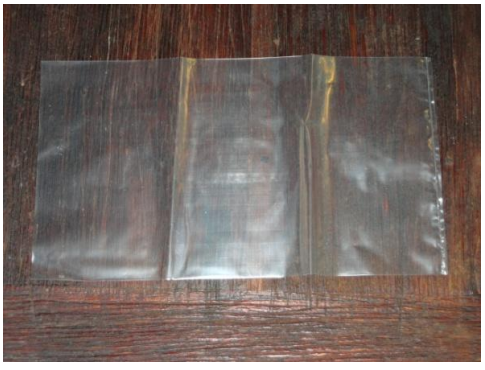
Light can also damage foods. Strong sunlight will bleach some natural food colours such as the carotenes (carrots) and darken others anthocyanins (chilies and red berries). It will also cause green coloured vegetables to darken to a pale brown colour. Probably more relevant to the snack food industry is that light will accelerate the onset of rancidity – especially if oxygen is present. Paper and aluminium foil will prevent light reaching the food.

Other gasses may be formed by the food itself. For instance freshly roasted coffee and living fresh fruits and vegetables will give off a gas – carbon dioxide. This may cause the plastic to inflate making the product less attractive. Barriers that allow carbon dioxide to pass through to the atmosphere are used in these cases. Movement of moisture, oxygen and carbon dioxide and the effects of light damage are not instantaneous.

Hence, if the market is very close and purchase and consumption will be very soon after manufacture then the simpler less expensive films such as polythene bags or even paper (Figure 8) will suffice (see Table 5 and Table 6; pages 41 and 42). The manufacturer must make sure that sales occur as soon as possible after manufacture. It may not be easy to control since supermarkets are not always careful about rotating stock and old stock can remain on the shelf for long periods by which time it is spoiled. Company reputation depends on reliability so that high quality products must be available at every purchase. If the product is required to have a longer shelf life – either to allow distribution over a wider area or sales are relatively slow then the barrier properties of the packaging must match that longer shelf life. For products intended for export, the shelf life may be extremely long and the packaging will contain several components. Films with poor barrier properties often allow other odours to contaminate foods – especially high fat foods. There are many instances in which products placed next to highly flavoured foods (e.g. garlic, disinfectant) have absorbed foreign flavours. It is important for manufacturers to ensure correct placement on supermarket shelves and choose packaging that prevent this.

Very common in Samoa is the simple polythene bag. Its poor barrier properties limit its use to domestic and very short shelf-life products, but it is inexpensive and readily available in Samoa(see Figure 8).

Figure 8 The Well-known Simple Polythene Bag



Cellophane is often used for wrapping hard boiled confections but the barrier properties are poor and the product requires an additional wrap for adequate protection.

Another very simple single component packaging material is polyethylene terephthalate (PET). This is a clear rigid polymer and enjoys widespread use in Samoa for packaging water, cordials, coconut oil and soft drinks. Very thin versions of this material are often combined with other single barrier films for packaging salads and sandwiches that have very short shelf lives.

Figure 9 PET Bottles Awaiting Filling (Courtesy of Levai Water-Bottling Co)

Table 1 gives an idea of the relative rates at which single barriers will allow moisture, carbon dioxide and oxygen through under a variety of decision and it is this which provides the basis for our choice of packaging. More detailed properties relating to this table are given in Appendix 4.

Table 1 Selected Properties of Single Component Flexible Films

FILM	Moisture vapour transmission rate	Oxygen transmission rate	Carbon dioxide transmission rate	Tensile strength	Light transmission	Sealing temperature
	ml m^{-2} per 24 h 25°C	ml m^{-2} per 24 h 25°C	ml m^{-2} per 24 h 25°C	MN m^{-2} Machine Direction	%	°C
Cellulose						
Uncoated	Moderate	Good	Moderate	Moderate	Trans	
Nitrocellulose coated	Good	Good	Good	Moderate	Trans	90-130
Polyvinilidine Chloride (PVDC)	Good	Good	Good	Moderate	Trans	100-130
Metallised PVDC –coated	Excellent	Excellent	Good	Good	Opaque	90-130
Vinyl chloride coated						
Polyethylene						
Low Density	Poor	Poor	Poor	Good	Trans	117-121
Stretch wrap						
Shrink wrap						
High Density	Moderate	Poor	Poor	Moderate	Moderate	135-170
Polypropylene						
Oriented	Excellent	Poor	Poor	Good	Trans	145
Biaxially oriented	Excellent	Poor	Moderate	Moderate	Trans	117-124
PVDC – coated	Excellent	Good	Good	Good	Trans	
Metallised	Excellent	Good	Moderate	Good	Opaque	120-145
Polyester						
Plain	Excellent	Moderate	Poor	Moderate	Moderate	100-200
Metallised	Negligible	Good	Negligible	Moderate	Opaque	100-200
PVDC-coated and metallised	Excellent	Excellent	Excellent	Good	Opaque	
Polyvinylidene chloride	Good	Excellent	Good	Good	Good	100-160

See Appendix 4 for more details

1.3.4 Multiple Component Films

Multiple polymeric films are produced by combining a number of the single polymeric films in a number of ways:

Coated Films

Films may be coated with other polymers to improve barrier properties or to impart heat stability. Nitrocellulose is applied to one side of cellulose film to provide a moisture barrier but to maintain oxygen permeability remains. PVDC is often applied to cellulose films either by using a solvent or water slurry. Such coated films are tough, stretchable and less permeable to air and moisture. They are used for products that have a tendency form condensation on the inside including packed meats and bacon and sausages. They can be coated with aluminium by condensing vaporised aluminium onto the surface of the carrier polymer. Such a process is called metallisation.

When metallised, cellulose, PP and PE form excellent barriers preventing movement of water vapour oxygen, light and carbon dioxide. This coated film is excellent for high speed form fill machines. The example given in Wooden shipping containers are still used extensively as a protective outer package for bottles and other delicate items and enjoy increasing use for single-use field crates. They remain in common use for wine, tea and beer. Wooden chests have high impact resistance and are stackable. They are also relatively inexpensive. High impact-resistant plastic crates are superseding wood as the container of choice because they can be used for many cycles.

Figure 4 is a stand-up pouch which enhances functionality and appearance.

Figure 10 Coated Printed PP (Courtesy of Crispy Chips)

Laminated films

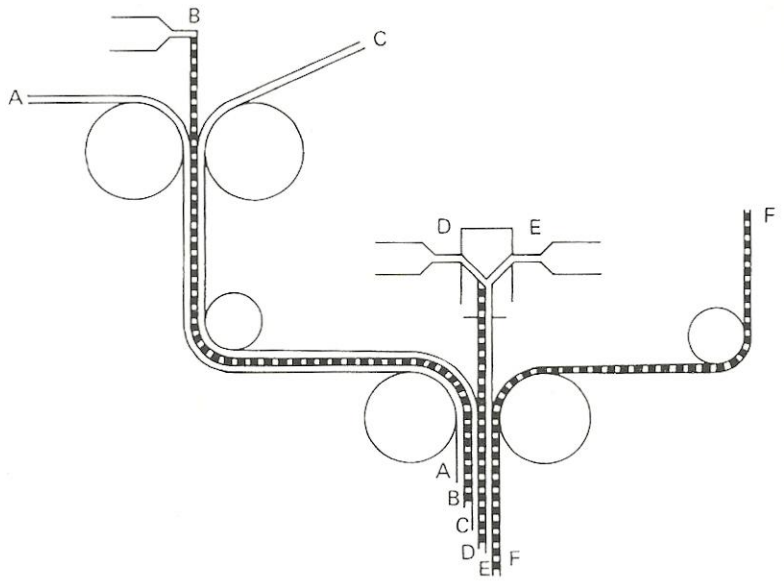
When single film packages will not provide the protection required for the time of distribution or storage in wholesale stores (shelf life), it often becomes important to stop the movement of oxygen, moisture, carbon dioxide and to protect the product form light. In these cases, additional films can be added to single films. A number of techniques are used to combine different films the simplest of which is lamination. Lamination of two or more films improves the barrier properties appearance and mechanical strength of flexible films. The most versatile method of forming is adhesive laminating in which an adhesive is applied to one surface of one film and then dried. The two films are bonded by passing through rollers. Two part adhesives are commonly used.

Not all polymer films are suitable for laminating – the two films must have similar characteristics and the film tension, adhesive application and drying conditions must be accurately controlled to prevent peeling (delaminating).

Figure 11 Laminated PP/PE Pouches for Hand Filling (Courtesy of TH Plantation)

Figure 12 Metallised, cellulose, PP and PE

Figure 13 Diagrammatic Representation of Multi-component Film Manufacture



A Single component is passed through heated rollers and adhesive B is applied to attach component C.

Components D and E are co-extruded and passed through heated rollers when component F is added.

Table 2 Selected Laminated Films Used for Food Packaging[1]

Laminate	Typical Food Application
Polyvinylidene chloride-coated polypropylene-metallised-polyvinylidene-coated polypropylene	Crisps, snack-foods, ice-cream, biscuits confectionery
Polyvinylidine-chloride-coated-polypropylene-polyethylene	Bakery products, cheese confectionery dried fruit frozen vegetables
Polypropylene-ethylenevinyl-Acetate	Modified atmosphere fruits, small goods (cured meats)
Biaxially oriented polypropylene Nylon- polythene	Retort pouches
Cellulose-polythene-cellulose	Pies, crusty bread, cooked meats and cheese
Cellulose acetate-paper-foil-	Dried soup mixes instant noodles

[1] The types of barriers reads from the outside to the inside – all examples of polythene are low density.

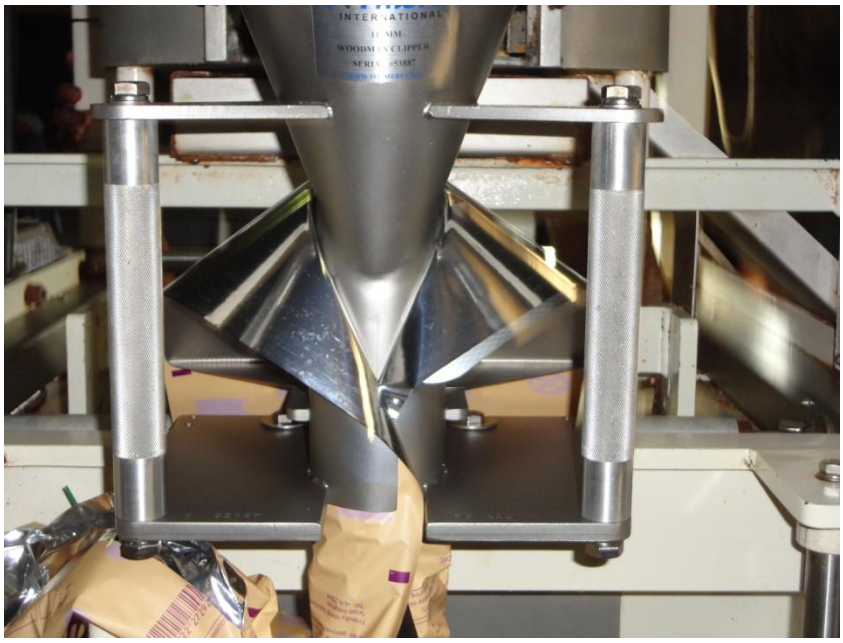
Polypropylene	
Metallised-polyester-polyethylene	Coffee, milk powder, bag in the box packaging
Polyethylene terephthalate-aluminium - polypropylene	Soft retort pouches
Polyethylene nylon	Vacuum packs for bulk fresh meat (cryovac).
Nylon-polyvinylidene chloride Polyethylene-aluminium-polyethylene	Boil in the bag products
Nylon-medium-density-ethylene butane copolymer	Boil in the bag products

Co-Extruded Films

Co-extruded films are formed by the simultaneous extrusion of two or more films. They have three significant advantages over other types of film.

- They have extremely high barrier properties similar to multi-layer laminates but at lower cost.
- They are thinner than laminates and closer to monolayer films which makes them particularly suitable for machines that fold the roll of laminate into a tube, fills and seals the top and bottom simultaneously - form-filling machines (see Figure 14).
- The layers do not separate.

Figure 14 Form Filling Machine at the End of the Run (Courtesy of Natural Foods International)



Copolymers should have similar structures in order to be compatible. The three main groups are:

- Olefins (LDPE and HDPE and PP).
- Styrenes (PS and acronitrile-butadiene-styrene).
- Polyvinyl chloride (PVC polymers).

Flat sheet co-extrusions which can reach 3,000 microns may be formed into pots, tubs or trays and are used for margarine, ice cream and single trays for meats and hard packaging for some confections.

Figure 15 Styrenes (PS and acronitrile-butadiene-styrene)

There are two main methods of producing co-extrusions.

Blown film co-extrusions are thinner than flat sheet types and are suitable for high speed form fill machines and sachet equipment. Typically, a three layer co-extrusion has an outside presentation layer that is glossy and printable, a bulk middle layer that provides stiffness, strength and split resistance. They are used in confectionery, snack foods and grocery items such as rice or dried peas producing a so-called 'pillow pack'.

Flat sheet co-extrusions (74-3,000 microns thick) are formed into pots, tubs or trays. Combinations are given below in Table 3:

Table 3 Selected Applications of Formable Flat Sheet Co-extrusions

Type of Co-extrusion	Properties	Application
High impact polystyrene-polyethylene terephthalate	Ultra violet and odour barrier	Rigid butter, bulk 20 litre containers margarine containers
Polystyrene-polystyrene-polyvinylidene-polystyrene	Ultra violet light and odour barrier	Juices, milk meat containers
Polystyrene-polyvinylidene-polyvinylidene chloride-polyethylene	Ultra violet and odour barrier	Squeezeable sauce bottles Vinegar
Polypropylene-saran-Polypropylene	Retortable trays	Ready to heat composite meals
Polystyrene-ethylene-vinyl-Acetate-polypropylene	Modified atmosphere packs	Meats, small goods and fruits

Figure 16 PS-PVD-PVDC-PE Squeezable bottle

Laminated Paperboard Cartons

Very complex laminates consisting of LDLPE-paper-LDPE-aluminium-saran-LDPE are enjoying increasing use for fruit juices and UHT milk. Most commonly the cartons are purchased as a roll with the spout pre-formed and they are filled as the carton is formed. Some headspace is allowed to facilitate mixing and avoid spillage on opening

Figure 17 LDLPE-paper-LDPE-aluminium-saran-LDPE

The advantages of this type of package are:

- they have excellent impact resistance;
- no additional labelling or capping is required;
- they require less energy to produce and are lighter than cans or bottles;

- they can be used for aseptic foods which therefore, suffer less heat damage;
- they stack well on supermarket shelves.

1.4 Printing Inks

Printing inks for films and papers consist of dyes which are dispersed in a blend of solvents and resin which forms a varnish. Inks may also contain extenders, plasticisers and slip agents. Solvents must be carefully removed in order to prevent odour-contamination of the food.

Three processes used to print films and papers:

- *Flexographic printing* in up to eight colours is high speed and suitable for lines and blocks. Fast drying inks are applied to the film using a flexible rubber plate with raised characters.
- *Photogravure printing* is able to produce high definition detail and realistic pictures and more recently with holograms. In this case a chromium plate is acid-etched and the ink is transferred to the packaging in an analogous way as bank notes and stamps are printed.
- *Offset lithographing* relies on the repulsion between oil and water. A greasy ink is repelled by water previously applied to the surface. Cans are still lithographed in this way and make labels superfluous.

1.5 Summary of Labelling Requirements

The requirements that a food label must meet in international trade are defined in a series of codex standards on food labelling. The codex standard on labelling of pre-packaged foods and the codex guidelines on nutrition labelling are included detail in Annexures 1A and 1B respectively. This is of particular importance for those companies intending for those intending to export their products. For local markets the labels must conform to the upcoming Samoan Food legislation.

In summary the general labelling requirements are:

- the name of the food
- list of ingredients
- quantitative ingredients declaration (where indicated)
- net contents and drained weights
- name and address
- the country of origin
- lot identification
- date marking and storage instructions
- instructions for use and special storage requirement
- general script
- nutrition labelling

Codex also guides the presentation of labelling information including the use of language.

Additional labelling issues for which codex guidance exists include:

- general claims and the use of nutrition and health claims in food labelling
- labelling and claims of organic foods
- “Halal” foods
- pre-packaged foods for special dietary uses
- food additives when sold as such

Greater detail is to be found in Annexes 1A and 1B.

Chapter 2
Food Manufacturing in Samoa

2.1 General

The preparation of this manual would not have been possible without dialogue with Samoan industry practitioners. Initial contact was made with members of the Samoan food industry through the Samoan Manufacturers Association and as far as possible arrangements for visits were made prior to arriving in Samoa. Those who willing gave up their time are named in Appendix 5. The list is not comprehensive because of the limitation of time spent in Apia, but it provides a cross sectional sample of the types of food manufacturers operating in Samoa.

It became apparent during the interviews that the range of products processed is limited and that a number of producers are competing in a relatively small market (see Table 4). It is probable that the narrow range has been dictated by the cost of technology required to produce wider portfolio of products. The following table gives an indication of the extent of activity within the sectors of the industry.

Table 4 Summary of Food and Beverage Processing in Samoa

Activity	Number of producers
Fried starchy staple crisps	6
Bottled water	4
Frozen popsicles	3
Cream freeze and ice cream	2
Nonu	4
Cordial mixes and fruit juices	5
Honey	1
Extruded snack (corn or maize)	2
Virgin coconut oil	5
Sauce	1
Confections	2
Beer	2

At least three companies are well equipped with modern technology (Krissy, Ah Liki and Apia Bottling) and are progressing toward HACCP certification. Vailima Brewery has just received accreditation in HACCP, ISO 9001and ISO22000 standards.

The view was expressed during a number of interviews that large buying cartels exist in Samoa that co-operate to buy large consignments of imported products – significantly from China - at prices that are so low that local companies cannot compete. They are then distributed to many outlets throughout Samoa. This provides a strong case for programmes of product development among food manufacturers – this is discussed further in Section 3.3 on page 44.

Ah Liki Ltd is no longer considered to be a small or medium-sized enterprise but was included in the list of visits. It is an exceptional company that is enjoying significant benefits from its own importing strategy and had extended the range of products produced in Apia to succeed in the local market. This company relies on external consultants for technical advice on all matters including packaging. Although not particularly forthcoming with information they have installed a canning line and are now canning coconut milk.

Many of the Small and Micro-Enterprises (SMEs) have relied on emulating (copying) existing products – the so-called 'Me Too,' approach to product development. Hence there are a significant number of snack food producers. Fortunately most were using locally grown starchy staples – taro, banana and breadfruit. The packaging for these products varied considerably ranging from cellophane (limiting the shelf life to a couple of days) (purchased locally) to quite sophisticated PP coated with PPDC and very attractive bi-axially oriented (BO) metallised PP-PE-Paper laminate, used by one company (Table 5). One company is importing sophisticated packaging *directly* from China others are importing from Narsey's Plastics Company in Fiji. Others are importing *indirectly* from China through GBK Exports in New Zealand – among the most common suppliers identified. Each processor is of course free to choose their own method of procurement but the composition and quality of that packaging must be linked to the performance and shelf life of that product in the market. Many packaging supply companies offer useful back-up advice including appropriate films, labelling and packaging layout – however these organisations are not disinterested parties and seek to maximise their own incomes. Less expensive options should always be explored.

Strictly speaking the 'ice-cream,' manufactured in Samoa does not conform to either US FDA Standard 58.2825 for ice-cream or FSNANZ Standard 2.5.6 so it is more accurately described as 'cream freeze.' For sundaes and small packs (185ml) the cream freeze is dispensed in printed, waxed card containers. For 1 Litre packs, the high impact PP-TT rigid containers are used. For retail dispenser packs of 5, 10, 16, 20 Litre packs, waxed, multi-layered corrugated cardboard is used. Although this cardboard is produced locally, it is not always purchased from the local supplier. The major supplier of ice cream is Tip Top™ which is imported from Fiji (Goodman Fielder International) and can be described as ice cream.

Popsicles are currently packed in PP - a system of melting the laminate during callandering 'pearlises,' the laminate giving it a more attractive finish.

Glass bottles for beer are imported from New Zealand by the Vailima company. This company also produces carbonated beverages and now enjoys the CocaCola™ franchise. The carbonated beverage, water, cordial, fruit juice one nonu and honey producers are importing PET bottles from Fiji and indirectly

from China through GBK. At least one company is blow moulding PET bottles locally but the 'substance' (effectively the quantity of plastic per bottle) is low – to reduce costs - and the bottles tend to collapse as the product is consumed. The local market is price sensitive and hence is tolerant of minor inconveniences but the tourism and export markets are not so forgiving and demand high quality packaging. There are significant disposal, and thus environmental problems associated with PET containers.

Much of the nonu produced in Samoa is exported in bulk as a bag in a box 50, 100 and 200 Litres. All packaging is imported but not all nonu producers were interviewed and so the nature and origin of their packaging is unknown. The major producer, however, is using a range of packaging from PET bottles for retail sale and bag in the box for bulk export.

The largest chili sauce manufacturer in Samoa is using glass bottles that are imported from New Zealand. The company is using a standard marketing ploy of producing a less expensive version of the product 'Hot Boys,Chili Sauce,' to compete with existing, analogous products. It was launched into New Zealand coincident with the world rugby cup.

Virgin coconut oil is packed in PET bottles for the local retail trade and high impact PS-PET 20 Litre containers for bulk export (Women in Business Inc).

It is also common to find very small scale market and road side sellers who reuse various glass and plastic bottles to package their home manufactured products, such as *vaga* (sea cucumber).

2.2 Associations

Overall there appears to be considerable scope to cooperate over the importation of flexible packaging and PET bottles. All packaging manufacturers have minimum order requirements – sometimes up to 500,000 units and this can tie up considerable sums of money – beyond the capacity of a single manufacturer in Samoa, as these tend to be too small for bulk packaging orders. Hence mixed containers may mean less initial outlay. Some packaging fabricating equipment remains in Samoa (Selprize, Trading) and it may be possible to resurrect this equipment should the demand and the costs of refurbishment permit. There is scope for bulk package material purchasing form overseas, however this would require the cooperation, agreement and unity among small and medium size manufacturers and the concept may best be considered under the umbrella of an overarching organisation such as Samoan Association of Manufacturers and Exporters (SAME) or other groupings that could create a suitable demand for bulk orders.

Many organisations will have intermittent requirements for assessing the pH (acidity) or the soluble solids (indicate water intake) and oxygen meters to assess the oxygen within a package. The cost of such equipment can be shared since they will not be used every day by all processors. As long as they are held in a safe place and returned by each user in pristine condition cooperation to purchase such

equipment is not punitive – especially if shared – and can be very important to assist in determining shelf life.

It is recommended that companies explore the options to cooperate over the importation of standard flexible pouches and have them printed to individual company needs in Samoa.

It is further recommended that SMEs cooperate over the acquisition of specialist equipment such as pH meters (acidity), refractometers (water content of liquid products) and oxygen meters for shared use.

In addition, there appears to be enormous scope for expanding product portfolios. In the past, three processors have been assisted (under separate programmes) with direct product development of dips for chips and pates and novel ways of packaging single serve water and fruit drinks. Product development could also be considered as a possible private – public partnership with the Scientific Research Organisation of Samoa (SROS), giving due consideration to economic feasibility prior to initiating any product research.

If there is sufficient interest, it is recommended that manufacturers collaborate to request assistance in generating ideas for new products and for getting started in new formulations to expand their product ranges.

2.3.1 Evidence of Deterioration

Immediately after manufacture products begin to deteriorate. They are assigned a "Best Before,' date implying that the product is safe beyond that date but does not impose a risk to health or a 'Use By,' date after which there is a risk to consumers if consumed after that date.

The following factors may become apparent as the product deteriorates.

- Softening of fried snack foods;
- Development of soapy or 'cardboardy,' tastes in snack foods;
- Evidence of mould in snack foods.

- Evidence of fizziness and yeasty flavours in soft drinks, popsicles, nonu;
- Evidence of excessive cloudiness in soft drinks;
- Evidence of settling or layering out of cloud in soft drinks and bottled water.

- Evidence of taint, foreign odours or foreign bodies in ice-cream;
- Evidence of melting (degradation of the gas in solid emulsion - overrun).

Liquid products such as fruit drinks, cordials, sauces and ice-cream mixes (prior to freezing/votating) can be checked for flavour using the Hedonic scale. Simple refractometers will give the soluble solids value or brix. pH paper can be used to assess the acidity. It is now possible to buy laboratory scale peroxide meters to assess deterioration of the oil used for frying. Shelf life of oil can be extended to a degree by using the antioxidant tert-butyl-hydroxy-quinone (TBHQ) in place of the more commonly used, but less stable butylated- hydroxy- toluene (BHT) or butylated- hydroxy- anisole (BHA). TBHQ continues to provide protection after packaging and distribution (but must be declared on the label).

In any event, it becomes important to initiate the process of record keeping. Traceability is a pivotal aspect of quality control and - eventually - essential in the move towards Hazard Analysis of Critical Control Points (HACCP) certification. At the same time, the in-house assessments of shelf life can be matched against consumer complaints. Production dates, batch numbers and 'Best Before,' dates are now mandatory in Samoa (see Appendix 6). Hence it is essential that record-keeping begins.

A daily record book should include such details as the date, the bar code, the production figures and incidental issues such as weather conditions, machine breakdowns, names of staff at each production line and disruptions to power and water. This is discussed further in Section 2.3.3; Page 39.

Only when the shelf life is understood and the factors that influence it are known can the appropriate packaging be chosen. Throughout the region, some products are packed in laminates that will far outlast the shelf life of products therein and the cost of the packaging is disproportionately high. As a general rule however, many manufacturers are under packing items that will not support the expected shelf life of the products. Assistance in matching packaging to shelf life most economically is given in Section 2.3.4; Page 41.

Most of the smaller manufacturers pay insufficient attention to the quality of incoming raw materials. In a couple of instances there was evidence that outer cardboard containers had been damaged – there is a possibility that the consignment of packaging may have also been damaged – this was not confirmed by manufacturers on receipt of the consignments. There is little evidence that records are kept of quantity and quality of incoming raw materials including packaging are kept. Recourse for recompense is difficult without it.

2.3.2 Product Shelf Life and Packaging

All foods deteriorate at a linear or, more often, an accelerating (exponential) rate. Fresh foods deteriorate at much faster rates than those that have been preserved. Among the range of preserved foods, the decline in quality is very difficult to determine. It maybe the steady increase in concentrations of toxic compounds such as peroxides in potato crisps (leading to rancidity) or the decrease in some important nutrient for which nutritional claim is made (especially vitamin C). It may be deterioration of flavour, taste, or texture. A fault pervading the food industry internationally is that the end of shelf is rarely

known. Apart from the four manufacturers mentioned, there is only scant attention paid to quality assessment in Samoa's factories and virtually no clear definition of shelf life.

The current situation in which shelf life has not been clearly defined is not a good grounding for successful competition with either the extremely large range of imported products or for opening export markets. It is impossible to choose the appropriate packaging if the shelf life is unknown. Most organisations claim that products stay on supermarket shelves for only 48 – 72 hours. However, stock turnover is not particularly diligent at the retail outlets and in some supermarkets, the ambient temperatures are uncomfortably high. As a general rule the shelf life halves with every 10^{o}C rise in temperature. In the Samoan context where daily temperatures tend to remain well above 25^{o}C all year round, shelf life would be significantly shorter than New Zealand, for example, where temperatures are lower and vary with the seasons. Thus it is especially important to maintain the 'first in, first out,' stock rotation system in the Samoan context to ensure minimum deterioration of products and manufacturers are advised to ensure that their products are treated appropriately. Manufacturers should attempt to ensure that retail outlets observe this practice. **It may be possible to cooperate over this issue and for several manufacturers to employ a merchandiser to visit retail shops to ensure good presentation and first in first out practices are observed.**

There are some quality features that can be determined objectively. For instance, the numbers of microorganism might be mandated by legislation or by the Recommendations, Standards and Codes within Codex Alimentarius or by local legislative standards. Samples retained by the company should be sequentially tested to asses when that point is reached. The rate of growth of microorganisms is very much dependent on the storage temperature and for dry products the moisture content. Temperature effects on shelf life can be exploited by processors. Some companies use high temperature facilities within their own premises to assess shelf life quickly – so-called accelerated shelf life testing. In any event, the packaging should be bacteria-proof and provide a good moisture barrier. A sequential testing chart is shown in Appendix 8b.

The end of shelf life may be determined by the loss of a particular nutrient – commonly vitamin C which will slowly oxidise during storage. If the level of vitamin C is included on the label then it is important to know the rate of vitamin C oxidation. Once again the rate that it deteriorates depends on storage temperature and the ability of the packaging to prevent access of oxygen into the product.

Lead and tin levels of some canned foods are also mandated by Codex, local legislation and importing countries such FSANZ, and the EU. The levels of these heavy metals may increase during storage of canned foods.

The essence of shelf testing is to monitor deterioration within the manufacturing company and to link it to what is likely to happen in the market. The Hedonic Scale (Appendix 8a) is very much part of that process in which a number of internal staff (minimum of six) is given samples to assess as weeks (or days or months) pass (Appendix 8b). It is important that the assessors do not know the date or the batch number but are merely presented using a paper plate (or other presentation that is suitable) on which

the date and age are coded. The assessment is commonly undertaken comparing a recent sample to make assessment of the aging sample more definitive.

The time related scale may also include quality features that are determined by Codex or by local or overseas standards and may include the regulatory issues (vitamin C, microbiological levels or lead and tin in canned foods).

As section 2.2 describes there are opportunities for food processors to cooperate over the purchase of such equipment as pH (acidity) meters, refractometers to determine the content of soluble solids (juice and cordial and ice-cream mixes and sauces) oxygen meters to determine the rate at which oxygen passes through the packaging. Held in an appropriate place with a custodian that determines proper use and maintenance this will assist many manufacturers to determine shelf life and where appropriate meet international standards to secure export markets. The frequency with which products are tested depends on the risk they impose not only to the consuming public but also to the reputation of the company. In a supermarket most food items are hidden from view and consumers have only their experience of that product on which to base their buying decisions. Companies that disappoint or have quality characteristics that change by the day will eventually find that consumers lose confidence in that product and their scarce discretionary income will be spent on products they know are consistent.

Retaining samples for periods of time noting the storage temperature for later testing against newly manufactured product will assist in determining shelf life. For some products mentioned above it may be important to test for the chemical (vitamin C, lead and tin) and microbiological levels. It also assists companies to comply with legislation, ensure absolute microbiological safety and determine changes in quality features on which consumers choices are based. These analyses are unlikely to be possible by most Samoa food industries but they require infrequent application and there are a number of laboratories such as SROS and the Institute of Applied Sciences that are capable of undertaking the work.

It is recommended that all companies initiate some simple quality testing of features that define the shelf life.

Such an approach could involve simple in-house taste panels are used as an inexpensive first step in this process. Such as a nine point score sheet estimating taste, appearance, aroma and overall acceptability (see Appendix 8a). In house staff can be used for the assessments and hence there is very little cost involved.

Using the Hedonic Scale (Appendix 8a) scores are averaged and a record kept of these scores. If these average scores begin to drift then the product quality is changing. A bad score may point to the end of shelf life.

In short the steps involved include:

1. Develop a system of annotating the date of manufacture on each package (now a requirement under the upcoming Samoan Food legislation).
2. Identify a storage area that best simulated supermarket conditions that is vermin-proof and secure from theft and tampering.
3. Select six long term employees who are committed to maintain the highest possible quality of product (these people can for the nucleus of the eventual HACCP team).
4. Taste fresh examples of each product, use the Hedonic Scale document (Appendix 8a) for each member of the quality team agree on scores for products produced on that day.
5. Store 10 samples from the same batch.
6. After a week's storage remove these samples from the store and assess using the same form and repeat the operation using that day's production.
7. Record any changes to the characteristics over this week's period.
8. Repeat this on a weekly basis.
9. Use the taste panel to assess the number of weeks it takes to reach unacceptability.
10. The time taken to reach this unacceptable point given by the factors detailed below (Section 2.3.2).
11. Should it be necessary to increase this shelf life (sales are too slow and the product remains on the supermarket shelf) then it will be necessary to re-examine the packaging according to Table 1.

2.3.3 The Day Book

A day book is very useful for noting all issues that can affect quality and the factors suggested here can be linked to the deterioration that is observed over time (Appendix 8b). In particular the following should be noted:

The Weather

As discussed, the temperature and humidity can affect food keeping quality especially if packaging has low barrier properties for moisture. Humidity meters are available but a simple subjective record of the weather can be useful. Rain indicates that the relative humidity is 100% for instance and moisture will be absorbed by products extremely quickly.

Equipment Breakdown

Equipment breakdown can affect quality within the factory particularly if product that requires immediate freezing or chilling is exposed to high temperature (e.g. ice-cream premix) or dry products are exposed to high humidity environments before packaging. In any event, product must be processed before lunch, tea and overnight breaks to avoid unnecessary deterioration imposed by the environment. Equipment breakdown may be caused by power cuts and these should also be recorded.

Staff

Staff absenteeism is common in the Pacific region either because of cultural commitments or illness. The absence of a key member of the workforce should be noted since a replacement or redeployed staff may not have the skills or the commitment to quality that matches the absentee. Staff handling food must be monitored for signs of infectious diseases or for boils or suppurating skin lesions and must be removed from production processes and the incident recorded.

Storage

The dates and consignment size of incoming raw material including packaging should be recorded to ensure that it there are no excessive delays. As with finished products, all raw materials will deteriorate with time and may need to be assessed before use.

The dates and codes for production runs should be recorded. HACCP demands that there is traceability so that complaints, and deterioration can be traced back to the manufacturer and events that may have influence rapid deterioration or excessive bacterial load can be identified and corrected.

Production Numbers

Volumes and production number should be recorded as a matter of course to ensure profitability. However volumes and production numbers can affect quality. Larger volumes of liquid products can take longer to heat and cool and this can affect quality.

Larger numbers of fried product can result in cooler oil which will affect eating characteristics and can affect oil content and moisture loss during frying.

Cleandown

Cleaning of production areas and equipment should be covered by a formal cleandown procedure – the Standard Sanitary Operating Procedures (SSOPs) but because of delays in deliveries of some cleaning materials substitutes are sometimes necessary – such changes to SSOPs or staff conducting procedures should be noted.

In summary, with four mentioned larger exceptions, there can be an overall improvement in production procedures. The current development of the new Samoa Food legislation (law and regulations) to replace the outdated Food and Drug Act and recent introduction of product regulations (e.g. for eggs) is likely to accelerate the need for more attention to quality issues shelf life, safety and protection including that afforded by improved packaging.

It is recommended that record keeping as part of a good hygienic and manufacturing practices becomes a priority for the smaller manufacturers in Samoa and efforts be supported through capacity building.

2.3.4 Shelf Life Manipulation Through Packaging Choices

The relative costs of packaging materials are given in Table 5. The effects of altering packaging material on shelf life are given in Table 6. It is stressed that these data are only estimates and they assume that the storage conditions are identical. Hence manufacturers can choose the most economical packaging that corresponds to their required shelf life.

Table 5 Relative Costs of Packaging Materials (Courtesy of Narsey's Pastics Ltd, Suva)

Film	Relative costs (WST)
Cellophane[2]	1 (WST 0.61)
PE	1.35
PP	2.6
PPPE	4.48
Boppmet laminate	6.87
Additional components[3]	3.12
Pet bottles 500ml Pet bottles 1 litre	WST 0.80 WST 1.36

[2] Suppliers who responded to requests for information are given in Appendix 7
[3] Jaenica Plastics Suva Fiji

Table 6 Estimates of the shelf life extension that can be achieved with different packaging options

Product	Packaging	Anticipated shelf life
Fried snack foods	PE	48 – 72 hours
	50 micron PP	18 - 20 days
	Laminated PP/PE	6 – 8 weeks
	Bi-axially oriented Metallised PP-PE-Paper	6-9 months
Cordials	PET	2-3 months
	LDLPE-paper-LDPE-aluminium-saran	12 – 15 months
	LDPE	4-6 weeks
	Aluminium deep draw cans	15 -18 months
Virgin coconut oil	Pet	7-12 months
	Glass	12-18 months
Nonu	PET	12 – 18 months
Frozen popsicles (below -18 ^{o}C)	PE	4- 5 weeks
	PP	8-10 weeks
Fresh salads (untreated)	Thermoplastic pet	4 – 5 days
Fresh salads (erythorbate dipped and chilled)	Thermoplastic pet	10 – 14 days

Chapter 3
Future Work

3.1 Where to from here?

In Samoa, small- and medium-sized food processors are constantly at risk from competition arising from the bulk importation of similar products and local competitors and from within Samoa. Processors make every effort to ensure that they meet the challenge by uncompromising commitment to quality maintenance. An aspect of quality maintenance is to ensure that products are packaged in such a way that:

- deterioration is minimised;
- they are attractive;
- they are convenient to the consumer;
- their barrier properties are appropriate for the time between production and consumption;
- they are within the budget of the SME.

The selection of appropriate packaging materials and label design is not simple. Poor advice – particularly from some packaging suppliers – has resulted in purchases of inappropriate packaging that either grossly exceeds product life or fails before a reasonable shelf life can be attained. This manual should enable processors in testing suppliers with the appropriate questions.

All processors were aware that quality control starts with the raw materials and all are more than capable of assessing the quality of fresh produce and have experience to deal with reliable overseas suppliers of imported raw materials. Assessment of incoming packaging is often neglected in that quality control step.

Packaging is a significant cost of production and it is recommended that the most economical packaging that will survive the shelf life is chosen. The relative costs of packaging are given in Table 5. It must be stressed however that the costs given here are only a guide. Most manufacturers are not only reluctant to give details of components but will give quotes based on the fabricated container and only then will they indicate the price and the minimum order. The figures given in Table 5 are merely an indication of the relative costs of packaging materials. They indicate the relative costs of films at the time of report preparation. Overseas suppliers may be much cheaper but the costs relative to the composition will be approximately the same.

Occasionally packaging is purchased by weight. This is a reflection of the thickness (and hence density) of the packaging material and the number of packaging units in the consignment. Manufacturers should check these issues with the suppliers – in the event that they quote weights then the number of individual packing units per kg must be confirmed from the packaging manufacturer.

3.2 The Buying Motive

A further weak point throughout the *regional* food industry is a lack of understanding about buying motive. The current economies around the pacific have seriously constrained disposable incomes and purchases tend to centre on essential grocery items such as flour, sugar rice and cooking oil. Consumable products are price-sensitive and where qualities of competing products are perceived as being identical, price will be the buying motive.

A short stay at supermarket checkout points through Apia, however, soon testifies however that impulse buying is still a very important incentive to purchase and this is important for the chips and confectionery manufacturers. 'Ice-cream,' chocolate, popsicles and other sweets are highly desirable among large parts of the population and purchases continue by consumers of all ages. The market also remains robust for snack foods, water, fruit-flavoured drinks and sweetened sodas. It is important that manufacturers of these commodities are aware of their comparative advantages. Label design, product and manufacturer reliability, characteristics relating to the features that attract consumers to a specific product as opposed to the competitors' should be known and understood. Disadvantages should be corrected and advantages exploited.

3.3 Competition

The food industry throughout the world is highly competitive. This is especially so in Samoa with so many manufacturers producing similar products. Without retaining some comparative advantage, sales figures will decline. Without a continuing development plan the risk becomes even greater. There are a number of enterprises that are constantly seeking to reduce processing costs and pay continuing attention to new opportunities. Product development programmes are the essence of progress. Product development is a separate project but processors are urged to continue to seek to increase the range of product and to stave off ever increasing competition.

Manufacturers indicated during interviews that buying cartels are now importing many foods from Asian countries – particularly China and that they are so large that costs are low. These products are now common in most retail outlets in Apia. In order to meet the impact of such imports product development programmes are essential. A number of processors have been provided with some formulations for new products (Beyer) and it is hoped that new products will result.

3.4 Recommendations for Immediate Action by Food Processors

✓ It is recommended that processors question packaging suppliers more closely using a simple check-list that includes:

- Detail of the content and thickness of the proprietary packaging laminate.
- Should the supplier quote the weight of packaging material then they must relate this to the number units per kilogram.
- Confirmation in writing from the packaging manufacturer that the packaging will not interact in an adverse way with the components of the food.
- An assurance in writing that the packaging will perform throughout the shelf life of the product.
- An assurance that the packaging will withstand the special environmental conditions found in Samoa.

This will assist the companies to garner have the same confidence in packaging in relation to their product needs as they do in the other raw materials they purchase.

✓ Processors must ensure that their labels conform to Codex requirements for pre-packaged food given in Annexe 1A and 1B for export products and for the upcoming Samoan Food Regulations for the domestic market.

✓ It is recommended that companies convene to explore the options for bulk purchasing of packaging (and other raw materials) and equipment such as pH meters, refractometers, etc.

✓ It is recommended that the most economical packaging is chosen within the bounds of product shelf life and performance.

✓ That all companies initiate some simple quality testing of features that define the shelf life. Such an approach could involve simple in-house taste panels are used as an inexpensive first step in this process. Taste panels should be selected from within the organisation and a system of daily storage sampling initiated to track changes to the product as time elapses. Taste panels do not necessarily have to be confined to finished product but can be used for syrups, premixes and incoming spice mixes. A nine point score sheet estimating taste, appearance, aroma and overall acceptability (see Appendix 8a) can be used.

✓ Entrepreneurs are encouraged to ensure that retail outlets rotate stock to match shelf life. It is suggested that manufacturers cooperate over this issue and for several manufacturers to employ a merchandiser to visit retail shops to ensure good presentation and that first in first out practices are observed.

- ✓ It is recommended that companies combine to seek assistance in receiving guidance in the first simple steps in quality control procedures that are inexpensive and can be implemented with minimum of delay.

- ✓ It is recommended that record keeping as part of a good hygienic and manufacturing practices becomes a priority for the smaller manufacturers in Samoa and efforts be supported through capacity building. Where records are not kept, processors should set up a system to record daily events including:

    - volumes and quality assessment of incoming raw materials;
    - volumes and varieties of products produced;
    - full stock control data (goods in storage, goods dispatched etc.);
    - traceable batch numbers with dates;
    - production personnel – particularly supervisory staff;
    - incidents (power and equipment failures, water disruptions);
    - taste panel scores for current production and stored samples.

- ✓ Where none exist begin the process of preparing written clean-down procedures known as Standard Sanitary Operating Procedures (SSOPs) detailing:

    - the name of the Hygiene Officer;
    - frequency of cleaning, floors, walls, ceilings and equipment;
    - cleaning materials used;
    - concentrations and
    - prepare check lists for written confirmation.

Appendix 1
Terms of Reference for the Mission

1. Consult with SMAEs to identify key products and issues for the industry (taking into account technical, socio-economic and other factors) and develop manual outline in close consultation with FAO FNO – Mission 1 to Samoa.
2. Develop draft manual on food packaging and labelling taking into account needs of SMAEs and submit draft to FAO for peer review and technical comments.
3. Revise draft based on feedback and resubmit for final technical clearance.
4. Conduct national workshop to disseminate findings to SMAEs – Mission 2 to Samoa

Appendix 2 List of Workshop Participants

Workshop on Food Packaging in Samoa
Apia, Samoa, 30-31 October 2012

Name	Company / Organisation	Contact
Richard Beyer	Self Employed	beyer@connect.com.fj
Luaao Iosefa Faatili	SROS	luao.faatili@sros.org.ws
Michael Soon	RMR Foods Ltd	29988
Nathan Wilson	Wilex Samoa	nathan@wilexsamoa.net
Joanne Wilson	Wilex Samoa	26726
Irene Leota	Wilex Samoa	26526
Cherith Lober	Vailima	cherith@vailima.ws
P G Percival	NFIL	percival@ipasifika.net
Karauna Lemalu	Tafaoata o Samoa	7767119 / 25536
Akeripa Misa	MAF	Akeripa.Misa@maf.gov.ws
Khosrow Moghbelpour	Selprize	kmobhelpour@hotmail.com / mobhelpour@hotmail.com
Papali'i J. Ryan	Apia Bottling Co. Ltd	7583001
Tania Stunzer	Samoa Snack Foods Ltd	ssf@fiafianet.ws
Faumuina Tafuna'i	Women in Business	flyinggeesepro@gmail.com
Jassamin Yazdani	Tafaoata o Samoa	25536
Uaea Laki Apelu	Edutech Samoa	7275285
Tania Stunzer	Samoa Snack Foods Ltd	ssf@fiafianet.ws
Tanya Ott	Tropical Crisps	tott.king@gmail.com

Appendix 3 Functions of Packaging

A. Contain

Packaging must contain the product offered for sale. Rigid containers or plastic bags of certain size enable the manufacturer to control the weight of the commodity, allowing them to maintain consistency and therefore stay within their budgets. Because foods are rarely open for display consistency it is of paramount importance for the consumer because they make repeat purchases on the basis of experience. Hence it is in the interests of all parties that package serves to contain in such a way that the portion sizes are consistent. Quality control to ensure that the product does not vary enhances the company reputation. The package is germane to product consistency and convenience and ensures consumers repeat purchase.

B. Protect

Packaging protects the product ensuring that it does not become contaminated. Samoa has an active Codex Committee and this mandates the use of Hazard Analysis of Critical Control Points. Risks to food include physical contamination (foreign objects such as glass, wood slivers, items of clothing chemical contamination including pesticides or other agricultural chemicals, and biological contamination which included bacteria and vermin). HACCP is the system that specifically targets risk at certain critical points in the production sequence. Packaging should be sufficiently integral to survive at least as long as the stated shelf life of the product so that risk is reduced to a minimum.

Once again the reputation of the company is at stake – the consuming public has a right to expect food that is safe, and free of dangerous or unhealthy foreign objects.

Light

Foods will deteriorate in a variety of ways depending on its components (See Section 2.2). Light transmission is required in packaging intended to display the content but must be restricted where light can cause damage to the food. Some natural colours (e.g. the carotenoids) will bleach if exposed to UV light and UV light will catalyse the formation of peroxides which will accelerate the deterioration of polyunsaturated fatty acids causing rancidity. The fraction of light passing through packaging material is usually determined by trial and error and accelerated storage trials but is given by the Beer-Lambert Law:

The intensity of light reaching the food, is exponentially related to the thickness of the packaging material in clear plastics but eliminated completely if aluminium or paper is incorporated.

Heat

The insulating effect of packaging is determined by the thermal conductivity of the composite material. Paper board, polystyrene and poly urethane have excellent insulation characteristics and aluminium foil is very reflective. Heat will accelerate chemical reactions (see section 2.2) so it may be important to choose packaging that will insulate food.

Moisture and Gases

The rate of moisture and gas transmission through flexible packaging is a significant controlling factor that determines the shelf life of many products - especially snack foods. These products are very common in Samoa and their appeal depends on their crisp mouth feel. They also contain significant quantities of fat which is very susceptible to oxidative rancidity. Assuming the packaging has no pinholes or other defects the rate at which moisture or gas is transferred to the product is given by:

$$m = \frac{\mathrm{bA(P1 - P2)}}{\mathrm{x}}$$

Where:
m is the moisture (or oxygen) ingress
b is the permeability of the packaging
A is the area of the package
P1-P2 is the pressure difference between the inside and the outside of the package
x is the thickness of the packaging

From this it is important that the manufacturer chooses packaging material that is impervious but not unnecessarily over-protective and that the package size fits the stated quantity of the product. Secondary packaging such as an outer cardboard box or larger plastic bag containing several dozen of the retail packs help reduce the pressure difference and assist in reducing moisture and oxygen ingress.

Micro-organisms

Intact packaging materials are barriers to micro-organisms but seals are a potential source of contamination. Packs that are folded, stapled or twist wrapped are not truly sealed and constant abrasion on plastic films can cause packaging to wear and become permeable to gasses, bacteria and moisture. So called Ziplock™ bags are not impervious to bacteria and should be used only when the anticipated shelf life after unsealing is short.

The main causes of bacterial contamination of adequately processed products are;

- contaminated air or water being drawn through pinholes in hermetically sealed containers as head space cools (this is common in cans and jars that are handled before they are cooled to ambient temperature);
- poorly aligned lids or caps;

- damage to packaging (tears or creases);
- pre-contamination prior to packaging (HACCP reduces the risk in this case).

C. Inform (Labelling)

Codex again mandates the requirements of the label. For Samoa the label must be in English although similar wording may appear in Samoan also. The requirements of the label are given in Appendix 3. However the label must also attract and be instantly recognisable. Most consumers rely on consistency in the label and often do not read the label but rely on reputation and consistency. Full labelling requirements are given in Annexe 1 on page 62.

D. Attract

The label is also designed to attract consumers. Red and gold labels are common in Chinese communities, blue is a rare colour for packaging because there are few blue foods. Blue tints are becoming increasingly common in PET water bottles. It is encouraging that several label designers are used in Samoa.

Appendix 4
Single Flexible Films – The Building Blocks

Cellulose (Cellophane)

Cellulose films are manufactured by mixing sulfite paper pulp with sulfur dioxide and carbon bisulfide to form *viscose.* This is then extruded into an acid salt bath to form cellulose hydrate. Glycerol is added as a softener and the film is dried on heated rollers. Higher proportions of softener may be used and extended residence time in the acid salt bath will increase flexibility but more permeable films. Plain cellulose is transparent glossy, tasteless and odourless. It is biodegradeable in 100 days, tough and puncture resistant although it tears easily. It is not heat sealable but it has low slip and excellent folding properties.

It is used for foods that do not require a complete moisture barrier. It is commonly used for confections as a secondary package (e.g. inside a waxed paper outer).

Polypropylene

Oriented polypropylene is a clear glossy film with excellent optical properties and high tensile strength and puncture resistance. It has moderate permeability to moisture vapour, gases and odours. It is thermoplastic and therefore stretches and has low friction which minimises static electricity build up. This makes polypropylene particularly suitable for high speed form filling machines. Biaxially oriented polypropylene (manufactured by stretching the film in two directions as it is extruded) is much stronger.

Polyester

Polyethylene terephthalate (PET) is a very strong transparent glossy film that has excellent impact resistance and very good barrier properties for moisture and gasses. It is flexible at temperatures between 70^{o}C and 135^{o}C which makes it ideal for blow moulding. There two blow moulding machines in Samoa and the bottles are used for soft drinks and cooking oil.

Polyethylene

Low density polyethylene is heat sealable, chemically inert, odour free and shrinks when heated. It is a good moisture barrier but has a relatively high gas permeability. It is unsuitable for oils and has poor odour resistance. It is among the less expensive of the plastic films and is therefore widely used including shrink- or stretch-wrapping. Thinner low density polyethylene is used for stretch wrapping. Linear low density polyethylene is stretched in one direction during extrusion which orientates the molecules leading to higher strength and high restraining force.

High density (HD) polyethylene is stronger than low density it is thicker, less flexible and more brittle. HD polyethylene has higher softening temperature which makes it suitable for hot fill or heat treated foods. It has high tensile strength and is water proof and chemically resistant. It is commonly used for oils and fats which have a tendency to adsorb odours. It is rarely used alone but is commonly used in combination with other films.

Polyvinylidine Chloride

Polyvinylidine Chloride film has very good moisture odour and gas barrier properties. It is fat resistant and does not melt in contact with hot fat. It is commonly used for freezer to oven foods. Polyvinylidine Chloride is also used as a coating for other films and bottles to improve barrier properties.

Other films

Polyvinyl chloride – vinylidine chloride copolymer is strong and can be used for very thin films. It has low gas and water vapour permeability and heat shrinkable and heat sealable.

Polyamides

The poly amides are extremely strong because they are cross-linked using a di-amine. They are tough water resistant and inert and heat resistant. They are rarely used alone but most commonly laminated or co-extruded with other films where they provide impermeability.

Aluminium Foil

Aluminium foil is rarely used alone since it has no impact resistance it tears easily and finds use in very specific circumstances (e.g. chocolate). It has excellent water and gas resistance and is used in combination with other polymers to eliminate light. Currently aluminium foil is condensed onto a support film where it is used to eliminate light and moisture and odours.

Appendix 5

Detailed Properties of Single Component Flexible Films

FILM	Moisture vapour transmission rate	Oxygen transmission rate	Carbon dioxide transmission rate	Tensile strength	Light transmission	Sealing temperature
	ml m^{-2} per 24 h 25°C	ml m^{-2} per 24 h 25°C	ml m^{-2} per 24 h 25°C	MN m^{-2} Machine Direction	%	°C
Cellulose						
Uncoated	40-275	25-30	30-40	33	TP	
Nitrocellulose coated	8-12	9-15	20-30	35	TP	90-130
Polyvinilidine Chloride (PVDC)	1-7	5.5-7	15	32-60	TP	100-130
Metallised PVDC –coated	0.8	2-3	15-20	28-60	O	90-130
Vinyl chloride coated						
Polyethylene						
Low Density	3,000	8,000	40,000	7-16	TP	117-121
Stretch wrap						
Shrink wrap						
High Density	64	500-2,000	7,000-8,000	24-61	84	135-170
Polypropylene						
Oriented	1-1.4	500-2,000	3,250	145-200	TP	145
Biaxially oriented	0.6-1.2	1,600-2,000	20-30	118-260		117-124
PVDC – coated	0.6-1.4	6-13	20-30	210	TP	
Metallised	0.2-0.3	80	150-500	215	0.5-3.1	120-145
Polyester						
Plain	8	53-110	200-500		87	100-200
Metallised	Negligible	48-120	Negligible		88	100-200
PVDC-coated and metallised	0.8	0.1	Negligible			
Polyvinylidene chloride	7-17	2	20	120-130	90	100-160

Appendix 6
SMEs consulted

Company	Contact person	Phone	Email	Products
Wylex Ltd	Eddie Wilson	722391	eddie@wilexsamoa.com	Cardboard packaging
Apia Bottling	Papalii John Ryan	25803	apiabottling@lesamoa.net	Ice cream, chilli sauce, compounded fruit drinks
Th Plantation	Tony Howman	7770827	samoasfavouritechips@yahoo.com	
Le VAI	Fatima Strickland	28915	levai@ipasifika.net	Bottled water
Women In Business Inc	Stephen Hazelman		Stephen.hazelman@gmail.com	Virgin coconut oil, dried bananas
Ah Liki	Alex Bennet	22583	bennet@ahlikiwholesale.com	Small goods, bottled water, canned coconut
Tafoata Ltd	Fred Yazdani	25536	n/a	Snack foods
Natural Foods Interna-tional	Papalii Grant Percival	7774325	percival@ipasifika.net	Snack foods
Selprise Ltd				General supplies plastic wrapping
Samoa Snack Foods	Tania Stunzer	25520	fiafia@fiafianet.ws	Snack foods
CCK Ltd	Ken Newton	24467	ken@ccktrading.ws	Nonu, honey
Uncle Johnnies	Robbie Rankin	7775123	food-pro@lesamoa.net	Cordials, snack foods
Vailima Breweries	Shaun Hellesoe	680000	samoabreweries@lesamoa.net	Beer, Coca-Cola, carbonated beverages

Appendix 7
Consultation Forms

In accordance with ToR 1 of this study, as many food processors as possible were visited during Phase 1 of this study. An interview sheet (see below) prepared prior to the meetings. Four weekdays were not enough to confirm the continued existence of a number of organisations but a total of 15 manufacturers were interviewed. A number of organisations produce several products. Coco Samoa Manufacturers were not included in this survey because of time constraints and their packaging is the high impact PS-PVDC co-polymer cup with a poly propylene bag liner.

PACKAGING QUESTIONNAIRE

Name of Company: .....

Position in the Company: .....

Interviewee:
.....

Number of Employees: .....

Company Established: .....

Target markets:
.....

Products:

.....
.

.....
.

.....
.

Number of different types of packaging:

.....
.

.....
.

.....
.

What type of filling equipment do you use?
.....

Who purchases packaging?
.....

From what companies do you purchase? Names and contacts:

.....
..

.....
..

.....
..

From where did you get your information on the type of packaging you needed?
.....

Do you know from what the packaging is composed?
.....

.....
.

Do you make any attempt to match the packaging to the shelf life of the product?
.....

Do you do any shelf life testing - if so what? .....

Do you use taste panels?
.....

How do you know that the packaging is high quality?
.....

Do you have any impediments to importing the packaging?
.....

Are you required to purchase minimum orders?
.....

Are there any customs impediments to importing packaging equipment?
.....

Can anyone in Samoa provide your packaging requirements?

.....

Is it possible to cooperate with other companies in Samoa to purchase minimum orders and have them printed here?

.....

Who designs your label?

.....

Do you know what information must go on the label?

.....

From where did you get that information?

.....

How do you think that packaging information for your use can be improved?

.....

.....

.....

Appendix 8
Selected Packaging Suppliers

Supplier	Packaging supplied	Contact	Minimum orders
Narsey's Plastics	PE, PP, Metallised PP, PE, Combination Laminates Standup Pouches	Vinay Narsey info@narseysplastics.com.fj	Laminated bags- 25,000 Reel stock 500 kg
Food Packaging	PE, PP, Metallised PP, PE, Combination Laminates Standup Pouches	www.foodpackaging.net.nz	Custom printed 15,000 bags
Alto Packaging	PS-PVD-PVDC-PE Squeezable Bottle	www.alto.co.nz	No minimum orders given
Pet Technology Ltd	Pet Bottles	www.motibai.com	1 litre 3 cartons containing 20 bottles 500 ml 3 cartons containing 30 bottles
Papermart N Z Ltd	Cellophane Bags And Rolls, PP Film, PE, PP, Zipper Bags	www.papermart.com	No minimum orders But prices is reflected in the size of the order
Bemis Flexible Packaging	Shrink Wraps, Custom Made Webs,	Sales.australasia@bemis.com	No minimum orders But prices is reflected in the size of the order
GBK Exports Ltd (Manukau Auckland)	Full Range Of All Packaging Requirements (Chinese Imports)	gbk.co.uk	500,000 Price is reflected in the size of the order
Babron Packaging, Brisbane	PP And PE Bags, Sheeting And Tubes	info@dabron.com.au	Price is reflected in the size of the order
Spartech Ltd	Complete Range Of Plastic Laminates And Co-Extruded Products	www.spartech.com/plastic	Price is reflected in the size of the order
TSL Plastics East Tamaki	Pet Bottles	www.petbottles.co.nz	Price is reflected in the size of the order
Premier Plastic Group	Pet, Glass Bottles And Jars And Closures	www.premierplastics.co.nz	Price is reflected in the size of the order

Appendix 9a
Evaluation Form

Product: .....

Variety: .....

Date: ..... / ..... / .....

Comments: .....
.....
.....
.....
.....

Appearance	
Excellent appearance	
Very good appearance	
Good appearance	
Moderately good	
Neither like nor dislike	
Moderately poor	
Poor appearance	
Very poor appearance	
Totally unacceptable	

Overall acceptability	
Excellent product	
Very good product	
Good product	
Quite good product	
Neither like nor dislike	
Dislike slightly	
Dislike moderately	
Dislike	
Totally unacceptable	

Aroma	
Excellent aroma	
Very good aroma	
Good aroma	
Quite good aroma	
Neither like nor dislike	
Slightly unacceptable	
Moderately unacceptable	
Unacceptable	

Taste	
Excellent taste	
Very good taste	
Good taste	
Moderately good	
Neither like nor dislike	
Moderately poor taste	
Poor taste	
Very poor taste	
Totally unacceptable	

Appendix 9b
Sequential Quality Assessment Chart

	Packing date	Date code	Week 1	Week 3	Week 5	Week 6	Week ….	Week 15	Week 16
Appearance									
Aroma									
Overall acceptability									
Packaging appearance									
Packaging integrity									
Defects (sediment, clouding, discolouration									
Acidity (pH)									
Total bacterial count									
Soluble solids									
Lead									
Tin									

Annex 10 General Standard For The Labelling Of Pre-packaged Foods

GENERAL STANDARD FOR THE LABELLING OF PREPACKAGED FOODS

CODEX STAN 1-1985

1. SCOPE

This standard applies to the labelling of all prepackaged foods to be offered as such to the consumer or for catering purposes and to certain aspects relating to the presentation thereof.

2. DEFINITION OF TERMS

For the purpose of this standard:

"Claim" means any representation which states, suggests or implies that a food has particular qualities relating to its origin, nutritional properties, nature, processing, composition or any other quality.

"Consumer" means persons and families purchasing and receiving food in order to meet their personal needs.

"Container" means any packaging of food for delivery as a single item, whether by completely or partially enclosing the food and includes wrappers. A container may enclose several units or types of packages when such is offered to the consumer.

For use in ***Date Marking*** of prepackaged food:

"Date of Manufacture" means the date on which the food becomes the product as described.

"Date of Packaging" means the date on which the food is placed in the immediate container in which it will be ultimately sold.

"Sell-by-Date" means the last date of offer for sale to the consumer after which there remains a reasonable storage period in the home.

"Date of Minimum Durability" ("best before") means the date which signifies the end of the period under any stated storage conditions during which the product will remain fully marketable and will retain any specific qualities for which tacit or express claims have been made. However, beyond the date the food may still be perfectly satisfactory.

"Use-by Date" (Recommended Last Consumption Date, Expiration Date) means the date which signifies the end of the estimated period under any stated storage conditions, after which the product probably will not have the quality attributes normally expected by the consumers. After this date, the food should not be regarded as marketable.

"Food" means any substance, whether processed, semi-processed or raw, which is intended for human consumption, and includes drinks, chewing gum and any substance which has been used in the manufacture, preparation or treatment of "food" but does not include cosmetics or tobacco or substances used only as drugs.

"Food Additive" means any substance not normally consumed as a food by itself and not normally used as a typical ingredient of the food, whether or not it has nutritive value, the intentional addition of which to food for a technological (including organoleptic) purpose in the manufacture, processing, preparation, treatment, packing, packaging, transport or holding of such food results, or may be reasonably expected to result, (directly or indirectly) in it or its by-products becoming a component of or otherwise affecting the characteristics of such foods. The term does not include "contaminants" or substances added to food for maintaining or improving nutritional qualities.

"Ingredient" means any substance, including a food additive, used in the manufacture or preparation of a food and present in the final product although possibly in a modified form.

"Label" means any tag, brand, mark, pictorial or other descriptive matter, written, printed, stencilled, marked, embossed or impressed on, or attached to, a container of food.

"Labelling" includes any written, printed or graphic matter that is present on the label, accompanies the food, or is displayed near the food, including that for the purpose of promoting its sale or disposal.

"Lot" means a definitive quantity of a commodity produced essentially under the same conditions.

"Prepackaged" means packaged or made up in advance in a container, ready for offer to the consumer, or for catering purposes.

"Processing Aid" means a substance or material, not including apparatus or utensils, and not consumed as a food ingredient by itself, intentionally used in the processing of raw materials, foods or its ingredients, to fulfil a certain technological purpose during treatment or processing and which may result in the non-intentional but unavoidable presence of residues or derivatives in the final product.

"Foods for Catering Purposes" means those foods for use in restaurants, canteens, schools, hospitals and similar institutions where food is offered for immediate consumption.

Adopted 1985. Amended 1991, 1999, 2001, 2003, 2005, 2008 and 2010.

3. GENERAL PRINCIPLES

3.1 Prepackaged food shall not be described or presented on any label or in any labelling in a manner that is false, misleading or deceptive or is likely to create an erroneous impression regarding its character in any respect.[1]

3.2 Prepackaged food shall not be described or presented on any label or in any labelling by words, pictorial or other devices which refer to or are suggestive either directly or indirectly, of any other product with which such food might be confused, or in such a manner as to lead the purchaser or consumer to suppose that the food is connected with such other product.

4. MANDATORY LABELLING OF PREPACKAGED FOODS

The following information shall appear on the label of prepackaged foods as applicable to the food being labelled, except to the extent otherwise expressly provided in an individual Codex standard:

4.1 The name of the food

4.1.1 The name shall indicate the true nature of the food and normally be specific and not generic:

4.1.1.1 Where a name or names have been established for a food in a Codex standard, at least one of these names shall be used.

4.1.1.2 In other cases, the name prescribed by national legislation shall be used.

4.1.1.3 In the absence of any such name, either a common or usual name existing by common usage as an appropriate descriptive term which was not misleading or confusing to the consumer shall be used.

4.1.1.4 A "coined", "fanciful", "brand" name, or "trade mark" may be used provided it accompanies one of the names provided in Subsections 4.1.1.1 to 4.1.1.3.

4.1.2 There shall appear on the label either in conjunction with, or in close proximity to, the name of the food, such additional words or phrases as necessary to avoid misleading or confusing the consumer in regard to the true nature and physical condition of the food including but not limited to the type of packing medium, style, and the condition or type of treatment it has undergone; for example: dried, concentrated, reconstituted, smoked.

4.2 List of ingredients

4.2.1 Except for single ingredient foods, a list of ingredients shall be declared on the label.

4.2.1.1 The list of ingredients shall be headed or preceded by an appropriate title which consists of or includes the term 'ingredient'.

4.2.1.2 All ingredients shall be listed in descending order of ingoing weight (m/m) at the time of the manufacture of the food.

4.2.1.3 Where an ingredient is itself the product of two or more ingredients, such a compound ingredient may be declared, as such, in the list of ingredients, provided that it is immediately accompanied by a list, in brackets, of its ingredients in descending order of proportion (m/m). Where a compound ingredient (for which a name has been established in a Codex standard or in national legislation) constitutes less than 5% of the food, the ingredients, other than food additives which serve a technological function in the finished product, need not be declared.

4.2.1.4 The following foods and ingredients are known to cause hypersensitivity and shall always be declared:[2]

- Cereals containing gluten; i.e., wheat, rye, barley, oats, spelt or their hybridized strains and products of these;
- Crustacea and products of these;
- Eggs and egg products;
- Fish and fish products;
- Peanuts, soybeans and products of these;
- Milk and milk products (lactose included);
- Tree nuts and nut products; and
- Sulphite in concentrations of 10 mg/kg or more.

---

[1] Examples of descriptions or presentations to which these General Principles refer are given in the Codex *General Guidelines on Claims*.

[2] Future additions to and/or deletions from this list will be considered by the Codex Committee on Food Labelling taking into account the advice provided by the Joint FAO/WHO Expert Committee on Food Additives (JECFA).

4.2.1.5 Added water shall be declared in the list of ingredients except when the water forms part of an ingredient such as brine, syrup or broth used in a compound food and declared as such in the list of ingredients. Water or other volatile ingredients evaporated in the course of manufacture need not be declared.

4.2.1.6 As an alternative to the general provisions of this section, dehydrated or condensed foods which are intended to be reconstituted by the addition of water only, the ingredients may be listed in order of proportion (m/m) in the reconstituted product provided that a statement such as "ingredients of the product when prepared in accordance with the directions on the label" is included.

4.2.2 The presence in any food or food ingredients obtained through biotechnology of an allergen transferred from any of the products listed in Section 4.2.1.4 shall be declared.

When it is not possible to provide adequate information on the presence of an allergen through labelling, the food containing the allergen should not be marketed.

4.2.3 A specific name shall be used for ingredients in the list of ingredients in accordance with the provisions set out in Section 4.1 (Name of the Food) except that:

4.2.3.1 Except for those ingredients listed in section 4.2.1.4, and unless a general class name would be more informative, the following class names may be used:

NAME OF CLASSES	CLASS NAMES
Refined oils other than olive	'Oil' together with either the term 'vegetable' or 'animal', qualified by the term 'hydrogenated' or' partially-hydrogenated', as appropriate
Refined fats	'Fat' together with either, the term 'vegetable' or 'animal', as appropriate
Starches, other than chemically modified starches	'Starch'
All species of fish where the fish constitutes an ingredient of another food and provided that the labelling and presentation of such food does not refer to a specific species of fish	'Fish'
All types of poultrymeat where such meat constitutes an ingredient of another food and provided that the labelling and presentation of such a food does not refer to a specific type of poultrymeat	'Poultrymeat'
All types of cheese where the cheese or mixture of cheeses constitutes an ingredient of another food and provided that the labelling and presentation of such food does not refer to a specific type of cheese	'Cheese'
All spices and spice extracts not exceeding 2% by weight either singly or in combination in the food	'Spice', 'spices', or 'mixed spices', as appropriate
All herbs or parts of herbs not exceeding 2% by weight either singly or in combination in the food	'Herbs' or 'mixed herbs', as appropriate
All types of gum preparations used in the manufacture of gum base for chewing gum	'Gum base'
All types of sucrose	'Sugar'
Anhydrous dextrose and dextrose monohydrate	'Dextrose' or 'glucose'
All types of caseinates	'Caseinates'
Milk products containing a minimum of 50% of milk protein (m/m) in dry matter *	'Milk Protein'
Press, expeller or refined cocoa butter	'Cocoa butter'
All crystallized fruit not exceeding 10% of the weight of the food	'Crystallized fruit'

*Calculation of milk protein content : Kjeldahl nitrogen × 6.38

4.2.3.2 Notwithstanding the provision set out in Section 4.2.3.1, pork fat, lard and beef fat shall always be declared by their specific names.

4.2.3.3 For food additives falling in the respective classes and appearing in lists of food additives permitted for use in foods, the following functional classes shall be used together with the specific name or recognized numerical identification such as the Codex International Numbering System (CAC/GL 36-1989) as required by national legislation.

- Acidity Regulator
- Anticaking Agent
- Antifoaming Agent
- Antioxidant
- Bleaching Agent
- Bulking Agent
- Carbonating Agent
- Colour
- Colour Retention Agent
- Emulsifier
- Emulsifying Salt
- Firming Agent
- Flavour Enhancer
- Flour Treatment Agent
- Foaming Agent
- Gelling Agent
- Glazing Agent
- Humectant
- Preservative
- Propellant
- Raising Agent
- Sequestrant
- Stabilizer
- Sweetener
- Thickener

4.2.3.4 The following class titles may be used for food additives falling in the respective classes and appearing in lists of food additives permitted generally for use in foods:

- Flavour(s) and Flavouring(s)
- Modified Starch(es)

The expression "flavours" may be qualified by "natural", "nature identical", "artificial" or a combination of these words as appropriate.

4.2.4 Processing aids and carry-over of food additives

4.2.4.1 A food additive carried over into a food in a significant quantity or in an amount sufficient to perform a technological function in that food as a result of the use of raw materials or other ingredients in which the additive was used shall be included in the list of ingredients.

4.2.4.2 A food additive carried over into foods at a level less than that required to achieve a technological function, and processing aids, are exempted from declaration in the list of ingredients. The exemption does not apply to food additives and processing aids listed in section 4.2.1.4.

4.3 Net contents and drained weight

4.3.1 The net contents shall be declared in the metric system ("Système International" units).[3]

4.3.2 The net contents shall be declared in the following manner:
(i) for liquid foods, by volume;
(ii) for solid foods, by weight;
(iii) for semi-solid or viscous foods, either by weight or volume.

4.3.3 In addition to the declaration of net contents, a food packed in a liquid medium shall carry a declaration in the metric system of the drained weight of the food. For the purposes of this requirement, liquid medium means water, aqueous solutions of sugar and salt, fruit and vegetable juices in canned fruits and vegetables only, or vinegar, either singly or in combination.[4]

4.4 Name and address

The name and address of the manufacturer, packer, distributor, importer, exporter or vendor of the food shall be declared.

4.5 Country of origin

4.5.1 The country of origin of the food shall be declared if its omission would mislead or deceive the consumer.

4.5.2 When a food undergoes processing in a second country which changes its nature, the country in which the processing is performed shall be considered to be the country of origin for the purposes of labelling.

[3] The declaration of net contents represents the quantity at the time of packaging and is subject to enforcement by reference to an average system of quantity control.
[4] The declaration of drained weight is subject to enforcement by reference to an average system of quantity control.

4.6 Lot identification

Each container shall be embossed or otherwise permanently marked in code or in clear to identify the producing factory and the lot.

4.7 Date marking and storage instructions

4.7.1 If not otherwise determined in an individual Codex standard, the following date marking shall apply:

(i) The "date of minimum durability" shall be declared.

(ii) This shall consist at least of:

- the day and the month for products with a minimum durability of not more than three months;
- the month and the year for products with a minimum durability of more than three months. If the month is December, it is sufficient to indicate the year.

(iii) The date shall be declared by the words:

- "Best before ..." where the day is indicated;
- "Best before end ..." in other cases.

(iv) The words referred to in paragraph (iii) shall be accompanied by:

- either the date itself; or
- a reference to where the date is given.

(v) The day, month and year shall be declared in uncoded numerical sequence except that the month may be indicated by letters in those countries where such use will not confuse the consumer.

(vi) Notwithstanding 4.7.1 (i) an indication of the date of minimum durability shall not be required for:

- fresh fruits and vegetables, including potatoes which have not been peeled, cut or similarly treated;
- wines, liqueur wines, sparkling wines, aromatized wines, fruit wines and sparkling fruit wines;
- beverages containing 10% or more by volume of alcohol;
- bakers' or pastry-cooks' wares which, given the nature of their content, are normally consumed within 24 hours of their manufacture;
- vinegar;
- food grade salt;
- solid sugars;
- confectionery products consisting of flavoured and/or coloured sugars;
- chewing gum.

4.7.2 In addition to the date of minimum durability, any special conditions for the storage of the food shall be declared on the label if the validity of the date depends thereon.

4.8 Instructions for use

Instructions for use, including reconstitution, where applicable, shall be included on the label, as necessary, to ensure correct utilization of the food.

5. ADDITIONAL MANDATORY REQUIREMENTS

5.1 Quantitative ingredients declaration

5.1.1 The ingoing percentage of an ingredient (including compound ingredients[5] or categories of ingredients[6]), by weight or volume as appropriate, at the time of manufacture, shall be disclosed for foods sold as a mixture or combination where the ingredient:

(a) is emphasised as present on the label through words or pictures or graphics; or

(b) is not within the name of the food, is essential to characterise the food and is expected to be present in the food by consumers in the country where the food is sold if the omission of the quantitative ingredient declaration would mislead or deceive the consumer.

Such disclosure is not required:

(c) where the ingredient is used in small quantities for the purpose of flavouring; or

(d) where commodity specific standards of Codex Alimentarius conflict with the requirements described here.

With respect to 5.1.1(a):

(e) a reference in the name of the food to an ingredient or category of ingredients shall not of itself require quantitative ingredient declaration if:

- that reference would not mislead or deceive or would not be likely to create an erroneous impression to the consumer regarding the character of the food in the country of marketing

[5] For compound ingredients the ingoing percentage means the ingoing percentage of the compound ingredient as a whole.

[6] For the purposes of Quantitative Ingredient Declaration, "category of ingredients" means the generic term which refers to the class name of an ingredient and/or any similar common term(s) which are used in reference to the name of a food.

because the variation in quantity of the ingredient(s) between products is not necessary to characterise the food or distinguish it from similar foods.

5.1.2 The information required in Section 5.1.1 shall be declared on the product label as a numerical percentage. The ingoing percentage, by weight or volume as appropriate, of each such ingredient shall be given on the label in close proximity to the words or pictures or graphics emphasising the particular ingredient, or beside the name of the food, or adjacent to each appropriate ingredient listed in the ingredient list as a minimum percentage where emphasis is on the presence of the ingredient and a maximum percentage where emphasis is on the low level of the ingredient.

For foodstuffs which have lost moisture following heat or other treatment, the percentage (by weight or by volume) shall correspond to the quantity of the ingredient(s) used, related to the finished product.

When the quantity of an ingredient or the total quantity of all ingredients expressed on the labelling exceeds 100%, the percentage may be replaced by the declaration of the weight of the ingredient(s) used to prepare 100g of finished product.

5.2 Irradiated foods

5.2.1 The label of a food which has been treated with ionizing radiation shall carry a written statement indicating that treatment in close proximity to the name of the food. The use of the international food irradiation symbol, as shown below, is optional, but when it is used, it shall be in close proximity to the name of the food.

5.2.2 When an irradiated product is used as an ingredient in another food, this shall be so declared in the list of ingredients.

5.2.3 When a single ingredient product is prepared from a raw material which has been irradiated, the label of the product shall contain a statement indicating the treatment.

6. EXEMPTIONS FROM MANDATORY LABELLING REQUIREMENTS

With the exception of spices and herbs, small units, where the largest surface area is less than 10 cm², may be exempted from the requirements of paragraphs 4.2 and 4.6 to 4.8.

7. OPTIONAL LABELLING

7.1 Any information or pictorial device written, printed, or graphic matter may be displayed in labelling provided that it is not in conflict with the mandatory requirements of this standard and those relating to claims and deception given in Section 3 – General Principles.

7.2 If grade designations are used, they shall be readily understandable and not be misleading or deceptive in any way.

8. PRESENTATION OF MANDATORY INFORMATION

8.1 General

8.1.1 Labels in prepackaged foods shall be applied in such a manner that they will not become separated from the container.

8.1.2 Statements required to appear on the label by virtue of this standard or any other Codex standards shall be clear, prominent, indelible and readily legible by the consumer under normal conditions of purchase and use.

8.1.3 Where the container is covered by a wrapper, the wrapper shall carry the necessary information or the label on the container shall be readily legible through the outer wrapper or not obscured by it.

8.1.4 The name and net contents of the food shall appear in a prominent position and in the same field of vision.

8.2 Language

8.2.1 If the language on the original label is not acceptable, to the consumer for whom it is intended, a supplementary label containing the mandatory information in the required language may be used instead of relabelling.

8.2.2 In the case of either relabelling or a supplementary label, the mandatory information provided shall be fully and accurately reflect that in the original label.

Annex 11 Codex Guidelines on Nutrition Labelling

GUIDELINES ON NUTRITION LABELLING

CAC/GL 2-1985

PURPOSE OF THE GUIDELINES

To ensure that nutrition labelling is effective:

- In providing the consumer with information about a food so that a wise choice of food can be made;
- in providing a means for conveying information of the nutrient content of a food on the label;
- in encouraging the use of sound nutrition principles in the formulation of foods which would benefit public health;
- in providing the opportunity to include supplementary nutrition information on the label.

To ensure that nutrition labelling does not describe a product or present information about it which is in any way false, misleading, deceptive or insignificant in any manner.

To ensure that no nutrition claim is made without nutrition labelling.

PRINCIPLES FOR NUTRITION LABELLING

A. Nutrient declaration

– Information supplied should be for the purpose of providing consumers with a suitable profile of nutrients contained in the food and considered to be of nutritional importance. The information should not lead consumers to believe that there is exact quantitative knowledge of what individuals should eat in order to maintain health, but rather to convey an understanding of the quantity of nutrients contained in the product. A more exact quantitative delineation for individuals is not valid because there is no meaningful way in which knowledge about individual requirements can be used in labelling.

B. Supplementary nutrition information

– The content of supplementary nutrition information will vary from one country to another and within any country from one target population group to another according to the educational policy of the country and the needs of the target groups.

C. Nutrition labelling

– Nutrition labelling should not deliberately imply that a food which carries such labelling has necessarily any nutritional advantage over a food which is not so labelled.

1. SCOPE

1.1 These guidelines recommend procedures for the nutrition labelling of foods.

1.2 These guidelines apply to the nutrition labelling of all foods. For foods for special dietary uses, more detailed provisions may be developed.

2. DEFINITIONS

For the purpose of these guidelines:

2.1 ***Nutrition labelling*** is a description intended to inform the consumer of nutritional properties of a food.

2.2 Nutrition labelling consists of two components:
(a) nutrient declaration;
(b) supplementary nutrition information.

2.3 ***Nutrient declaration*** means a standardized statement or listing of the nutrient content of a food.

2.4 ***Nutrition claim*** means any representation which states, suggests or implies that a food has particular nutritional properties including but not limited to the energy value and to the content of protein, fat and carbohydrates, as well as the content of vitamins and minerals. The following do not constitute nutrition claims:
(a) the mention of substances in the list of ingredients;
(b) the mention of nutrients as a mandatory part of nutrition labelling;
(c) quantitative or qualitative declaration of certain nutrients or ingredients on the label if required by national legislation.

Adopted 1985. Revisions 1993 and 2011. Amendment 2003, 2006, 2009, 2010 and 2012. Annex adopted 2011

2.5 ***Nutrient*** means any substance normally consumed as a constituent of food:
(a) which provides energy; or
(b) which is needed for growth, development and maintenance of life; or
(c) a deficit of which will cause characteristic bio-chemical or physiological changes to occur.

2.6 ***Nutrient Reference Values (NRVs)***[1] are a set of numerical values that are based on scientific data for purposes of nutrition labelling and relevant claims. NRVs are based on levels of nutrients associated with nutrient requirements, or with the reduction in the risk of diet-related noncommunicable diseases.

2.7 ***Sugars*** means all mono-saccharides and di-saccharides present in food.

2.8 ***Dietary fibre*** means carbohydrate polymers[2] with ten or more monomeric units[3] , which are not hydrolysed by the endogenous enzymes in the small intestine of humans and belong to the following categories:

- Edible carbohydrate polymers naturally occurring in the food as consumed,
- carbohydrate polymers, which have been obtained from food raw material by physical, enzymatic or chemical means and which have been shown to have a physiological effect of benefit to health as demonstrated by generally accepted scientific evidence to competent authorities,
- synthetic carbohydrate polymers which have been shown to have a physiological effect of benefit to health as demonstrated by generally accepted scientific evidence to competent authorities

2.9 ***Polyunsaturated fatty acids*** means fatty acids with cis-cis methylene interrupted double bonds.

2.10 ***Trans Fatty Acids***[4]*:* For the purpose of the Codex *Guidelines on Nutrition Labelling* and other related Codex Standards and Guidelines, trans fatty acids are defined as all the geometrical isomers of monounsaturated and polyunsaturated fatty acids having non-conjugated, interrupted by at least one methylene group, carbon-carbon double bonds in the trans configuration.

3. NUTRIENT DECLARATION

3.1 Application of nutrient declaration

3.1.1 Nutrient declaration should be mandatory for all prepackaged foods for which nutrition or health claims, as defined in the *Guidelines for Use of Nutrition and Health Claims* (CAC/GL 23-1997), are made.

3.1.2 Nutrient declaration should be mandatory for all other prepackaged foods except where national circumstances would not support such declarations. Certain foods may be exempted for example, on the basis of nutritional or dietary insignificance or small packaging.

3.2 Listing of nutrients

3.2.1 Where nutrient declaration is applied, the declaration of the following should be mandatory:

3.2.1.1 Energy value; and

3.2.1.2 The amounts of protein, available carbohydrate (i.e. dietary carbohydrate excluding dietary fibre), fat, saturated fat, sodium[5] and total sugars; and

3.2.1.3 The amount of any other nutrient for which a nutrition or health claim is made; and

3.2.1.4 The amount of any other nutrient considered to be relevant for maintaining a good nutritional status, as required by national legislation or national dietary guidelines[6].

3.2.2 When a voluntary declaration of specific nutrient, in addition to those listed in section 3.2.1, is applied, national legislation may require the mandatory declaration of the amount of any other nutrients considered relevant for maintaining a good nutritional status.

3.2.3 Where a specific nutrition or health claim is applied, then the declaration of the amount of any other nutrient considered relevant for maintaining a good nutritional status as required by national legislation or national dietary guidelines should be mandatory.

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[1] See also the Annex for the General Principles for the Establishment of Nutrient Reference Values.

[2] When derived from a plant origin, dietary fibre may include fractions of lignin and/or other compounds associated with polysaccharides in the plant cell walls. These compounds also may be measured by certain analytical method(s) for dietary fibre. However, such compounds are not included in the definition of dietary fibre if extracted and re-introduced into a food.

[3] Decision on whether to include carbohydrates from 3 to 9 monomeric units should be left to national authorities.

[4] Codex Members may, for the purposes of nutrition labelling, review the inclusion of specific trans fatty acids (TFAs) in the definition of TFAs if new scientific data become available.

[5] National authorities may decide to express the total amount of sodium in salt equivalents as "salt".

[6] Countries where the level of intake of trans-fatty acids is a public health concern should consider the declaration of trans-fatty acids in nutrition labelling.

3.2.4 Where a claim is made regarding the amount and/or the type of carbohydrate, the amount of total sugars should be listed in addition to the requirements in Section 3.2.1. The amounts of starch and/or other carbohydrate constituent(s) may also be listed. Where a claim is made regarding the dietary fibre content, the amount of dietary fibre should be declared.

3.2.5 Where a claim is made regarding the amount and/or type of fatty acids or the amount of cholesterol, the amounts of saturated fatty acids, monounsaturated fatty acids and polyunsaturated fatty acids and cholesterol should be declared, and the amount of trans fatty acid may be required according to national legislation, in addition to the requirements of Section 3.2.1 and in accordance with Section 3.4.7.

3.2.6 In addition to the mandatory declaration under 3.2.1, 3.2.3 and 3.2.4 vitamins and minerals may be listed in accordance with the following criteria:

3.2.6.1 Only vitamins and minerals for which recommended intakes have been established and/or which are of nutritional importance in the country concerned should also be declared.

3.2.6.2 When nutrient declaration is applied, vitamins and minerals which are present in amounts less than 5% of the Nutrient Reference Value or of the officially recognized guidelines of the competent authority per 100 g or 100 ml or per serving as quantified on the label should not be declared.

3.2.7 In the case where a product is subject to labelling requirements of a Codex standard, the provisions for nutrient declaration set out in that standard should take precedence over but not conflict with the provisions of Sections 3.2.1 to 3.2.6 of these Guidelines.

3.3 Calculation of nutrients

3.3.1 Calculation of energy

The amount of energy to be listed should be calculated by using the following conversion factors:

Carbohydrates	4 kcal/g – 17 kJ
Protein	4 kcal/g – 17 kJ
Fat	9 kcal/g – 37 kJ
Alcohol (Ethanol)	7 kcal/g – 29 kJ
Organic acid	3 kcal/g – 13 kJ

3.3.2 Calculation of protein

The amount of protein to be listed should be calculated using the formula:

Protein = Total Kjeldahl Nitrogen x 6.25

unless a different factor is given in a Codex standard or in the Codex method of analysis for that food.

3.4 Presentation of nutrient content

3.4.1 The declaration of nutrient content should be numerical. However, the use of additional means of presentation should not be excluded.

3.4.2 Information on energy value should be expressed in kJ and kcal per 100 g or per 100 ml or per package if the package contains only a single portion. In addition, this information may be given per serving as quantified on the label or per portion provided that the number of portions contained in the package is stated.

3.4.3 Information on the amounts of protein, carbohydrate and fat in the food should be expressed in g per 100 g or per 100 ml or per package if the package contains only a single portion. In addition, this information may be given per serving as quantified on the label or per portion provided that the number of portions contained in the package is stated.

3.4.4 Numerical information on vitamins and minerals should be expressed in metric units and/or as a percentage of the Nutrient Reference Value per 100 g or per 100 ml or per package if the package contains only a single portion. In addition, this information may be given per serving as quantified on the label or per portion provided that the number of portions contained in the package is stated.

In addition, information on protein may also be expressed as percentages of the Nutrient Reference Value[7].

The following Nutrient Reference Values should be used for labelling purposes in the interests of international standardization and harmonization:

[7] In order to take into account future scientific developments, future FAO/WHO and other expert recommendations and other relevant information, the list of nutrients and the list of nutrient reference values should be kept under review.

Protein	(g)	50
Vitamin A	(µg)	800[8]
Vitamin D	(µg)	5[9]
Vitamin C	(mg)	60
Thiamin	(mg)	1.4
Riboflavin	(mg)	1.6
Niacin	(mg)	18[6]
Vitamin B_6	(mg)	2
Folic acid	(µg)	200
Vitamin B_{12}	(µg)	1
Calcium	(mg)	800
Magnesium	(mg)	300
Iron	(mg)	14
Zinc	(mg)	15
Iodine	(µg)	150[6]
Copper	Value to be established	
Selenium	Value to be established	

3.4.5 In countries where serving sizes are normally used, the information required by Sections 3.4.2, 3.4.3 and 3.4.4 may be given per serving only as quantified on the label or per portion provided that the number of portions contained in the package is stated.

3.4.6 The presence of available carbohydrates should be declared on the label as "carbohydrates". Where the type of carbohydrate is declared, this declaration should follow immediately the declaration of the total carbohydrate content in the following format:

"Carbohydrate ... g, of which sugars ... g".

This may be followed by the following: "x" ...g

where "x" represents the specific name of any other carbohydrate constituent.

3.4.7 Where the amount and/or type of fatty acids or the amount of cholesterol is declared, this declaration should follow immediately the declaration of the total fat in accordance with Section 3.4.3.

The following format should be used:

Total Fat		...	g
	saturated fatty acids	...	g
of which	trans fatty acids	...	g
	monounsaturated fatty acids	...	g
	polyunsaturated fatty acids	...	g
Cholesterol		...	mg

3.5 Tolerances and compliance

3.5.1 Tolerance limits should be set in relation to public health concerns, shelf-life, accuracy of analysis, processing variability and inherent lability and variability of the nutrient in the product, and, according to whether the nutrient has been added or is naturally occurring in the product.

3.5.2 The values used in nutrient declaration should be weighted average values derived from data specifically obtained from analyses of products which are representative of the product being labelled.

3.5.3 In those cases where a product is subject to a Codex standard, requirements for tolerances for nutrient declaration established by the standard should take precedence over these guidelines.

[8] For the declaration of β-carotene (provitamin A) the following conversion factor should be used: 1 µg retinol = 6 µg β-carotene

[9] Nutrient Reference Values for Vitamin D, Niacin and Iodine may not be applicable for countries where national nutrition policies or local conditions provide sufficient allowance to ensure that individual requirements are satisfied. See also section 3.2.6.1 of the Codex Guidelines on Nutrition Labelling.

4. PRINCIPLES AND CRITERIA FOR LEGIBILITY OF NUTRITION LABELLING

4.1 General principles

In the case of nutrition labelling whether applied on a mandatory or voluntary basis, the principles of Sections 8.1.1, 8.1.2, 8.1.3 and 8.2 of the General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985) should be applied. Sections 8.1.1, 8.1.2 and 8.1.3 should be applied to any supplementary nutrition labels.

4.2 Specific features of presentation

4.2.1 These recommendations related to specific features of presentation are intended to enhance the legibility of nutrition labelling. However, competent authorities may determine any additional means of presentation of nutrition information taking into account approaches and practical issues at the national level and based on the needs of their consumers.

4.2.2 Format – Nutrient content should be declared in a numerical, tabular format. Where there is insufficient space for a tabular format, nutrient declaration may be presented in a linear format.

4.2.3 Nutrients should be declared in a specific order developed by competent authorities and should be consistent across food products.

4.2.4 Font – The font type, style and a minimum font size as well as the use of upper and lower case letters should be considered by competent authorities to ensure legibility of nutrition labelling.

4.2.5 Contrast – A significant contrast should be maintained between the text and background so ~~as to be~~ that the nutrition information is clearly legible.

4.2.6 Numerical Presentation – The numerical presentation of nutrient content should be in accordance with the provisions of Section 3.4.

5. SUPPLEMENTARY NUTRITION INFORMATION

5.1 Supplementary nutrition information is intended to increase the consumer's understanding of the nutritional value of their food and to assist in interpreting the nutrient declaration. There are a number of ways of presenting such information that may be suitable for use on food labels.

5.2 The use of supplementary nutrition information on food labels should be optional and should only be given in addition to, and not in place of, the nutrient declaration, except for target populations who have a high illiteracy rate and/or comparatively little knowledge of nutrition. For these, food group symbols or other pictorial or colour presentations may be used without the nutrient declaration.

5.3 Supplementary nutrition information on labels should be accompanied by consumer education programmes to increase consumer understanding and use of the information.