GUIDELINES FOR ENVIRONMENTAL HEALTH OFFICERS ON THE INTERPRETATION OF MICROBIOLOGICAL ANALYSIS DATA OF FOOD

DEPARTMENT OF HEALTH
DIRECTORATE: FOOD CONTROL

TABLE OF CONTENTS

1 Introduction

All foodstuffs manufactured, processed or sold in South Africa as well as those imported into South Africa are governed by the *Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act 54 of 1972)* (FCD) from a human health perspective. There are two sets of regulations promulgated in terms of this Act which make provision for microbiological standards or specifications for certain foodstuffs.

- **Regulations Governing Microbiological Standards for Foodstuffs and Related Matters (R.692 of 16 May 1997)**
- **Regulations Relating to Milk and Dairy Products (R.1555 of 21 November 1997)**

In addition, the Regulations Relating to Foodstuffs for Infants, Young Children and Children (R.1130 of 1984) stipulate that these foods should be **free from pathogenic microorganisms and/or their toxins.**

All foodstuffs, however, should not contain microorganisms at levels, which may cause harm to humans upon consumption. This is one of the regulations of section 2(1)(b)(i) of the FCD Act.

It must be borne in mind that the presence of microoganisms in foods is not necessarily an indicator of a hazard to the consumer. Plants and animals form the major origin of the foods, which we eat and these sources are naturally associated with microorganisms, which implies that foods will be associated with microorganisms.

Food can become microbiologically hazardous to the consumer when the principles of hygiene and sanitation are not met or when it becomes contaminated by pathogens from humans or from the environment during production, processing or preparation, or when it originates from a sick animal, for example, a cow with mastitis or an animal with anthrax. On subjection to conditions that allow the entry and/or growth of infectious agents, it may become a vehicle for transmission of diseases such as

salmonellosis or staphylococcal food poisoning. Examination of food samples allows us to determine the presence of these hazards.

Many different microorganisms have been associated with foodborne disease and many more are emerging as potential causes of foodborne disease. However, what constitutes a significant pathogen is not always obvious. Under various circumstances, *Staphylococcus* may be an indicator of excessive human handling, a food-poisoning hazard, or a harmless contaminant of little significance. Likewise, precooked or ready-to-eat foods should contain no salmonellae, but some raw foods, such as meats are often unavoidably contaminated with salmonellae, which in the normal course of events die during cooking.

Increasingly, the need to assess the safety of foods and to a lesser extent the quality of food is being recognised. Surveillance has also become increasingly important due to the increase in international trade in foods. Hazards could stem from the introduction of new techniques for mass production, rapid and widespread distribution, and introduction into commerce of foods from areas with endemic enteric diseases. Control agencies need authoritative guidance on two problems long enveloped in uncertainty:

- The significance of particular species or groups of microorganisms, when found in foods; and
- Microbiological specifications or standards.

This document sets out to explain to EHOs the use of significant species or groups of microorganisms used in microbiological standards and to give guidance on the interpretation of microbiological analysis data especially in instances where no microbiological legislative standards exist.

2 Types of microorganisms analysed for during sampling of foodstuffs

2.1 Indicator organisms

Routine examination of foods for a range of pathogenic microorganisms is impractical. In order to assess the microbiological safety from foodborne pathogens, widespread use of groups or species which are easily enumerated and whose presence in foods indicates exposure to conditions that might introduce hazardous organisms and/or allow their growth, are used. These groups are referred to as **indicator organisms**.

Indicator organisms are generally used to assess food hygiene. However, routine tests for selected pathogens and/or their toxins are necessary whenever epidemiological or other evidence suggests that occurrence of a specific agent in a particular type of food, e.g., *Salmonella* in eggs or egg products.

Indicator organisms have historically been used to indicate the presence of pathogens of intestinal origin as a result of direct or indirect faecal contamination. The main objective of using bacteria as indicators, is to reveal conditions of treatment of the product which may imply a potential hazard that is not necessarily present in the specific sample examined, but could be present in parallel samples.

The following indicator organisms have been used universally to determine the conditions foodstuffs are exposed to during handling.

2.1.1 Plate counts (total viable counts / aerobic mesophilic plate counts)

Counts of viable bacteria are commonly based on the number of colonies that develop in nutrient agar plates which have been inoculated with known amounts of diluted foods and then incubated under prescribed environmental conditions. Only those bacteria, which will grow under the chosen environmental conditions, can be counted. A wide variety of conditions can be obtained by changing the composition of the growth (agar) medium, the gaseous environment of incubation (presence or absence of O_2) and the time and temperature of incubation. The aerobic mesophilic count is most commonly used.

Most processed foods should be regarded as unwholesome when they have large populations of microorganisms, even if the organisms are not known to be pathogens. The reason being that high counts in shelf-stable foods often indicate contaminated raw materials in perishable products and may also indicate unsuitable time/temperature storage conditions. Some strains of common mesophilic bacteria, which are not commonly associated with foodborne disease, have been reported to cause illness when in excessive numbers. All recognised foodborne pathogens that are mesophilic will contribute to the detected plate count.

There are, however, other food products, such as milk and fermented products, which may contain high bacterial numbers which form part of the product's natural microflora. **It is, thus also important to take into consideration the composition of foodstuffs, before taking action based on bacterial numbers.**

The use of plate counts has a number of advantages. **In international trade in food, aerobic mesophilic plate counts can be a helpful guide.** If it is high, or if it varies widely among samples from different lots or within a lot, microbiological control in processing or transport was probably inadequate. There are, however, limitations to the value of mesophilic counts. High counts have no value in particular foods, e.g., fermented sausage, cheese, yoghurt, maas and other dairy products.

The following causal factors can be considered when unsatisfactory plate counts are observed specifically in milk samples:

- Insufficient cleansing of milking equipment before and/or after milking sessions;
- Insufficient cooling of milk and/or maintenance of cold chain thereafter;
- Secondary contamination of milk by means of hands / water used during handling process, containers and environmental pollution (e.g., dust);
- Infection of the udder (mastitis); and
- Milk, which has been allowed to age sufficiently (i.e. milk that has become old).

2.1.2 Enteric indicator bacteria

The presence of enteric bacteria, e.g., coliforms and *E.coli* have been widely accepted as indicators of faecal contamination and therefore the indicators of the possible presence of pathogens of enteric origin, e.g., *Salmonella*. *E.coli* have been classically used as indicators of the possible presence of enteric pathogens in water, shellfish, milk and dairy products and other foods. The enumeration of *E.coli* in water provides a measure of the extent of the pollution. Factors such as, multiplication, dying-off, or adhesion of the organism to food particles may influence the numbers detected in foods. However, substantial numbers of *E.coli* in foods suggest a general lack of cleanliness in handling and improper storage. Its presence, however, does not directly suggest the presence of pathogens, but only implies a certain risk that it may be present.

A common practice is to use tests for coliforms, including *E.coli* for screening and if there is reason to determine the likelihood of faecal contamination, the coliforms or other Enterobacteriaceae are subjected to further tests to establish whether any of them are *E.coli*.

While the presence of large numbers of coliforms and *E.coli* in foods is highly undesirable, it would virtually be impossible to eliminate all of them from fresh and frozen foods. The basic question regarding these numbers is:
At what quantitative level do coliforms or *E.coli* indicate that a product has become unsafe?

Low numbers of coliforms are usually permitted in sensitive foods at numbers ranging from 1 to not exceeding 100/g or ml.

It must be noted, that there are limitations to their use as food safety indicators. As a means of assessing the adequacy of sanitation, the use of coliforms is recommended. This test, however, is not recommended to indicate faecal contamination, but rather to assess, for instance, the dairy farm and plant sanitation. For frozen or blanched vegetables, coliform counts are of no sanitary value because some have common associations with plants and do not indicate faecal contamination. Hence, *E.coli* is the only valid index organism for the monitoring of fresh vegetable foods and it is the organism (indicator) of choice for determining faecal contamination of milk. In fresh foods of animal origin, most Enterobacteriaceae, stem from faecal contamination and their occurrence in high numbers may indicate poor hygiene handling and/or inadequate storage. The standard coliform test is not suitable for meats, but faecal coliforms are, however, of value.

Coliform tests are widely used in shellfish sanitation. However, they are not always good predictors of sanitary quality. However, in at least some foods, coliforms have proved to be of value as safety indicators. They are best employed as a component of a safety programme such as HACCP. In foods processed for safety, the presence of considerable numbers of Enterobacteriaceae or coliforms indicates:

- Inadequate processing and/or post process recontamination due to cross-contamination by raw materials, dirty equipment or poor hygienic handling;
- Microbial proliferation, which could have allowed multiplication of a wide range of pathogenic and toxigenic organisms.

However valuable such information may be, it should never be interpreted as indicating with certainty that faecal contamination has occurred.

2.1.3 Other indicator organisms

A number of other indicator organisms are also frequently used in assessing food safety, which includes staphylococcal and mesophilic sporeformers.

a) The presence of staphylococci is usually indicative of contamination from the skin, mouth or nose of food handlers. Inadequately cleaned equipment or raw animal products may also be sources of contamination. The presence of large numbers is in general a good indication of poor hygiene and temperature control. The presence of high numbers in cured meat may indicate the presence of enterotoxin producing strains of *S. aureus*.
b) The presence of mesophilic sporeforming bacteria in canned foods indicates that either the container was not hermetically sealed or that the heat processing was insufficient. It is possible that *Clostridium botulinum* could be present under such circumstances. If so, growth and toxin production might occur in an acid environment (pH 4.6 or above) such as in canned foods, e.g., mushrooms.

   When sporeforming bacteria are present in chilled or dried food in usually high numbers, there is a risk that they may include *C.perfringens, C.botulinum* or *B.cereus* which could present a hazard either in the foods as processed or in its future use.

2.1.4 Yeasts and moulds

In non-acid, moist foods, yeasts and moulds grow more slowly than bacteria and therefore seldom cause problems in such foods. However, in acid foods and foods of low water activity, they outgrow bacteria and thus cause spoilage losses especially if the products (e.g., fresh fruit and vegetables, frozen or dried foods) are improperly stored. Additionally, there is also the potential hazard form production of mycotoxins by moulds.

Humans should not consumer foods that are visibly mouldy. This excludes cheeses such as Roquefort or Camembert and certain salamis, which owe their special flavours to mould.

Their presence is of little significance in fresh and frozen foods. One can expect to find small numbers of spores and yeast cells present in these foodstuffs. Consumers will recognise spoilage when very high numbers of yeast or visible moulds are present. **It must be noted that yeast spoilage is not a hazard to health.**

2.2 Foodborne pathogens

2.2.1 Staphylococcus aureus

- Is found in the mucous membranes and skin of most warm-blooded animals (including humans).
- Unless heat processing steps have been applied, this opportunistic pathogen may be expected to exist in low numbers in many food products that are of animal origin or in those that are handled directly by humans.
- Does not compete well with other bacteria.
- Seldom linked to food poisoning outbreaks from consumption of raw products (An exception to this, is consumption of milk from a mastitic cow in which levels of *S.aureus* is very high).
- Readily killed by cooking, but toxins are heat stable and will survive.
- Resistant to freezing and thawing.
- Survives well in foods stored at $-20^{o}C$, but at higher temperatures ranging from $-10^{o}C$ to $0^{o}C$ the viability of these cells decreases markedly during frozen storage.
- The minimum number of cells of *S.aureus* required to produce the minimum level of enterotoxin considered necessary to cause the gastroenteritis syndrome in humans depends on the substrates.
- In milk, counts of 10^{7} resulted in production of enterotoxin. (The minimum quantity of enterotoxin needed to cause illness in humans is about 200ng.)
- Counts of 10^{5}/g are highly suggestive of the possibility of food poisoning occurring.

2.2.2 Salmonella

- *Salmonella* occurs worldwide and it is recognised as a zoonotic agent.
- The primary habitat is the intestinal tract of animals including humans.
- Ingestion of certain strains of *Salmonella* can result in foodborne disease.
- Foods that are commonly identified as vehicles of salmonellosis to humans include eggs, poultry, meat and meat products.
- The food-poisoning syndrome is generally due to the ingestion of foods that contain significant numbers of certain serotypes of *Salmonella*.
- Normally levels necessary to cause salmonellosis range from $10^7 - 10^9$ cells/g.
- Levels of 10^5/g is highly suggestive of the possibility of food poisoning occurring.
- Salmonellae can survive for long periods in foods.

2.2.3 Clostridium perfringens

- Widely distributed in soil, water, foods, dust, spices and the intestinal tract of human and other animals.
- Produces spores that are relatively heat stable which influences their survival during and after cooking.
- Those that survive will grow and multiply especially during poor storage conditions and cause food poisoning.
- Food poisoning caused by this organism is relatively mild.
- Normally large numbers of cells have to be ingested to cause illness.
- Counts of 10^5/g are highly suggestive of the possibility of food poisoning occurring.
- Raw meats are known to contain a few vegetative cells of *C.perfringens* especially in the deep muscle tissue immediately after slaughter. Cells may also be found in the liver.
- Spore populations are likely to result from faecal contamination.
- May also be found on surfaces of carcasses.
- Foods commonly associated with *C.perfringens* contamination include dairy products, pasta, flour, poultry and vegetables, which have been exposed to soil, dust and faecal material.

2.2.4 Clostridium botulinum

- Sporeforming organism.
- Produces a heat-labile toxin, which is considered to be the most toxic of all naturally occurring substances.
- Is widespread in nature and spores are widely distributed in soil.
- Levels of between 0.1 and 1.0 ng of toxin A have been estimated to cause death.
- May occur on or in almost all foods whether of vegetative or animal origin. (although *C.botulinum* is widely distributed in the soil and on raw agricultural products, levels of contamination are generally low).
- Since huge quantities of agricultural produce are stored, processed in many ways and consumed by man, the possible survival of *C.botulinum* spores and their potential for growth and toxin production should be taken fully into account.
- Human botulism is commonly a result of eating improperly preserved foods.

2.2.5 Bacillus cereus

- *B.cereus* is widely distributed in nature.
- Can be readily isolated from soil, dust, cereal crops and fresh water, amongst others. (Is virtually found in or on every raw agricultural commodity).
- Is sporeforming therefore able to survive food processing, except retorting (canning).
- The organism is present in most raw materials used in food manufacture. (Normally found in food at concentrations of 10^3 / g or less, but mostly at levels less than 10^2 / g. **These levels may therefore be considered to be innocuous.)**
- Has been estimated that the infectious dose is $> 10^5$/g.
- Food normally implicated in *B.cereus*-caused intoxications, include spice ingredients, cereals, rice products or gravies.

2.2.6 Listeria monocytogenes

- Is ubiquitous in nature (i.e. widespread in soil, food-processing environments, raw meats and faeces of healthy humans and animals).

- Is an opportunistic pathogen affecting mainly the elderly, immunocompromised persons, pregnant women and young children.
- The minimal infectious dose is estimated to be $>10^2$/g.
- Hs the ability to grow at refrigeration temperatures.
- Foods normally implicated in outbreaks include soft cheeses, pates, fermented sausages and coleslaw and other salads.
- High-risk ready-to-eat foods (soft cheeses, etc.), which can support the growth of *Listeria monocytogenes*, should normally be free from *L. monocyotogenes*.

2.2.7 *Escherichia coli* O157:H7

- An important reservoir of this organism is the intestinal tract of cattle and other food animals.
- Widely distributed in food environments in low numbers.
- The infectious dose is low (as low as $10^1 - 10^2$/g). Low doses cause illness in young children, the elderly and immunocompromised persons.
- Foods implicated include undercooked hamburger patties and other fast foods and cheese made from unpasteurised milk.

2.2.8 Yersinia enterocolytica

- Widely distributed in the environment.
- Pigs are believed to be the principal reservoir of bioserotypes pathogenic to man.
- Sensitive to heat.
- Resistant to adverse storage conditions.
- The minimum infectious dose is uncertain.
- Foods implicated in outbreaks include unpasteurised milk, chocolate milk and raw pork.

2.2.9 *Vibrio* species

- Three species of importance are *V.cholerae, V.parahaemolyticus* and *V.vulnificus*.
- Widely distributed in rivers and marine environments.

- Commonly isolated from molluscan shellfish.
- *V.cholerae* 01 counts of $>10^7$/g normally cause disease in healthy persons.
- V.parahaemolyticus and *V.cholerae* are typically present in seafoods at levels below 10^3 / g.
- Foods implicated in outbreaks are usually raw oysters and other molluscan shellfish. (Normally due to storage at high temperatures).

2.2.10 Shigella

- Not natural inhabitants of the environment (originate from man and other animals).
- Food, which serves as vehicles include milk, vegetable salads, orange juice and cooked rice.
- Small infective dose (10^1- 10^2/g)

2.2.11 Brucella

- Species of importance include *B.melitensis, B.suis* and *B.abortus*.
- Can be isolated from animals such as cattle, sheep and goats.
- Transmission to man can occur through contact with infected animals in the farm and during slaughter and through consumption of raw or unheated processed products of animal origin.
- Main vehicles of alimentary infections are raw milk and raw milk products, such as cream, butter and cheese.
- In milk, freezing supports survival, especially when contamination levels are high.
- Unlikely to multiply in food.
- If the Milk Ring Test (MRT) is used to demonstrate *B.abortus* antibodies in milk it must be taken into consideration that false positive reactions may occur due to the following:
    - A large number of cows have just calved or are in late lactation;
    - An outbreak of mastitis occurs in such a herd;
    - Poor sample quality; and
    - Elevated temperatures during storage or in transit of the milk.

If two consecutive MRT's are positive within a month's interval, the herd should be bled to ascertain what the situation is.

3 Current legislation

In terms of the Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act 4 of 1972) two sets of regulations make provision for specific microbiological standards for foodstuffs:

- **The Regulations Governing the Microbiological Standards for Foodstuffs and Related Matters (R.692 of 16 May 1997);**
- **The Regulations Relating to Milk and Dairy Products (R.1555 of 21 November 1997)**

a) The Regulations Governing the Microbiological Standards for Foodstuffs and Related Matters (R.692 of 16 May 1997) and its amendments

These regulations make provision for different microbiological standards for different commodities such as:

- Desiccated coconut;
- Sugars for canning;
- Edible gelatin;
- Seafood (uncooked, partially cooked and cooked);
- Poultry (cooked);
- Bottled water;
- Spices and dried aromatic plants (herbs); and
- Edible ices.
- Egg products

b) The Regulations Relating to Milk and Dairy Products (R.1555 of 21 November 1997)

These regulations set levels for the indicator organisms, e.g., coliforms and *E. coli* as well as for the standard plate count (SPC) for different categories of milk and dairy products. These levels have been determined to ensure the safety of milk and dairy products.

A summary of the microbiological specifications referred to under the above sets of regulations is given in Annexure A.

Pointers on how these criteria should be interpreted

- View the standards holistically, i.e. consider the entire set of microbial criteria rather than focussing on one criterion, e.g., total bacterial counts.
- Too much emphasis should not be placed on total bacterial counts, but rather on what the counts are comprised of (where applicable).
- Base decisions on the presence of indicators of faecal contamination or pathogens where these have been included in the standards.
- Use total bacterial counts and coliform counts to evaluate the hygienic aspects and decide what education at processing level is required.
- If the general status of all the microbiological results is not in compliance with the standards, pay the processing plant / food premises a visit, check hygiene practices and advise accordingly.
- Re-sample (however, remember that biological samples can differ).
- Ask advice from the laboratory personnel who carried out the analysis or consult with the microbiologist in the employ of the Department of Health, Directorate: Food Control.
- If there is a history of non-compliance and the product is a health risk to consumers formal remedial action, such as, possible legal prosecution should be considered or product condemnation / withdrawal is an option.

4 An approach for foodstuffs not covered by current legislation

What happens when no standards exist for foodstuffs in current legislation? The question that normally arises is what should be tested for and how should these results be interpreted?

In many instances bacteriological analysis is done on food samples by the South African Institute for Medical Research (SAIMR) as well as other laboratories linked to provincial administrations and local authorities. In such cases, where no legal standards exist it is very important that results be carefully assessed before decisions are taken on whether foodstuffs pose a risk to the health of consumers.

In terms of foodborne pathogens, the rule of thumb is that processed food should ideally be free from pathogens [refer to Section 2(1)(b)(i)]. What happens if pathogens are present? Should zero tolerance be the yardstick for all foodstuffs? Note that regulations state that samples should be free from pathogens. This, however, is dependent on the type of sample.

The questions that need to be asked are:

- What further processing will take place?
- How will the products be prepared for consumption?
- What mishandling is likely to occur during preparation?
- Will highly susceptible populations, e.g., young children, the elderly and immunocompromised consume the food?
- What is the likelihood that microorganisms present will increase during further handling or storage?
- What is the normal infective dose of the organism?

In order to fully answer all these questions and to assess safety of foods, one needs to understand what foodborne pathogens are, which foods are likely vehicles of these pathogens and what levels may cause foodborne disease as previously discussed under item 2.2 of these guidelines.

Microbiological specifications for food commodities not covered in the current legislation are given in Annexure B and can be used as guidelines for microbiological analyses.

5 Conclusion

It is advisable that foods for which standards have been set, be tested so that further action can be taken. This would include education of food handlers and food processors as well as the taking of legal action. It must always be borne in mind that whenever food samples are taken for microbiological analysis that this is done in an aseptic manner. However, if it is necessary to sample foods for which no standards exist, careful consideration must be given to the results thereof before any action is taken. In terms of raw foods, e.g., meat or poultry, that it be borne in mind that these products are likely to have high microbiological counts and that certain enteric pathogens are associated with these products and the fact that they will undergo further processing should be considered. It is also important to remember that the hygiene of the premises is regarded as extremely important and this is probably one of the important factors in ensuring a safe product at the end of the day.

Finally, it must be remembered that even though end-product sampling for, amongst others, statutory compliance, has its place in determining the safety of foods, emphasis should also be placed on promoting the introduction of preventative systems such as HACCP to ensure food safety.

6 Glossary

Aerobic	Grows in the presence of atmospheric oxygen
Coliform	A gram-negative, facultative rod that ferments lactose, producing gas
Contamination	The effect exerted by an external agent on food so that it does not meet acceptable food hygiene standards or is unfit for human consumption
Enterobacteriaceae	Gram-negative, non-motile, facultative anaerobic, straight rods (also used for those that live in the intestinal tract)
Enterotoxin	A toxin specifically affecting the cells of the intestinal mucosa, causing vomiting and diarrhoea
Food hygiene	All measures necessary to ensure the safety, soundness and wholesomeness of food at all stages from its growth, production or manufacture until its final consumption
Hazard	An agent (chemical or biological) that may contaminate food so that consumption of such food is likely to be dangerous or detrimental to health
HACCP system	An effective management tool for food safety assurance that can be applied to all sections of the food chain
Infective dose	The number of organisms that will cause illness (or infect) a specific number of individuals in a given period of time
Immunocompromised	When one's immune system is unable to produce a normal complement of antibodies in response to specific antigens
Mesophile	A microorganism with a growth optimum around 20^{o} to $45^{o}C$
Mycotoxins	Fungal toxins

Psychrotroph	A microorganism with a growth optimum between 20^{o} and $30^{o}C$
Pathogens	Organisms that cause disease

REGULATIONS GOVERNING MICROBIOLOGICAL STANDARDS FOR FOODSTUFFS AND RELATED MATTERS (r.692 OF 16 MAY 1997)

Food Category	Analysis	Limits
Desiccated coconut	*Salmonella*	0/g
	Shigella	0/g
	Coagulase-positive *Staphylococcus.aureus*	0/g
Sugars for canning of vegetables and other products	Total viable counts	<100/10 g
	Escherichia .coli	0/20g
	Clostridium perfringens	0/20g
	Sulphate spoilage organisms	<10/100 g
Edible gelatin	Total viable counts	<1000/g
	E.coli	0/0.1g
	Clostridium species	0/0.1g
	Salmonella	0/g
Partly cooked / uncooked freshwater and sea water products: prawns, shrimps, crayfish, lobsters, crab meat, oysters, clams, mussels, eels and fish	Histamine	<10mg/100g
	Antibiotics	0
	Salmonella	0/20g
	Shigella	0/20g
	Vibrio cholerae	0/20g
	Vibrio parahaemolyticus	0/20g
	Coagulase-positive *S.aureus*	0/20g
	Total viable count	1000 000/g
Oysters, mussels, clams	*E.coli* Type 1	<500/100g
Prawns, shrimps, crayfish, crab meat, eels, fish	*E.coli* Type 1	<10/100 g

Cooked freshwater and sea water products: prawns, shrimps, crayfish, lobsters, crab meat, oysters, clams, mussels, eels and fish	Histamine	<10mg/100g
	Antibiotics	0
	Salmonella	0/20g
	Shigella	0/20g
	E.coli Type 1	0/20g
	V.cholerae	0/20g
	V.parahaemolyticus	0/20g
	Coagulase-positive *S.aureus*	0/20g
	Colony count	1000 000/g
	Coliform counts	1000/100g
Cooked poultry	Antibiotics/other antimicrobials	Permissible limits
	Salmonella	0/20g
	Shigella	0/20g
	E.coli	0/20g
	S.aureus	0/20g
	C.perfringens	<0/20g
	Total viable count	<10 000/g
Bottled water	*E.coli*	0/250ml
	Non-faecal coliforms	0/250ml
	Faecal streptococci	0/250ml
	C.perfringens	0/250ml
	Pseudomonas aeruginosa	0/250ml
	Total viable count	<100/ml after 72hrs at $20^{o} - 22^{o}C$ or <20/ml after 24hrs at $37^{o}C$ **when sampled within 12 hours of bottling**

Dried spices and aromatic plants	*Bacillus cereus*	0/20g
	C.perfringens	0/20g
	E.coli	0/20g
	S.aureus	0/20g
	Salmonella species	0/25g
	Total colony counts	<1 000 000/g
	Yeasts and moulds	<10 000/g
	Coliform count	<1000/g
Edible ices	Colony count	<50 000/ml
	Pathogens	0
	E.coli Type 1	0/0.1ml
***Egg and egg products**	Colony count	<20 000/g
	Coliform count	<50/g
	Yeasts and moulds	<200/g
	Salmonella	0/25g
	S.aureus	0/g
#Rooibos tea		
In bulk	Colony count	<75 000/g
	E.coli	<20/g
	Salmonella	0
In retail packaging	Colony count	150 000/g
	E.coli	<20/g
	Salmonella	0

Regulations regarding processed foodstuffs	**Limitations**: (1) no person shall use any processed foodstuff which has been exposed for sale and is unsound in any way as an ingredient in the further manufacture of such processed foodstuff for human consumption; or (2) no person shall treat a processed foodstuff referred to in subregulation (1) in any way, including cleaning or repackaging, for sale as a foodstuff for human consumption. These limitations are applicable to processed foodstuffs on the premises where they were exposed for sale or on any other premises.

***Published for comments**

[#]**These are amendments submitted to the Department's Legal Advisory Service (LAS)**

REGULATIONS RELATING TO MILK AND DAIRY PRODUCTS (R.1555 OF 21 NOVEMBER 1997)

Food category	Analysis	Limits
Raw milk intended for further processing	Antibiotics	Permissible levels
	Pathogens	0
	Colony count	<200 000/ml
	Coliform count (MPN)	<10/ml
	Coliform count (VRB)	
	Rehydrated film method – VRB	<20/ml
	E.coli (Eijkmann test)	0/0.1ml
	E.coli (Dry rehydrated film method)	0/ml
	Clot-on-boiling test	Negative result
	Somatic cell count (bovine)	<500 000/ml
	Somatic cell count (goat)	<750 000
	Ethanol stability test	Must not fail
Raw milk, cream and skimmed milk; raw reconstituted (prepared) milk and reconstituted (prepared) skimmed milk	Antibiotics	Permissible levels
	Pathogens	0
	Colony count	<50 000/ml
	Coliform count (MPN)	<20/ml
	Coliform count (VRB)	<10/ml
	E.coli	0/ml
	Clot-on-boiling test	Negative result
	Ethanol stability test	Must not fail
	Somatic cells (bovine)	<500 000
	Somatic cells (goat)	<750 000
	Brucellosis	Negative
	Tuberculosis	Negative
Raw sour milk	Antibiotics	Permissible levels
	Pathogens	0
	Coliform count	<50/ml
	E.coli	0 / ml

Pasteurised milk and skimmed milk; pasteurised reconstituted (prepared) milk and reconstituted (prepared skimmed milk; pasteurised cream	Antibiotics Pathogens Colony count Coliform count *E.coli*	Permissible levels 0 <50 000/ml <10/ml 0/ml
UHT cream or milk	Antibiotics Pathogens	Permissible
Dairy products or composite dairy products	Pathogens Colony count Coliform count *E.coli*	0 <50 000/g <50/g 0/g
Ripened cheese	Coliform count *E.coli*	1000/g 0/g

ANNEXURE B

PROPOSED MICROBIOLOGICAL SPECIFICATION TO BE USED AS GUIDELINES FOR FOODS

Food type	Analysis	Limits
Cooked items before cooling: pastry, bulk vegetables, deep fried potato chips, pizzas, ready-to-eat frozen meals, tinned jam, tinned vegetables and fat cakes	Colony count	<10 000/g
	Coliform count	<10/g
	E.coli	0/g
	Salmonella species	0/25g
	S.aureus	<10/g
	C.perfringens	<10/g
	Bacillus species (as applicable)	<10/g
	L.monocytogenes	0/25g
	Campylobacter (as applicable)	0/25g
Cold meal items: cold meats, processed meats (e.g., viennas), polony, dried vegetables, ham and potato salad with mayonnaise	Colony count	<200 000/g
	Coliform count	<200/g
	Yeast and mould count	<1000/g
	Vibrio species (as applicable)	0/25g
	E.coli	0/g
	Salmonella species	0/25g
	S.aureus	<100/g
	C.perfringens	<100/g
	Bacillus species	<100/g
	Campylobacter (as applicable)	0/25g
	L.monocytogenes	<10/g
Cold smoked or fermented meal items: salami, bacon, buns, bread, smoked cold meat and caviar	Colony count	<200 000/g
	Coliform count	<200/g
	Yeast and mould count	<10 000/g
	E.coli	0/g
	Salmonella species	0/25g
	S.aureus	<100/g
	C.perfringens	<100/g
	B.cereus	<100/g

	Campylobacter (as applicable) *L.monocytogenes*	0/25g <10/g
Items requiring further cooking: blanched and frozen vegetables, half-cooked meal (also steak, chops and wors), meat basting sauce and raw meat	*E.coli* *Salmonella* species *C.perfringens* *Campylobacter* species *Bacillus* species *L.monocytogenes*	<10/g 0/25g <100/g <1000/g 0/25g <1000/g <100/g
Raw vegetables and raw fruits, including fresh fruit salad, salad dressing and peanut butter	Coliform count Yeast and mould count *E.coli* *Salmonella* species	<200/g <100 000/g 0/g 0/25g
Cheese	*L.monocytogenes*	0/g
Soy milk (dried)	Colony count	1 000 000/g