Code of Hygienic Practice

for

Commercial Prepackaged

and

Non-Prepackaged Water

1st Edition - August 27, 2003

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NOTE: This Code is to be used as a guideline and in conjunction with the CFIS *Food Retail and Food Services Regulation and Code*. This Code is voluntary and is intended to provide guidance for processing and packaging water. Federal, provincial/territorial and municipal legislation may prescribe specific requirements and proponents should consult with their local jurisdiction.

1.0 INTRODUCTION

The prepackaged water industry is large and growing internationally. The types of water products and packaging vary dependent upon consumer tastes. The Canadian water industry has also expanded in size and diversity. There is a need for appropriate guidelines so that water bottlers and processors can ensure the microbiological, chemical and physical safety of their products.

At the time of developing this Code there have been no serious illnesses reported in Canada associated with bottled water (Warburton D., Health Canada). However, prepackaged water like any food may be exposed to sources of contamination (biological, chemical or physical) that may impair its quality or become a safety risk to consumers.

Canadian and international surveys indicate that sources of contamination may be naturally occurring, or may be introduced during processing or packaging. Contamination may also occur when water is transferred from the original source to tanker trucks that haul water to prepackaging plants or non-prepackaged consumer self-serve devices.

Studies conducted in Canada during the 1980s and 1990s indicate that prepackaged waters may contain harmless bacteria from naturally occurring sources, as well as those introduced during the processing or packaging process. The presence of these harmless bacteria should not be confused with microbial pathogens or indicators of faecal contamination, which must not be present in prepackaged or non-prepackaged water sold in Canada.

The Canadian Food Inspection System (CFIS) was created in 1994 for the development of national food safety codes. This was a collaborative process between federal, provincial and territorial governments. The objectives of CFIS are to facilitate harmonization, streamline the inspection process, reduce pressures on industry and provide a system that is flexible, responsive and timely. Working committees have been established to develop model regulations and Codes. A CFIS sub-committee was formed to develop the *Code of Hygienic Practice for Commercial Prepackaged and Non-prepackaged Water* (the Code) for use in Canada.

1.1 Objective

The Code establishes a common set of hygienic practices for the safe collection, processing, packaging, transporting and storing of commercial prepackaged water and the collection, transportation, storage, processing and dispensing of non-prepackaged water for human consumption offered for sale.

This is accomplished by:

1.1.1 adopting the principles of the Codex Alimentarius Commission, such as those contained in the Codex documents in the Reference List;

1.1.2 developing a HACCP (Hazard Analysis Critical Control Point) plan or similar type system that is commodity/industry specific and identifies specific hazards and establishes system controls that focus on prevention rather than end product testing; and

1.1.3 providing a Code that is responsive to the changing needs of industry and other stakeholders.

1.2 Scope

1.2.1 The Code may be applied to all facilities that process, package, bottle, distribute or dispense water intended for human consumption but does not include water classified as a public or private community drinking water system.

1.2.2 The Code may be applied to prepackaged and non-prepackaged water that is labelled such as spring, mineral, glacial, prepared, flavoured (without added sweetener) and/or carbonated. It also may be applied to prepackaged water that is distributed for point of use drinking water, water coolers and water that is distributed in bulk containers for replenishing water vending facilities designed for point of use dispensing into individual consumer containers.

1.2.3 The hygienic practices for commercial non-prepackaged water are limited to requirements for source water protection, safe collection, water vending machines, and non-prepackaged haulage of water in tanker-trucks.

1.2.4 The Code references the *Food and Drugs Act* and *Division 12, Prepackaged Water and Ice* of the *Regulations*. Together, the *Food and Drugs Act* and its *Regulations* govern commercial prepackaged and non-prepackaged waters for quality, safety, labelling and identity standards.

1.2.5 Provincial and territorial legislation may also prescribe specific standards for water safety and quality, equipment and construction standards.

1.2.6 The Code references the most recent edition of the *Guidelines for Canadian Drinking Water Quality* for good manufacturing practices for hygienic requirements.

1.3 Code Use

The Code reflects the needs of the consumer, industry and regulatory agencies and will be aimed at promoting national uniformity. It is to be used in conjunction with applicable federal and provincial laws and regulations and the CFIS *Food Retail and Food Services Regulation and Code* (FRFSRC) to ensure a safe product.

1.4 Definitions

For the purposes of this Code the following definitions apply:

bottled water is prepackaged water.

carbonated water is water which contains dissolved carbon dioxide, added and/or naturally occurring, in a concentration such that the water is perceptibly effervescent when the water is in contact with the atmosphere, both the water and the atmosphere being in a normal or near normal state of atmospheric temperature and pressure.

contaminant is any foreign physical, biological, chemical, or radiological agent, material or other substance which may compromise food safety or quality.

contamination is the exposure of food to conditions which may permit the introduction of foreign material including filth, poisonous or other harmful substances or pests, pathogenic microorganisms, toxins, or parasites.

control is action to ensure and maintain compliance with criteria established in a food safety management system such as a (HACCP) plan.

Critical Control Point (CCP) is a point, step or procedure at which control can be applied and a food safety hazard can be prevented, eliminated, or reduced to acceptable levels.

disinfection is an effective germicidal treatment, by means of chemical or physical methods.

establishment is a suitable building, area or surroundings in which water intended for bottling or distribution is collected, processed and bottled.

flavoured water (non-sweetened) is water to which aromatic substance(s), other than sweeteners or alcohol, has been added so that the resultant water still retains normal water transparency and is without colour.

glacial water is water collected from glacial melt water that maintains the same consistent composition of the major minerals and characteristics as that of the proglacial stream at the point of emergence.

ground water is water originating from subsurface which may be protected or unprotected.

lot is the amount of product of a specific container size, product style and code produced by a specific plant during a specified period of time not exceeding one day.

mineral water is water from a potable and safe groundwater source that has not passed through a community water distribution system and that contains a minimum amount of total dissolved solids as may be prescribed by existing federal and provincial regulations.

non-prepackaged water is water that is intended for human consumption, is offered for sale and is dispensed directly into consumer's containers from a self-serve device or from a tanker-truck.

prepackaged water is water contained in a sealed container that is intended for human consumption.

prepared water is water not designated by its origin or that does not comply with the Codex definition for "waters defined by origin".

protected ground water is ground water which is not directly influenced by surface water or the surface environment.

spring water is water which comes from a potable and safe groundwater source without passing through a community water distribution system and that contains a maximum amount of total dissolved solids as may be prescribed by existing federal and provincial regulations.

water vending machine is any self-service device connected to an approved water supply which, upon insertion of a coin, coins, paper currency, token, card or receipt of payment by other means, dispenses a unit serving of treated water and/or other water products into a container without the necessity of refilling the machine between each operation (Source: National Automatic Merchandising Association *Standard for the Sanitary Design and Construction of Food and Beverage Vending Machines* and the Association of Food and Drug Officials *Model Water Vending Machine Regulation*).

2.0 CONSTRUCTION DESIGN & FACILITIES

2.1 Site and Location

Rationale:
The building and equipment should be designed and constructed so as not to contaminate water. Conditions that might lead to contamination include excessive dust, foul odours, smoke, pest infestations, airborne microbial and chemical contaminants, and other similar conditions.

2.2 Design and Construction Specifications

Note: General guidelines on construction standards and requirements are contained in the CFIS *Food Retail and Food Services Regulation and Code*. This section contains only those recommendations, which are specific to the source and processing or packaging facilities.

2.2.1 Premises Design and Layout

Rationale: Unnecessary movement of water and personnel within the water packaging premises increases the likelihood of contamination, and should be controlled as much as possible. If unsanitary operations are conducted in close proximity to sanitary operations, the likelihood of contamination is increased. A properly designed and operated water packaging establishment will minimize the opportunity for water to be contaminated. Establishing sanitary water handling areas within the plant will reduce the risk of contamination from environmental sources.

2.3 Lighting

Rationale:
Adequate lighting promotes cleanliness by facilitating the identification of unclean areas. Shielding lights to prevent the contamination of water from glass fragments in the event of breakage is an essential public health protection measure. Adequate lighting also facilitates the identification of physical contamination in susceptible areas.

There should be adequate (> 540 lux) lighting levels in work areas where inspection of bottles and bottle filling and capping takes place.

2.4 Ventilation

> Rationale:
> The air supplied to a water processing or packaging facility should be of sufficient quality so as not to contaminate the equipment or the water. Unclean air, excessive dust, odours, or build-up of condensation or grease are all potential sources of water contamination.

Adequate ventilation should be provided to prevent excessive accumulation of heat, ozone gas, condensation, and dust, and to remove any contaminated air.

Ventilation openings should be equipped with close fitting screens or filters to prevent the intake of contaminated air.

Filters should be cleaned or replaced as appropriate.

> Rationale:
> Packaging water is one CCP where physical contamination can occur because it is not a closed system as is the case in most of the plant. Contamination can occur from splashing, insects, filth or dust. Preventing dust from entering the area can reduce the opportunity for contamination.

Packaged water should have an enclosed room/chamber for filling and this area should be under positive air pressure with filtered air.

> Rationale:
> Ozone is an atmospheric pollutant and excess levels of ozone in the atmosphere may pose serious health and safety issues for employees. When ozone is used in treatment there should be an effective means of removing or neutralizing the residual ozone released to the indoor air.

Sufficient ventilation should be provided to prevent unacceptable accumulation of ozone gas.

Ozone gas should be vented through a suitable destructor unit.

2.5 Storage Areas

> Rationale:
> Water including prepackaged water can be susceptible to physical contamination or odour and taste transference from external sources.

Packaging materials and finished products should not be stored in areas where volatile chemicals (with the ability to transfer strong odours or taste to finished water) and high humidity (where mould growth potential is increased) exist.

Finished products should be stored and handled so as to prevent damage and contamination by:

a) storing and handling under conditions to prevent deterioration, including stored away from light sources to prevent algae growth;
b) storing in clean and dry areas to prevent packaging contamination;
c) storing the packaged product separate from chemicals or products which may transfer odour or taste;
d) rotating stock to prevent deterioration that could prevent a health hazard or compromise the product quality;
e) clearly identifying and isolating returned or defective suspect product for appropriate disposition; and
f) providing customers with educational materials explaining the proper handling and storage of the water and the bottles.

2.6 Water and Steam Supply for Cleaning

Rationale:
An adequate water supply, in quantities that encourage cleaning and rinsing, is necessary to ensure effective cleaning and safe processing operations. A safe water supply for cleaning and other sanitation is necessary to avoid contamination of the water handling equipment or the water product.

The water used for sanitation in the plant should be potable.

2.7 Final Rinse Water

Rinse water should be potable.

3.0 WATER COLLECTION

3.1 Primary Water Collection

Water may be from a community drinking water system, a groundwater source (e.g., well) or a surface water source (e.g., glacier).

> Rationale:
> An assessment of the safety of the source, the collection process, and the water quality will determine the treatment necessary to achieve final end product safety. Water collection is a CCP in selecting and sustaining a safe source. A safe water supply is also critical for equipment cleaning and sanitization and packaging sanitation. The source will also determine the market identity of the water.

3.2 Safety Goals and Principles of Water Collection

> Rationale:
> It is often difficult to determine the safety of a source. Routine testing of the source water for consistency of water characteristics is the prime method of conducting a risk assessment. A risk assessment can help determine the water source safety and alert the bottler to possible hazards.

Presently most water used for bottling is obtained directly from the environment, rather than a community water source. The following steps may increase the safety of the primary water collection:

a) Choose a safe source and location (see sections 3.4 to 3.6).
b) Protect the recharge and contribution area (see sections 3.7 and 3.8).
c) Construct a safe water collection facility and establish safe procedures for operation (see sections 3.9 and 3.10).
d) Monitor the level of safety and determine if alternative monitoring or protection measures are necessary (see sections 3.11 and 3.12).

3.3 Source Safety Levels and Recommended Treatment

There are three levels of safety; **maximum, minimum** and **unacceptable level**.

3.3.1 **Maximum level of safety** applies to water from a source which has the following characteristics verified through long-term monitoring (see Appendix 4.3):

a) The water is safe without treatment;
b) The water displays no evidence of direct external influence of foreign substances or microorganisms;
c) The source is at minimal risk to existing and future contamination from an external origin;
d) The source possesses natural barriers against risks of contamination (including those microorganisms generated by the external fauna and flora);
e) The source is protected from the occurrence of new or future risks of contamination through watershed protection; and
f) The water is regularly monitored to verify its safety and consistency of the above criteria.

Note: At a source which meets the **maximum level of safety**, the water may be bottled without disinfection provided the bottling is performed hygienically at the source (no bulk transport between the source and the bottling facility). This level of safety corresponds to the safety objectives set by Codex general standard for "waters defined by origin".

3.3.2 **Minimum level of safety** applies to water from a source which has the following characteristics verified through long-term monitoring:

a) The water source has had all existing contaminants and microorganisms and present and future risks identified;
b) Safe treatments are available that will control or eliminate contamination or microbiological hazards in the water;
c) Measures have been implemented to monitor and if possible prevent any increase of identified risks or introduction of new or future risks of contamination at the source; and
d) The water is regularly monitored for quality to establish a history of the results to help verify the adequacy of the treatment processes.

Note: At a source which meets the **minimum level of safety**, the water should receive anti-microbial treatment and any other treatment necessary to ensure its safety prior to bottling or dispensing.

3.3.3 **Unacceptable level of safety** applies to water from a source which is contaminated and adequate treatment is not available, or the water is not regularly monitored.

3.4 Establishing Safe Water Collection

> Rationale:
> Ground water is generally safer than surface water, such as streams, rivers and lakes. Surface water sources are not recommended for commercial prepackaged or non-prepackaged water without an appropriate treatment. If a community drinking water distribution system is used, a review of the adequacy of monitoring is prudent.

Most of today's commercial water comes directly from ground water sources and the methods of assessment (Hazard Analysis) for the type of environmental source are well known (see Appendices 5.1, 5.2 and 5.3).

Glaciers and icebergs are marketed as "water defined by origin". The general principles for the establishment of safe spring and mineral water collection are applicable to "waters defined by origin".

Community drinking water distribution systems are commonly used as the source for the production of "prepared waters", such as demineralized, mineralized or other types of processed or treated waters. They are also often used as a utility water source for sanitizing and rinsing premises, equipment and water containers. The risk assessment of the source should include a review of the records of the community drinking water system.

A Hazard Analysis should be carried out when choosing a source (see section 3.5) and the exact location for a water collection point (see section 3.6). The following criteria will help establish the safety of the source at the collection point:

a) The water at the collection point should be comprehensively tested and assessed to determine its characteristics prior to any treatment. (Appendix 4.2 is an example of a source water analysis and Appendix 4.3 is an example of an analysis for a pre-screening of a proposed source.)
b) The recharge and contribution area that supplies water to the proposed water collection point should be identified (see Appendix 5.1).
c) The potentially vulnerable sub-zones in this area should be located and evaluated for contamination risks, including parasites, bacteria, human enteric viruses and chemical substances (see Appendix 5.1). This appendix is an example of the evaluation of groundwater sources. Other equivalent science-based methods may be available. It is recommended that a qualified hydrogeologist carry out a comprehensive risk assessment.
d) Existing and future activities in each of these sub-zones that present a potential risk should be identified, e.g., avoid areas subject to flooding, intensive livestock production, etc. Future risks of contamination may be predicted through municipal or regional land management plans, zoning,

by-law, or provincial agriculture and mining development plans. Potentially vulnerable areas subject to future activities should undergo a risk assessment to determine any necessary preventive measures.

e) Each sub-zone should be assessed to determine its natural ability to stop or reduce identified contaminants from migrating into the source (see Appendix 5.2). This appendix is an example of evaluating groundwater sources. Other equivalent science-based methods may be available. It is recommended that a qualified hydrogeologist carry out a comprehensive risk assessment.

It is recommended that a proponent consult with a qualified environmental specialist or hydrogeologist (depending on the type of source chosen) to analyse the data from the Hazard Analysis and determine the level of safety of the source and the water collection point.

Critical Control Points should be established for the source and the location of the water collection point by:

a) implementing protection measures such as protective perimeters to prevent future contamination in the higher risk-zones (see Appendix 5.3). This appendix is an example of evaluating a groundwater source. Other equivalent science-based methods may be available. It is recommended that a qualified hydrogeologist carry out a comprehensive risk assessment;
b) adhering to safe design and GMP construction for water collection installation (see section 3.9);
c) establishing a safe water collection procedure (see section 3.10); and
d) implementing source surveillance and water monitoring programs for human activities in the water recharge and contribution area (see sections 3.11 and 3.12).

3.5 Determining the Current State of Water Quality

> Rationale:
> The recharge and contribution zone and the contamination risk sub-zone may change in shape and increase in area from their original assessment. Reassessment of the safety of the source and collection point may be necessary to evaluate new risk activities or larger risk areas.

Key microbiological and chemical parameters should be analysed on a number of samples to ensure reliability. Appendix 4.2 shows an example of a source water analysis and Appendix 4.3 shows an example of an analysis for pre-screening of potential candidate sources.

Water quality should be tested at the proposed collection site in a worst-case scenario, such as:

a) Water is at its maximum flow rate.
b) Wildlife fauna and flora have attained maximum activity.
c) Human activities, especially agriculture, have attained their maximum level.
d) Natural water bodies have attained their year-round maximum temperature.
e) Rain precipitation is at its peak.

Note: In a community drinking water distribution system the sampling analysis may be available from the system operator and/or from the government authorities that monitor these systems. An analysis of the water quality should be available in the monitoring records of the system over a period of years. The history of compliance to drinking water standards will help determine variations and reliability of the water quality.

3.6 Determining the Source's Natural Ability to Resist Contamination

Each identified contamination hazard should be evaluated to determine to what extent the contaminants (microbiological and chemical) will penetrate into the source and migrate to the water collection point. Contaminant load, water precipitation rate, water flow rate, contaminant properties, media properties and distance to water collection point should be included in the evaluation. This information is essential to determine what protection measures are necessary to supplement the source's natural ability to minimize the identified contamination hazard or to determine the adequacy of existing protection measures. (Appendix 5.2 provides a method for vulnerability evaluation of the source media.) This appendix is an example of evaluating ground water sources. Other equivalent science-based methods may be available. It is recommended that a qualified hydrogeologist carry out a comprehensive risk assessment.

3.7 Re-assessment Needs

Re-assessment with a Hazard Analysis may be necessary when:

a) the maximum production flow rate of a collection point is increased beyond the initial risk assessment;
b) new collection points are added in the vicinity of the original collection point;
c) new water collection points on adjacent property have been established near the original water collection point or existing collection points have increased flow rates; or
d) new or increased risk activities commence on adjacent property.

3.8 Protecting the Source and Water Collection Point

Protection perimeters should be implemented in the recharge and contribution area to determine what protection measures are necessary, their location and what surveillance may be warranted. Three protection perimeters should be established according to the different range of risks.

3.8.1 The "**immediate protection perimeter**" or the "defence perimeter" is intended to ward off intruders, stray animals, restrict human activities and limit man-made objects to only those needed for the source water collection. It is recommended that the "immediate protection perimeter":

a) be fenced and the surrounding area is under control of the operator; and
b) extend a distance beyond the water collection shelter (see Appendix 5.3).

Note: In some jurisdictions a perimeter distance is mandatory for water collection facilities intended for human consumption.

3.8.2 The "**close protection perimeter**" determines part or parts of the recharge and contribution area that have been identified by means of a risk analysis as being the most vulnerable. In this area, contamination may have short-term negative consequences in the quality and safety of the water. The exact location of the perimeter requires a case-by-case determination (see Appendix 5.3).

Rationale:
The intent is to control and/or monitor the imminent risks of contamination. The "close protection perimeter" usually encompasses all parts of the recharge and contribution zone that are vulnerable to contamination from microorganisms (parasites and harmful or nuisance bacteria and viruses) because these may cause illness. The balance of the recharge and contribution zone is less vulnerable because it is too far away or the underlying media is more impervious or the contaminants would not produce significant illnesses.

In addition to determining current and future activities and ensuring compliance with existing zoning by-laws and environment protection regulations, other more direct or stringent control measures may be necessary dependant on the risk of these activities and the underlying media's vulnerability. Where zoning by-laws or environment protection measures are inadequate, the water collection operator may control these activities by acquiring land ownership or by contracting agreements with neighbours.

The **"close protection perimeter"** generally does not extend beyond areas that are vulnerable to chemical contamination however it should include areas that may be susceptible to microbiological contamination.

3.8.3 The **"far protection perimeter"** covers the rest of the recharge and contribution areas and extends beyond the "close protection perimeter". The "far protection perimeter" is the area that is least vulnerable to contamination. Protection measures may be limited to human activity surveillance.

3.9 Constructing a Safe Water Collection Facility

Rationale:
A shelter or other methods can be used to protect the water collection point from contamination. A shelter both protects and permits access to the wellhead or spring catchment basin.

3.9.1 Water Collection Point Shelter

The shelter should be properly constructed. The inside materials should be water-resistant and the floor should be sloped to a screened drain exiting as far away as possible from the shelter (outside the "defence perimeter" is recommended). Adequate lighting should be provided. To protect the shelter against vandalism, windows should be avoided, a steel door installed and a monitored alarm system should be in place.

3.9.2 Ground Water Collection Design and Safety

Wells can be a safe method to collect or extract water directly from the aquifer provided that the wells are properly designed and maintained. Collection directly from a naturally flowing spring should be performed under conditions that prevent surface water intrusion.

a) Well casing:
- Commercial wells should be cased and grouted as deep as possible in order to prevent direct surface water intrusion.
- Steel is the preferred casing material as biofilms are less likely to develop on steel than on plastic casings. Stainless steel offers the best protection against corrosion and growth of iron bacteria. Plastic casings, if used, should be approved for potable water.
- The wellhead casing should have a sanitary seal and be designed to prevent seepage or contamination.
- The casing should be designed so that all parts can be properly sanitized.

b) A sampling port should be placed in the main water line close to the wellhead (see Appendix 3.7).

3.10 Safe Operation and Maintenance of a Water Collection Facility

Rationale: Properly designed water collection installations will facilitate safe operation and maintenance.

After final construction, start up disinfection should be scrupulously carried out by:

a) spraying disinfectant on the upper inside casing walls above the static water table level;

b) introducing sufficient chlorine solution (or other approved disinfectant) to obtain an effective germicidal concentration (e.g., 500 mg/L water) throughout the entire system; and
c) providing sufficient contact time without pumping activity to achieve disinfection before flushing and rinsing (24 hours is generally recommended).

Maintenance disinfection should be repeated using the same process, as often as necessary, based upon the water quality monitoring results (minimum annually). Storage tanks and long aqueducts should be disinfected more frequently.

3.11 Source Water Quality Monitoring

Rationale:
Monitoring source water quality is critical and is the most reliable means to confirm the overall safety of the water and the collection point. After determining knowledge of the base line water quality, monitoring is the only way to detect hazards that may have been overlooked or under estimated by the initial risk assessment study (or by future risk re-assessments). Monitoring is critical for a hazard analysis and is an essential CCP.

a) New water collection points should have increased sampling frequency for the first two to three years to determine the consistency of the water quality, particularly bacteriological quality.
b) Following a contamination incident, the frequency of sampling should be increased for sufficient time to ensure water safety and quality.
c) Routine monitoring frequencies should be dependant on the level of vulnerability of the source and its surroundings. Additional parameters may be necessary to detect specific local contaminant risks, e.g., pesticides in an agricultural area.
d) The results should be continuously and closely monitored so as to adjust the frequency and the selection of parameters in accordance with the testing results. Specific monitoring or the availability of monitoring results may be required by some government agencies.

3.12 Permanent Surveillance in the Recharge and Contribution Area

Regular surveillance of the recharge and contribution areas in the watershed including changes in human and wildlife activities is essential in deciding if a re-assessment of the risk is needed and/or if the quality monitoring program should be modified. Surveillance re-assessments and continual revision of the monitoring program are part of the HACCP safety approach.

4.0 PROCESSING CONTROLS

> Rationale:
> After the water is taken from the source, it may be handled, treated or processed depending on source water quality and safety, end product quality objectives and general case by case operating constraints. Many processes serve no direct hygienic purpose (e.g., carbonation, flavouring, demineralization, etc.) where as others are performed primarily to ensure end product safety such as disinfection and bottled water container sanitation. Most processes, including those intended to assure safety, may be potentially hazardous if not properly designed, executed and controlled.

a) Water should have treatment processes as required to ensure consistent product safety and end product characteristics.
b) The water and its characteristics will determine the type and design of treatment needed.
c) Treatment systems and equipment should be operated and maintained in accordance with the manufacturer's specifications.
d) Components of water treatment systems and product water contact surfaces should be of a food grade quality and appropriate for water use.
e) Maintenance and sanitation programs should be documented and maintained.

4.1 Filtration

All water filtration systems should be designed, operated and maintained to ensure the safety of the product water. The filters should be operated and maintained in accordance with the equipment manufacturer's specifications so as to prevent them from becoming a source of contamination.

4.1.1 Carbon and Activated Charcoal Filters (adsorption, absorption)

Purpose: to reduce or remove odour and/or taste producing substances or other undesirable substances that have bonding properties to a specific filtration media, e.g., activated carbon.

Operating Considerations: filter size, bed life, regeneration and renewal program as needed.

Health and Safety Requirements: regular back-flushing and sanitization programs (see Appendix 7).

4.1.2 Particulate Filtration

Purpose: To reduce or remove particulate, water insoluble matter or other turbidity causing substances (e.g., suspended solids, colloids, oxidized iron and manganese compounds etc.) by granular media or membrane filtration or more rarely, by decanting or other clarification methods.

Operating Considerations: Capacity
Granular media: granular size and bed depth, compactness, and horizontal uniformity.

Membrane/cartridge filtration: particulate and pore size, and pressure differential.

Health/Safety Requirements: regular back-flushing and sanitization programs are necessary. Filter replacement may be required more frequently than indicated depending on the quantity and size of the particulate matter in the raw feed water (see Appendix 7).

4.1.3 Reverse Osmosis

Purpose: To remove and reduce total dissolved solids content.

Operating Considerations: to protect the membrane, pre-treatment of the water such as softening, particulate filtration, chlorine removal, oxidant removal. Regular membrane demineralization and flow-rate differential monitoring as needed.

Health/Safety Requirements: regular back-washing and sanitization programs (see Appendix 7).

4.2 Other Treatments

4.2.1 Deionization

Purpose: To reduce/remove total dissolved solids.

Operating Considerations: filter bed capacity, back-flushing and regenerating renewal.

Health/Safety Requirements: regular back-flushing and sanitization programs (see Appendix 7).

4.2.2 Distillation

Purpose: To remove total dissolved solids.

Operating Considerations: pre-treatment of the water by water softening, sediment removal and removal of chlorine and organic substances.

4.2.3 Other Treatment Processes

The following are examples of specific water treatment processes: iron and manganese removal, water softening, degassing, mineralization/flavouring and carbonation. Other methods may be used depending on the situations.

4.3 Disinfection Treatments

Rationale: Disinfection treatments may be necessary to ensure end-product safety.

The decision to implement a disinfection treatment and the type of treatment needed is dependent on the level of safety of the water supply and the safety of handling and processing (see Appendix 7).

Disinfection may be unnecessary if the water is:

a) directly tapped from a ground water source which meets the criteria for the **maximum level of safety** (see section 3.3); or
b) municipal water that is disinfected and treated and consistently meets the requirements of the most recent edition of the *Guidelines for Canadian Drinking Water Quality*.

However, disinfection of the water referred to in a) and b) is necessary if the water is sold through a water vending machine, or is subjected to further processing which could jeopardize the microbiological safety.

4.3.1 Validated Disinfection Process

If the water disinfection procedure is required the disinfection process should:

a) be in accordance with the most recent edition of the *Guidelines for Canadian Drinking Water Quality* and applicable provincial/territorial legislation;
b) be designed to continually and effectively disinfect the product;
c) be documented in writing;
d) include at least one complete effective disinfection process in place as the effects of different processes are not necessarily cumulative;
e) be conducted with complete monitoring and documentation;

f) be designed so that the risk of recontamination after disinfection is minimized; and
g) be as close to the filling stage as feasible.

4.3.2 Disinfection Methods

The following sections outline several popular disinfection methods currently in use although other effective methods may be used.

a) Ozonation

Purpose: To disinfect (bacteria, viruses and parasites).

Operating Considerations: continuous and effective dissolution, cleanliness and humidity of intake air, water temperature, ozone demand and monitoring and ozone venting.

Health/Safety Requirements: adequate CT value (see Appendix 6), prevention of the formation of disinfection by-products such as bromate (see Appendix 8).

b) Ultra-Violet Irradiation

Purpose: to disinfect (bacteria).

Operating Considerations: water turbidity and color, light source and intensity, consistency of flow rate and pressure lamp breakage controls.

Health/Safety Requirements: water turbidity, color, maximum flow capacity and light irradiation.

Refer to *NSF/ANSI 55 Ultra-Violet Microbiological Water Treatment Systems* for additional information.

c) Microfiltration

Purpose: to remove parasites.

Operating Considerations: water pre-filtration, porosity, capacity and pressure differential.

Health/Safety Requirements: Parasite removal effectiveness (refer to *NSF/ANSI 53 Drinking Water Treatment Units – Health Effects*), regular back-flushing and sanitization programs are necessary. Filter replacement may be required more frequently than indicated depending on the quantity and size of the particulate matter in the raw feed water.

5.0 CONTROL OF OPERATION

5.1 Incoming Materials Control

5.1.1 Water Intended for Bottling

(See Chapter 3.0 - Water Collection)

5.1.2 Packaging Materials

Rationale:
Packaging can provide a potential source of contamination and needs consideration in the control process. Bottled water is a food and as such its packaging must comply with the appropriate rules and regulations for food contact surfaces.

The bottler should:

a) maintain control over incoming packaging materials so as to minimize any biological, physical or chemical hazards which may affect the finished product,
b) take steps to ensure that incoming bottles are free of contaminants,
c) use new container caps and/or closures, and
d) ensure that retail packaging is designed to be tamper evident.

5.1.3 Empty Container Handling

a) Empty containers should be handled to minimize damage.
b) Damaged, defective or contaminated containers should not be used because they may prevent proper closure of the product container and permit contamination.

5.1.4 Cleaning of Multi-Use and Returnable Bottles

Rationale:
Returnable bottles pose a challenge for product safety and require additional controls than single use packaging materials.

If multi-use containers are refilled bottlers should:

a) inspect, wash and sanitize the container prior to filling so as to remove any extraneous materials, chemical or microbiological contaminants;
b) develop a program for the maintenance and operation of the bottle washing and sanitation unit (manufacturers' instructions may provide a source of the necessary information);

c) inspect returnable bottles to detect damage and contamination including suspicious odours, oily appearances and foreign objects in order to cull these bottles for separate handling or rejection;
d) invert the bottles and wash both the internal and external surfaces using an effective cleaning agent within the concentration, contact time and temperature range recommended by the manufacturer's specifications;
e) ensure that the operation includes monitoring, documenting, routine maintenance and regular cleaning of equipment;
f) after washing the bottles, they should be rinsed free of the washing agent and sanitized using an effective sanitizer within the recommended concentration, contact time and temperature range according to the manufacturer's specifications; and
g) ensure that chemical agents, if used, are compatible with packaging materials such that chemicals do not leach into or otherwise contaminate the water.

5.1.5 Cleaning of Single-Use Bottles

The bottler should:

a) ensure that all single-use bottles are free of extraneous materials and contaminants prior to filling; or
b) clean all containers, if they are not ensured free from contamination, by inverting and rinsing them with an effective sanitizing solution; and
c) ensure that chemical agents, if used, are compatible with packaging materials such that chemicals do not leach into or otherwise contaminate the water.

5.1.6 Protection of Cleaned Containers

Rationale: Cleaned containers may become contaminated if not protected during storage.

The bottler should have suitable controls established to prevent contamination of cleaned containers including:

a) Containers should not be left unprotected on the line between the washer and the filler during employee breaks, during clean-up or extended downtime.
b) Suitable environmental controls should be in place to prevent potential contamination.

c) The processing operations for container cleaning, filling and closing should be located within the closest possible physical proximity so as to minimize product exposure to the environment.
d) Cleaned containers should be stored in a clean and dry environment.

6.0 TRANSPORTATION OF PREPACKAGED AND NON-PREPACKAGED (VENDED) WATER

The safe and sanitary transportation of prepackaged and non-prepackaged (bulk) water is governed in general terms by the CFIS draft *Good Transportation Practices Code*. The most applicable provisions of that code are included below as part of this Code.

Bulk water transportation units should be constructed with inner surface materials that are non-toxic, easy to clean and compatible with the transported water. Examples include stainless steel and food-grade plastic containers. Bulk water carriers should be designed and constructed to be completely self-draining, and permit cleaning and disinfection. Stainless steel is less prone to scoring, more resistant to biofilm development and more inert than plastic.

Rationale:
Transportation of foods (including water) presents three types of hazards:

- Physical hazards, such as pieces of metal, wood or glass that may find their way into bulk liquid in tankers.
- Chemical hazards, from previous non-food cargoes, from non-food cargoes mixed in the same load; from refrigerant leaks, from residues of cleaning agents, or from the external environment during a spill.
- Biological hazards, from contamination by bacteria, moulds, yeast, parasites, rodents and the growth of biological contaminants.

Reducing or eliminating the hazards:

- Physical hazards can be reduced or eliminated by using filters or detectors for foreign objects.
- Chemical hazards can be reduced by applying sound sanitization and cleaning procedures and by adhering to the good transportation practices in section 6.1.
- Microbiological hazards can be reduced utilizing adequate cleaning and sanitizing procedures.

Dedicating tanker trucks exclusively to potable water transport can reduce exposure to hazards.

6.1 Bulk Water Transportation

a) Bulk water transportation transit time from the source to the processing plant or to the bulk water distribution point should be minimized.

b) Bulk water transportation units should be equipped with an adequate number of spray balls to reach all inside surfaces in order to ensure thorough cleaning and sanitization.
c) Water transportation units should be cleaned and sanitized on a regular basis.
d) Transportation units intended to transport bulk water should not be previously used for the transport of any incompatible non-food product. It is recommended wherever possible that water transportation trucks should be dedicated for that purpose only.
e) Where the transportation unit is utilized for bulk transport for other food products, the unit should be cleaned and sanitized to remove all traces of contamination and residue from the food products previously transported.
f) Bulk transportation units dedicated to the transport of potable water should be clearly and indelibly marked to show that they are used solely for the transport of water for human consumption (e.g., "For Potable Water Only").
g) Tanker trucks should be filled and emptied with clean hoses that are equipped with sanitary connections. Filling or draining tanker trucks via manhole covers is not recommended because of the potential for contamination.
h) Recommended sanitary procedures for tanker truck loading include:
    - Female and male connectors should be soaked in a safe and effective disinfectant solution with an adequate contact time (e.g., one minute in a 250 mg/l chlorine solution) immediately prior to connecting.
    - Rinsing may be omitted because the disinfectant will be diluted to a low concentration.
    - The tanker-truck filling hose should be permanently connected to the main water collection pipe, rather than being transported on the tanker-truck to reduce the risk of being readily contaminated. If permanently connected, a continuous small water flow through the filling hose may reduce the frequency of disinfections.
    - If not permanently connected, the hose, when not in use, should be protected by end caps.

6.2 Water Storage Tanks

> Rationale:
> Fluctuations in water temperature while in storage can impact microbial growth. Water storage tanks need to be designed, installed and maintained so that they can be easily cleaned and they are not a source of contamination.

Water storage tanks located in temperature-controlled environment may minimize bacteria re-growth and biofilm development thereby reducing the frequency of the necessity for cleaning and sanitizing.

Water flowing continuously at a minimal rate (siphon protected overflow) sufficient to maintain the tank temperature close to the source temperature can be a means of controlling the water temperature.

The interior of tanks should be food grade material and resistant to cleaning and sanitizing solutions. Stainless steel is resistant to the growth of biofilm

The tank vent should be equipped with an air filter.

Adequate spray balls should be installed to facilitate routine cleaning and sanitizing all interior areas of the storage tank.

6.3 Water Distribution Piping

Distribution piping should be suitable for potable water. Stainless steel is recommended for the piping from the bottling plant or point of connection to the bulk water transportation vehicle.

To minimize bacteria growth in piping it is recommended that:

a) exterior piping be buried deep enough to prevent the water from freezing in the winter and heating in the summer;
b) the water temperature at the pipe outlet be close to the source water temperature;
c) longer piping runs be insulated to reduce water temperature fluctuation;
d) a small continuous water flow may maintain constant temperature; and
e) the pipe at the entry point in the plant be equipped with a sampling valve.

7.0 CLEANING AND DISINFECTION OF WATER COOLERS

Bottled water coolers are freestanding units which may have internal refrigeration and/or heating devices and are capable of dispensing single servings of water from a prepackaged refillable container.

7.1 Water Cooler Design

> Rationale:
> There are many types of water coolers. They may differ in their tap point, connection of the container and the reservoir. Within the framework of HACCP it is important that the design and construction of the water cooler presents no additional risk of contamination and is designed to be easily cleaned.

All water contact surfaces/materials should be approved food grade material

Coolers supplied with disposable cups should be provided with a sanitary-type dispenser and the cups should be designed for the dispensed water temperature. Cups should be properly protected and stored.

7.2 Reservoir

Three types of reservoirs are used in water coolers: fixed, removable reusable, and removable disposable. Cleaning procedures vary with each type of reservoir. Fixed reservoirs should be easily accessible from the outside for easy cleaning and sanitization. A decal should be located on the cooler with recommendations on cleaning and sanitizing procedures.

7.3 Air Filter

On bayonet style water coolers equipped with no-spill safety caps, air is drawn through a filter as the water is removed.

7.4 Bayonet (tap point)

The bayonet (tap point) should be easily cleanable.

7.5 Cleaning and Sanitization of Water Coolers

> Rationale:
> Water coolers require routine maintenance in order to protect the product.

A decal should be located on the cooler with the manufacturer's instructions on the proper methods of cleaning, sanitizing and maintenance (with a minimum recommendation of 4 times annually). Additionally the water cooler should be cleaned and sanitized after any electrical or mechanical maintenance.

7.5.1 Cleaning and Disinfection Principles

> Rationale:
> The water cooler can be a source of contamination to the water therefore it requires regular cleaning and sanitizing.

Cleaning and sanitizing may be conducted by a combined cleaning/sanitizing process or a separate cleaning and subsequent sanitizing procedure.

Disposable reservoirs should be discarded after each use because they cannot be properly cleaned and sanitized.

Chemical products for cleaning, descaling, and sanitizing water coolers should be:

a) approved for use on food contact surfaces;
b) used at the appropriate concentration, adequate retention time and according to the chemical manufacturer's instructions;
c) properly stored; and
d) flushed out after sanitization with potable water to remove all traces.

7.6 Maintenance

The components of coolers should be examined regularly to determine the effects of cleaning and sanitizing chemicals and external environmental factors. Instructions on the operation and maintenance of cooler should be available.

7.7 Location of Water Coolers on Consumer Premises

Bottled water cooler manufacturers should advise consumers on the preferred locations for the placement of water coolers.

It is recommended that water coolers **not** be located:

a) in any area where the environment poses a risk of contamination of the water;
b) outside in the open air or in direct sunlight to prevent algae growth;
c) in a dusty, unventilated, or humid environment;
d) on an uneven or sloping surface or close to a lavatory;
e) in damp areas, under leaking pipes or where water may collect underfoot; or
f) within 20 cm of a heating radiator.

7.8 Water Coolers in Public Locations

The person or company leasing (the lessee) the water coolers should clean and maintain the water cooler as provided for in this Code.

8.0 WATER VENDING MACHINES

> Rationale:
> There are numerous self-serve vending machines that sell and distribute water in retail food stores. This Code considers vended water a food, similar to bottled water. Vended water requires increased handling and therefore has a higher risk. Consumers fill their bottles in the store and the water is "processed" in an "uncontrolled" environment that may increase the complexity and potential health risk.

Water obtained from a vending machine is intended for personal use only and should not be re-sold or re-distributed by the consumer nor should this water be used to supply (public) water coolers that provide water to the general public (e.g., waiting rooms).

8.1 Construction and Design

8.1.1 Construction of Dispensing Equipment

All water contact surfaces/materials should be approved food grade material.

8.1.2 Design of Dispensing Tube, Chute or Orifice

> Rationale:
> Product can become contaminated from the vending machine so equipment needs to be designed so that the consumer filling the container does not contaminate the equipment or product.

The dispensing tube, chute or orifice of the water vending machine should be designed so:

a) splashes and drips (including drips from condensation) are directed away from the container receiving the water and from the dispensing spout or delivery tube (by means of barriers, baffles or drip aprons);
b) water dispensing spouts (tubes, chutes and orifices) are protected from contamination from dust, dirt or manual contact and contact with the consumer's container (e.g., by being recessed or behind a drop-down door); and
c) the drain is equipped with a device to preclude the entrance of insects and rodents.

Additional references for water dispensing equipment:

NSF International (formerly the National Sanitation Foundation) can be contacted for further information contained in *NSF/ANSI 25 Vending Machines for Food and Beverages*.

NSF International
P.O. Box 130140, Ann Arbor, Michigan, 48113-0140
Phone: 734-769-8010; Toll free: 888-NSF-9000; Fax: 734-669-0196
Email: info@nsf.org Website: www.nsf.org

NAMA – National Automatic Merchandising Association
20 N. Wacker Drive, Suite 3500
Chicago, Illinois 60606-3102
Phone: 312-346-0307; Fax: 312-704-4140
Email: tech@vending.org Website: www.vending.org

8.2 Control of Operation

8.2.1 Water Source

a) Water intended for dispensing and self-serve bottling should be safe with or without treatment and of suitable quality for consumption.
b) Source water should be from a potable water supply (municipal supply) that meets the requirements of the most recent edition of the *Guidelines for Canadian Drinking Water Quality*.
c) Vending machines (and their associated water treatment systems) should be equipped with backflow prevention devices to protect the water supply from potential contamination.

8.2.2 Treatment of Water

The provisions for the treatment of water apply to water vending machines.

a) Disinfection should take place immediately before the dispensing spout.
b) Disinfection should be the last process before dispensing.
c) The disinfection operation should be equipped with a monitoring device (fail-safe) which automatically shuts the unit down if the disinfection process fails.

8.2.3 Standards for Water Treatment Devices

a) Water treatment devices used in conjunction with water vending machines should meet the requirements of NSF/ANSI water treatment device standards.
b) Piping, gaskets and other materials used in water vending machines should be resistant to the deleterious effects of disinfection processes (e.g., ozone, UV, cleaning agents and sanitizers).
c) Treatment systems that use or generate ozone for treatment should be equipped with a mechanism to prevent or minimize the release of ozone from the machine to the atmosphere.

   Note: Ozone is an indoor air contaminant with levels regulated by worker health regulations in most jurisdictions.

d) Vending machines that treat water to remove microbiological or other contaminants (such as the use of Reverse Osmosis) should be equipped with a fail-safe device to prevent dispensing of untreated water when the treatment unit is inoperable or requires maintenance.

> Rationale:
> Fail-safe devices are necessary to ensure that the dispensed water meets the most recent edition of the *Guidelines for Canadian Drinking Water Quality.* Failure of treatment systems will not be readily or immediately obvious, thereby allowing potentially contaminated water to be dispensed to the public.

8.2.4 Delivery of Water to Vending Machine

The distance between the point of disinfection and the dispensing spout should be kept to a minimum (e.g., with UV less than 60 cm). Ideally, the water treatment system should be an integral part of the dispensing unit. Remote treatment systems that require long runs of piping to the dispensing machine should be equipped with a means to prevent bacterial growth in the piping.

> Rationale:
> Studies have shown that even with the best treatment and disinfection, water held for long periods of time in water lines can be subject to bacterial regrowth and slime build-up in the lines.

8.2.5 Storage of Water

The storage tank in the dispensing equipment should be provided with an inverted air return spigot/vent to minimize the potential for contaminants from entering the storage tank.

> Rationale:
> Intake air vents with openings facing upward are exposed to potential airborne contamination.

Air vents and overflow spigots should face downwards to minimize the potential for contaminants gaining entry into the water storage tank. Vents and spigots should be screened or protected from the entrance of insects.

8.2.6 Dispensing of Water

Decals or labels should be posted that advise consumers to use new, clean refillable bottles or to properly clean and sanitize refillable containers prior to filling them. Easy-to-read pamphlets further explaining the proper cleaning and sanitizing procedures should also be available.

8.2.7 Monitoring, Documentation and Records

Operators of water vending machines should:

a) monitor the quality of the dispensed water to ensure that it meets the safety requirements of the most recent edition of the *Guidelines for Canadian Drinking Water Quality* ;
b) submit samples to an accredited laboratory at a frequency consistent with the Association of Food and Drug Officials, *Model Water Vending Machine Regulation* or more frequently as required by the regulatory authority; and
c) maintain records of sample results and regular maintenance, repair and cleaning operations for a minimum of two years.

8.2.8 Maintenance and Sanitation

a) Cleaning procedures for the water-dispensing machine should meet the standards set out in the CFIS *Food Retail and Food Services Regulation and Code*.
b) Filters should be maintained, back flushed and replaced according to the manufacturer's specifications.

Note: If the water treatment system is remote from the dispensing unit, the piping used to deliver the treated water to the unit should be cleaned and sanitized at least weekly to prevent re-growth and slime build-up in the line, unless other methods are used to minimize bacterial growth in the lines.

8.2.9 Training

Maintenance and operational personnel responsible for the water vending machine should receive training on the recommendations of this Code and the application of good hygienic practices.

8.2.10 Protection of the Water Supply

The potable water supply should be protected from any possible back-siphonage or contamination originating from the water vending machine by means of an approved and operational back-siphonage control device. The back-siphonage protection device should be checked on a regular basis.

REFERENCE LIST

Association of Food and Drug Officials (www.afdo.org):
Model Water Vending Machine Regulation, 1986, Revised 2002

Canadian Bottled Water Association (www.cbwa-bottledwater.org):
Model Bottled Water Code, 2000

Canadian Food Inspection System (www.cfis.agr.ca):
Food Retail and Food Services Regulation and Code, 1999, Code Amended 2001

Good Transportation Practices Code, 2001 Draft

Codex Alimentarius Commission (www.codexalimentarius.net):
CAC/RCP 1-1969, Rev. 3-1997, Amd. (1999) Recommended International Code of Practice General Principles of Food Hygiene

CAC/RCP 33-1985 Recommended International Code of Hygienic Practice for the Collecting, Processing and Marketing of Natural Mineral Waters

CAC/RCP 48-2001 Code of Hygienic Practice for Bottled/Packaged Drinking Waters (Other than Natural Mineral Waters)

CODEX STAN 227-2001General Standard for Bottled/Packaged Drinking Waters (Other than Natural Mineral Waters)

Health Canada (www.hc-sc.gc.ca):
Food and Drugs Act
Food and Drug Regulations, Division 12, Prepackaged Water and Ice

Guidelines for Canadian Drinking Water Quality (Link: http://www.hc-sc.gc.ca/ehp/ehd/catalogue/bch_pubs/drinking_water_quality_guidelines/toc.htm)

International Bottled Water Association (www.bottledwater.org):
Model Bottled Water Regulation, 1995, Revised 2002

National Automatic Merchandising Association (www.vending.org):
Standard for the Sanitary Design and Construction of Food and Beverage Vending Machines

NSF International (www.nsf.org):
NSF/ANSI 25 Vending Machines for Food and Beverage

NSF/ANSI 53 Drinking Water Treatment Units – Health Effects

NSF/ANSI 55 Ultraviolet Microbiological Water Treatment Systems

Warburton, Donald W. 1999. *The Microbiological Safety of Bottled Waters,* Safe Handling of Foods, edited by Jeffrey Farber and Ewen Todd.

World Health Organization (www.who.int):
Guidelines for defining safe drinking or potable water, from international and national manuals and codes (WHO, 1993)

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April 2003

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