TECHNICAL MANUAL

September 2011

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The object of this Health & Safety Policy is to provide the framework around which a safe and healthy working environment can be maintained.

It is the policy of this company to place great importance on the health and safety of its employees and it considers this to be a management function equal to that of any other responsibility.

The company accepts responsibility as an employer for providing a safe and healthy working environment in all areas under its direct control and undertakes where appropriate to liaise with clients to provide for its employees a safe and healthy working environment on customer's premises.

This company recognises and accepts its obligations to ensure that other parties are not adversely affected by its activities.

The company will take steps, so far as is reasonable, to meet its health and safety responsibilities by means of good safety management and assessment of risks, paying particular attention to:

- Safe provision and maintenance of plant, equipment and systems of work.
- Safe arrangements for the use, handling, storing and transporting of products.
- Provision of information, instruction, training and supervision.
- A safe and healthy working environment and safe access to it.

Any policy is unlikely to be successful unless it actively involves the people who work in the company. This company will, therefore, seek to ensure effective consultation and communication to all levels of management and employees. The Company Safety Policy will be reviewed as appropriate and revisions will be brought to the notice of each employee.

It is equally the duty of each employee to work in accordance with the Company Policy for Health and Safety at work. Each employee must accept and carry out their responsibilities to:

- act with due care to prevent injury to themselves and others.
- report accidents, damage to equipment and potential hazards.
- follow working procedures, including the correct use of equipment and protective clothing.

It is the duty of each employee who is required to operate equipment with which they are unfamiliar to make this fact known to their supervisor so that training can be given. It is essential that the principles set out in this Health & Safety Policy be faithfully applied if accidents and the resultant suffering and loss are to be avoided.

Management give full backing to this Policy and will support all those who endeavor to carry it out and request each employee to sign a copy of this statement in acknowledgement of their awareness of this Policy.

Manager responsible for Health & Safety
Name Signature

Good personal hygiene protects coolers and bottled water against contamination.

a) Personal Hygiene - Checklist
All personnel working in the bottling room, sanitising coolers at the depot or on customer's premises **should**:

- Have a high standard of personal cleanliness and grooming.
- Keep fingernails short and clean.
- Keep hair and beards clean.
- Bath or shower daily.
- Clean their teeth at least once daily.
- Wear appropriate, **clean** company provided protective clothing and headwear.
- Avoid the use of nail varnish, strong smelling perfumes, etc.
- Remove watches and jeweler.
- Not smoke in the plant, sanitisation rooms or on customers' premises.

b) Protective Clothing
In defined high-risk areas (bottling and cooler sanitisation rooms) all personnel and visitors **should** wear full protective clothing. This should include coats, hats and/or hairnets.

Personnel sanitising coolers on customers' premises should wear a clean company uniform **and** hat.

Personnel **should not**:

- Wear personal clothing over their protective clothing.
- Roll up sleeves to reveal personal clothing underneath.
- Launder their protective clothing themselves.
- Travel to and from work in protective clothing.

Personnel **should**:

- Keep protective clothing fastened.
- Always remove protective clothing when leaving the high-risk area.
- Always hang protective clothing in lockers or hanging areas provided.
- Ensure that hairnets enclose all the hair.

c) Footwear
Outdoor footwear should not be worn in high-risk areas. Footwear should be clean at all times.

d) Laundry
Protective clothing for use in a high-risk area should be laundered by the company.
Clean laundry should be stored hygienically and tidily.

Fresh clean protective clothing should be worn each day.

e) Hand Washing
Hands are one of the main ways in which illness and contamination is spread. Employers have a responsibility under the EU Food Hygiene Directive EC 852 2004 to provide hand-washing facilities in food premises as detailed in TM 7.4.

Personnel sanitising coolers on customers' premises should be provided with an alcohol based skin scrub or wipes and or their own soap and paper towels as hand wash facilities may be inadequate or lacking at some customer's premises.

How to Wash Hands:

- Use hot water at 45-49C if available
- Roll up sleeves to the elbow.
- Remove watches and other wrist jewellery
- Use a non-perfumed soap.
- Soap the hands thoroughly and make sure that **all** parts are cleaned.
- Clean the fingertips and thumbs - these are often missed.
- Use a clean nailbrush if the hands or nails are soiled.
- Dry with clean paper towels or a hot air dryer.
- Do **not** use an ordinary towel or clothing to dry the hands.
- Dispose of paper towels in a covered bin.
- Use an alcohol based antibacterial rinse/skin scrub if available and allow it to dry before commencing work.

When to wash hands:

- After putting on protective clothing and before commencing work.
- Entering/re-entering defined high-risk areas (i.e. bottling or cooler sanitisation rooms).
- Before beginning work on **each** cooler at customers' premises.
- Before putting on disposable gloves.
- Before and after rest periods.
- After visiting the toilet.
- After eating/drinking/smoking.
- After blowing the nose, coughing or sneezing
- After carrying out cleaning duties/handling waste.
- After handling dirty equipment, walls, floors, etc.
- After touching 'dirty' water (i.e. spillage, bottle exteriors, wet surfaces etc).

f) Bad Habits

Personnel **should not**:

- Lick fingers to open polythene/paper bags etc.
- Scratch their head, comb hair, pick noses or scratch spots when sanitising coolers.
- Dry hands on protective clothing.
- Cough over bottled water or coolers.
- eat, chew gum, drink, spit or smoke when sanitising coolers or working in a high risk area

g) Jewellery

Jewellery or watches **should not** be worn when sanitising coolers or working in a high-risk area or on coolers in the field

Specifically forbidden are:

- necklaces and bracelets
- brooches and badges
- most earrings
- body piercing and studs

h) Perfume, Nail Varnish etc
Strong perfume or nail varnish should not be worn when sanitising coolers or working in a high-risk area.

- Regulation (EU) No 10/2011 of 14 January on plastic materials and articles intended to come in contact with food.

i) Smoking.
Smoking is forbidden in high-risk areas or on customers' premises. National laws across the EU vary on their tolerance to smoking in the work place. In many countries this is forbidden.
If smoking is to be permitted at the bottling plant a designated smoking area with adequate ventilation to the outside should be provided.

All personnel should remove their protective clothing before smoking and then wash their hands before recommencing work.

j) Wound Dressings
All wounds suffered by staff and delivery personnel should be dressed with coloured food-grade waterproof dressings.

All wounds should be given coloured food-grade dressings on arrival at work if suffered away from work.

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All travelling staff, including delivery personnel should be issued with a first aid kit with coloured food-grade water poof dressings.

Food grade dressings have the following desirable properties:

- they are easy to see
- they are guaranteed waterproof
- They contain metal strips to facilitate detection.

They confirm to members of the public that the company is working to food hygiene standards. Unsuitable dressings give the reverse effect.

Sanitisation personnel **should** ensure that they:

- receive relevant training within the set period and that it is up to date (see TM 7).
- have access to and have read the Training Manual.
- know when and to whom to report illness and if they are medically fit to work.
- understand fully their duties and the equipment, chemicals and materials used.
- wash hands thoroughly before working on coolers.
- wear protective clothing, which is clean and appropriate for the work.
- wear disposable gloves when cleaning the cooler's water contact surfaces.
- protect eyes and hands when handling hazardous chemicals.
- comply with national laws on smoking in the workplace. If local laws tolerate such smoking staff should not smoke whilst on customers' premises, sanitising coolers or in the cooler sanitisation room or any other area where smoking is prohibited by the company.
- do not eat, chew gum or drink when sanitising coolers or in the sanitisation room.
- do not wear watches, inappropriate rings, jewellery or perfumes.
- only use chemicals for sanitising water coolers that are approved for food use and are at the right concentration.
- store and transport cleaning equipment and chemicals in a way which ensures that they are not contaminated.
- allow sanitising chemicals sufficient contact time and follow EBWA, cooler supplier and chemical manufacturer's recommendations.
- keep descaling chemicals away from disinfectants.
- drain and rinse the cooler thoroughly after descaling and disinfection – paying special attention to the hot tank.
- ensure they never reuse sanitisation chemicals.
- dispose of sanitization chemicals carefully and responsibly - following the chemical manufacturers' recommendations if available.
- protect cooler components from contamination during sanitization, storage or transport to the customers' premises.

- ensure that **all** cooler components are effectively sanitised especially taps and non-spill systems.
- prevent leaks after sanitisation caused by deteriorated, damaged or badly fitting seals and components.
- never pack coolers or components if still wet. Condensation and dampness will cause the items to deteriorate microbiologically in a short while. This may lead to taste and smell complaints.
- sanitised coolers in store should be kept covered, inspected for signs of moisture and resanitised before issue if there are any doubts. Only very dry surfaces will retain their sanitized condition

Bottling plant and its personnel are subject to the Food Hygiene Directive 852/2004 or derived local food laws.

Personnel should ensure that they:

- receive relevant training within the required time period and to check that it is up to date as detailed in TM 7.
- have read the relevant sections of the Company Technical/Hygiene Manual.
- know when and to whom to report illness and ascertain if they are medically fit to work.
- do not smoke on company premises
- fully understand their duties, equipment, chemicals and materials used.
- wash hands well before beginning work, after meal breaks, visiting the toilet etc.
- wear protective clothing and headwear, which is clean and appropriate for the work.
- protect eyes and hands when working with dangerous chemicals.
- restrict eating, chewing gum, drinking or smoking to those the areas (if any) designated for these purposes.
- do not wear watches, rings (except plain bands), jewellery or perfumes when working.
- use only chemicals that are approved for food use.
- store equipment and chemicals so that they do not become contaminated especially by dust.
- use cleaning and disinfection chemicals with the correct concentration and contact time and ensure that they observe the manufacturers recommendations.
- avoid mixing chemicals.
- prevent carry-over of sanitisation chemicals into the product.
- ensure that all new bottles are inspected and washed before filling.
- ensure that all bottles that are loaded onto the washer have been sniffed and inspected for taints, excessive dirt or greening and that affected bottles are rejected or set aside for further treatment.
- handle bottle caps and new bottles hygienically, taking care to avoid dust contamination.

EU Food Hygiene Directive 93/43/EEC stated:

'No person known or suspected to be suffering from, or to be a carrier of, a disease likely to be transmitted through food or while afflicted, for example with infected wounds, skin infections sores or with diarrhoea shall be permitted to work in any food handling area in any capacity in which there is any likelihood of directly or indirectly contaminating food with pathogenic micro-organisms.'

This continues to apply for the current Food Hygiene Directive EC 852 2004

Bottled water is a food. Bottling plant and cooler sanitisation staff must obey the above rule.

a) Food Poisoning and Food-borne Disease

In order to be safe it must be assumed that anyone suffering from gastrointestinal symptoms is developing food-borne illness and be a risk to the public although this may prove later not to be so.

People are at their most infectious at the beginning of an illness so it is important that action is taken immediately symptoms appear

b) Symptoms of Food Poisoning and Food-borne Disease

- Nausea.
- Vomiting.
- Diarrhoea.
- Abdominal pain/cramps.
- Fever.

c) Reporting Illness - Responsibilities

Personnel must report illness to their supervisor before beginning work or as soon as they fall ill.

Supervisors or Management must decide if personnel are fit to do their designated work and **must not** allow staff to work in the bottling plant, deliver water, sanitise coolers or handle caps, cups or bottles if they are suffering from any of the following conditions:-

- Infection of the stomach or bowel or gastro intestinal symptoms (see TM 1.2.4 b).
- Typhoid, paratyphoid, parasitic/bacillary dysentery, Salmonella, Campylobacter or E.coli type 157 infection.
- Feverishness.
- Septic cuts, boils, abcesses, sores or discharge from the ears or eyes.
- Any other condition which in the opinion of the supervisor may result in infection of the cooler or bottled water.
- Norovirus
- If in any doubt or if the condition is serious or long lasting **medical opinion must be sought.**

Vacation Illness

With more people taking exotic holidays it is important that anybody contracting significant gastro intestinal disease on vacation (i.e. lasting more than a couple of days and accompanied by fever) should report that fact to their supervisor on return - even if the symptoms have apparently resolved themselves. Some Salmonellas are excreted for up to three months after symptoms have stopped whilst typhoid fever can be carried for life.

Medical advice should be sought in these cases.

The following instructions should be issued to customers:-

Do not: -

- dispense other liquids or tap water from the water cooler.
- interfere with the electrical circuits of the cooler or change the fuse rating.
- attempt to dismantle the cooler.
- use the cooler or bottle as a storage shelf for plants, food etc.
- touch the tap nozzles or dispense water from the cooler with dirty hands.
- pour unwanted drinks into the drip tray.
- leave the cooler connected to the electrical supply if the bottle is empty.
- leave the cooler without a bottle on it.
- relocate the cooler without informing the cooler supplier.
- locate the cooler in direct sunlight or close to bright lights.
- move the cooler with a bottle on it or lay a cooler on its side.
- use sprays, mists or vapours near the cooler.
- use corrosive, abrasive or perfumed cleaners on the cooler exterior surfaces.
- **load bottles onto the cooler without removing the protective cap label.**
- allow bottle necks to touch the cooler tap when filling drinks bottles from the cooler
- leave empty bottles outside or in direct sunlight. This may render them unfit for further use**.**

Do: -

- wash your hands before using the cooler
- report cooler malfunction, leaks or unusual noises to the cooler supplier.
- follow handling guidelines when lifting or loading bottles onto the cooler.
- empty and clean the cooler drip tray regularly.
- report unusual water taste, smell or appearance to the cooler supplier at once.
- report any bottles that show signs of turning green to the cooler supplier at once.
- read the date code on the bottles and use in strict rotation.
- store both full and empty bottles in a cool and dark place.
- keep bottles away from tainting substances such as solvents, fuels etc.
- store empty and full bottles hygienically.
- consider using peroxide sprays on the taps from time to time - and on the bayonet when changing bottles.

The following instructions should be issued to customers:-

No one should dispense water from a cooler, change the bottle or sanitise any part of the cooler who is suffering from any of the following conditions:-

- Gastro-intestinal symptoms such as diarrhoea, vomiting or nausea.
- Infection of the stomach or bowel.
- Typhoid, paratyphoid, dysentery, salmonella, Campylobacter or E. Coli type 157 infection.
- Feverishness.
- Septic cuts boils, abcesses, sores or discharge from the eyes or ears.
- Hepatitis.
- Influenza
- Cryptosporidiosis
- Any other conditions which may threaten water safety.

Customers should be instructed to wash their hands before changing bottles or touching cooler components.

Refer to the instructions detailed in TM 1.3.1.

Water cooler bottles are very heavy, come close to and, in some cases, may exceed national lifting guidelines. A 19 liter bottle when full will weigh close to 20 kilos. Please note that the weight of bottles has become a major factor affecting sales so it is important that the issue is addressed.

The following guidance should be given to staff and all customers:-

- Remove the old bottle
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- Wash your hands
- Wipe up any water in the bayonet well with a clean tissue
- Plan the lift, first removing all obstacles, wrappings etc
- TAKE THE LABEL OFF THE BOTTLE CAP
- Keep feet well apart to give a stable lifting base.
- Grasp the bottle by its handle and base or by the neck and base if there is no handle. Some bottles have insets in the base to make lifting easier.
- When picking up the bottle from the floor, bend the knees first.
- Whilst lifting, keep the back straight. Use leg power to lift.
- Whilst lifting, turn by shuffling the feet - do not turn the body.
- When loading the bottle on the cooler, rest it on the cooler before, finally, carefully lowering it onto the spike.

Lifting straps are available that can be fitted to a bottle so that it may be lifted by two persons. This option should be made available to customers.

Under no circumstances should any person attempt to lift a bottle if they:

- are under 18 or over 55years of age.
- are pregnant.
- have heart or respiratory problems.
- have a history of hernias.
- have musculo-skeletal problems.
- have any temporary impairment or disability that would prevent lifting in the correct manner.

The following features are required for coolers supplied to and used by EBWA members.

The responsibility for using unsuitable/non conforming equipment rests with the cooler company. The onus is on the cooler company to obtain necessary certification documents from the supplier/importer.

The use of such unsuitable equipment may, in some member states, ultimately result in the removal of the equipment from the market and fines/imprisonment for those concerned.

a) Refrigeration System
This should make use of non-HFC based refrigerants. It should also be noted that only reclaimed or recycled HCFC refrigerants can be used from 2010. After 2014 all HCFC refrigerants will be banned. Great care must be taken when disposing of or replacing refrigerants.

2006/842/EC and1005/2009/EC refer

b) Electrical Safety, Electromagnetic Compatibility and use of hazardous materials
All coolers and related electrical equipment (steamers, ozonators etc) must meet the requirements of the following EC Directives:

- EMC 2004/108/EC (Electromagnetic Compatibility)
- LVD 2006/95/EC (Electrical Safety)
- 2002/95/EC 2005/618/EC and 2008/35/EC (Use of Hazardous Materials) (new RoHS Directive)

Coolers must carry the CE mark with supporting documentation made available by the supplier on request**.** The CE Marking on its own is insufficient.

c) Materials in Contact with Water
These should comply with European or equivalent standards for materials in contact with food. Such standards include:

- 2002/72/EC
- 2009/1978/EC
- NSF or similar certification
- Regulation (EU) No 10/2011 of 14 January on plastic materials and articles intended to come in contact with food.

The cooler manufacturer shall maintain proof of purchase records for each material and should provide certification of compliance documents on request.

d) Sealed Reservoir System

This **must** have the following features:-

- Non spill loading system.
- Sealed reservoir or direct chill pipework.
- Air filter to remove airborne particles (max. 5 micron) for air entering the water cooler.

The following features are recommended for improved hygiene and safety:-

a) Electrical

- Connections to be made by non-permanent fasteners (e.g. push-in or screw connectors). It should not be necessary to break soldered joints when repairing or replacing electrical components.
- Hot and cold-side electrical circuits should be independent of each other.
- It should be possible to switch off the hot tank whilst the cooler remains in use. (This is increasingly important as customer concern about excessive use of electricity and its perceived role in global warming grows).

b) Construction//Materials

- A valve/float in the non-spill device to prevent the bottle leaking.
- A non spill-device that is easy to dismantle and clean.
- Reservoir, hot tank and other water contact materials resistant to damage by sanitisation chemicals including descaling acids and ozone.
- A hot tank that is easy to descale and remove for descaling.
- Taps proofed against contamination whilst in use.
- Taps easy to dismantle and sanitise and made of materials resistant to sanitisation and descaling chemicals.
- Reservoirs that can be drained fully during sanitisation to facilitate rinsing.
- Removable reservoirs that are easy to remove and refit. Tap seatings are especially important.
- Disposable reservoirs that are manufactured hygienically and delivered single wrapped in contamination proof packaging.
- All screw/nut fittings of European standards.
- All major assembly fittings easy to reach.
- A shallow drip tray that is easy to clean and replace

c) Supporting Literature

Each cooler should be supplied with a basic manual that gives the following information:

- How to commission the cooler.
- A sanitisation procedure that has been proved to be effective by the methods of EBWA test protocols.
- Descaling instructions (hot tank only).
- An electrical circuit diagram.
- Certification details for electrical safety, food contact materials etc

Sanitization is a vital part of the hygienic maintenance of water coolers.

a) What is Sanitization?
Sanitization is the process of **cleaning** followed by **disinfection**.

It should cover:

- Cooler exterior.
- Drip tray.
- Non-spill system.
- Internal reservoir baffle.
- Reservoir and pipework.
- Taps.

Disinfection is 'the reduction of bacterial numbers to a safe level'.

b) Why Sanitize?
- Water contact surfaces will build up a layer of **biofilm.**
- Slime and taste problems may otherwise occur.
- To remove scale from the water contact parts.
- To eliminate microbiological contamination of the cooler
- To eliminate algae.

c) When to Sanitize?
First sanitization has to be done before putting the cooler in operation.
The recommended frequency of sanitisation is **regulated by the EBWA Code of Practice.**

d) Sanitary Maintenance
Sanitary maintenance is a reduced form of sanitisation that does not require the cooler to be opened. It comprises:-
- Sanitising of the bayonet system
- Cleaning or replacement of the drip tray
- Sanitisation or replacement of the taps
- Cleaning of the cooler exterior

EBWA may permit the replacement of some sanitisation visits with sanitary maintenance visits in coolers fitted with new technology providing the manufacturers have proved to EBWA that the frequency of visits may safely be reduced (see 2.1.14)

d) Hot tanks
These may need descaling from time to time but not at every visit to sanitise the cooler. The frequency will depend on the mineral content of the water supplied and the rate of use.

Chemicals used to sanitise cooler should be compatible with cooler materials and food grade. Safety recommendation for their use to be watched. A number of different kinds may be used.

a) Descalers

Descalers are used to remove scale deposits in the reservoir, pipework, taps and hot tank.

The following may be used:-

- Phosphoric acid (very corrosive and quick acting - handle with care!).
- Citric acid (much less corrosive and slower to act. Comes in crystal form).

The use of descalers will disrupt biofilm and kill many bacteria. They are particularly suited to direct chill coolers.

b) Detergents

These are cleaning agents which lift grease, biofilm and dirt. They may be used to:-

- clean the cooler exterior and the drip tray.
- clean water contact surfaces that have been soiled by misuse.

Detergents should be:-

- unperfumed.
- non-foaming.

c) Sanitisers

These chemicals combine the role of detergent and disinfectant and are only suitable for cleaning the cooler exterior and drip tray.

Note: The term sanitiser means disinfectant in the USA.

d) Disinfectants

These are used to reduce microbial contamination. There are many suitable types for disinfecting the water contact surfaces of coolers:-

- Chlorine as hypochlorite (bleach) (needs rinsing)
- Chloramines (need rinsing)
- Chlorine dioxide (needs rinsing)
- Hydrogen peroxide (needs rinsing if high concentration)
- Peroxyacetic acid. (needs rinsing)
- Ozone (no rinsing)

The following disinfectants are **not** suitable for water contact surfaces:-

- Phenols - highly toxic and tainting.
- Pine or lavatory disinfectants - toxic and tainting.
- Quaternary Ammonium Compounds (QACs) - ineffective. Can cause problems with Pseudomonas aeruginosa
- Amphoterics - relatively ineffective (can be used for cooler exterior).

e) Ozone

Ozone is an aggressive gas which must be used with great care.

Ozone generators can be very effective in disinfecting coolers; however their capability varies.

Test results should be requested from the manufacturer that the equipment is effective on coolers that have been in use for a minimum of three months.

f) Hydrogen Peroxide Sprays

Small sprays containing 2% peroxide are now available.

- These are intended for use on taps, either during sanitary maintenance or by the customer in between scheduled sanitisation projects. They are of especial value in schools and hospitals.
- Trials on coolers indicate that they are effective
- The sprays do not need heavy rinsing as the contents are harmless and similar to levels in proprietary mouthwashes.

Some brands are fitted with a useful nozzle that enables the user to get all of the peroxide within the tap interior.

a) General

Personnel should be in compliance and fully conversant with the details of TM 1.2.
The following should points be noted:

- Water used for sanitising and final rinse should be potable and free of pathogens. **Water from a toilet area or non-potable water taps must not be used.**
- The cooler should be disconnected from the electrical supply before beginning work. An exception is where coolers have taps that are electrically operated.
- All cloth/paper wipes and disposable gloves should be for one time use. Heavy-duty rubber gloves should only be used for descaling.
- No cloths, sponges, abrasive pads, etc should be washed/disinfected and reused.
- Disinfectants should be used as recommended by the supplier (concentration and time).
- Water used for the final rinse of coolers in the field should be bottled water from a new-opened bottle. Most coolers should be rinsed thoroughly to remove all traces of sanitisation chemicals. Thorough rinsing is generally not necessary with ozone.
- All sanitization chemicals should be kept in clearly labeled containers carrying the warning 'Hazardous Chemicals'.
- Chemicals for cooler sanitization should not be mixed. This can be very dangerous.
- All dirty or used materials should be discarded after use by placing in a sealed bag for removal and disposal off-site (if sanitising on customers' premises).
- Coolers or components should never be sanitised in a toilet or washroom area.
- Cooler parts and components should never be placed on the floor. The resting surface should always be dry and clean.
- Personnel should wash hands thoroughly before commencing work on the cooler, wear one use disposable gloves and never touch water contact surfaces with bare hands.
- Sanitisation chemicals in the reservoir should not enter the hot tank.
- Taps and non-spill devices are prone to contamination and need special care. Taps should be taken apart for cleaning or replaced with a freshly sanitized ones
- All water contact parts should be checked for crazing, serious abrasion, splits, cracks, staining or corrosion and be replaced if necessary.
- The outside of the cooler and the drip tray may be cleaned while the interior surfaces are being disinfected except where ozone is being used. For safety reasons staff should be away from the cooler when the ozone generator is running.

- The cooler should be checked for leaks and reconnected to the electrical supply only when the cooler has refilled with water.

- Checks should be made that the cooler and hot tank are functioning again before the cooler is signed off

b) Special Cases

Coolers should be returned to the depot for intensive sanitisation if:-

- there is reported microbiological contamination e.g. Pseudomonas or coliforms.

- customers allege that coolers have been responsible for illness.

- a bottle has turned green with algal growth.

All sanitisation operatives **should** observe the instructions detailed in TM 2.1.5.

a) Cleaning Water Contact Surfaces
Please note that this is the most important part of cooler care

1 Disconnect the cooler from the electrical supply.
2 Remove the bottle from the cooler.
3 Drain water from the taps but leave some in the reservoir as a vehicle for the cleaning chemicals
4 Remove the non-spill device.
5 Disassemble the non-spill device (Note: may not be possible on some types of coolers).
6 Remove the air filter.
7 Remove the reservoir baffle if fitted.
8 If a hot & cold cooler, insert a plug in the outlet from the reservoir to the hot tank.
9 Clean and/or descale the reservoir interior.
10 The cleaning efficiency may require vigorous physical effort
11 Clean the non-spill device and baffle in a clean container.
12 Drain off the cleaning/descaling solution through the taps.
13 Rinse reservoir and components with clean water (bottled water or from a drinking water supply).
14 Remove and disassemble the taps.
15 Clean and or descale the taps.
16 Reassemble the cooler and refit the taps.
17 Drain off the cleaning liquid.

b) Disinfection of Water Contact Surfaces/Cleaning the Cooler Exterior

18 Fill the cooler reservoir with clean water.
19 Add a measured amount of the chosen disinfectant at the correct concentration.
20 Mix well.
21 Drain a small volume through the cold tap so that it is filled with disinfectant solution.
22 Leave for a **minimum** of 5 minutes.
23 Disinfect the non-spill device and its components by immersion in the disinfectant solution for a **minimum** of 5 minutes.
24 While the disinfectant solution is in place clean the outside of the cooler and the drip tray using a mild cleaning agent/sanitiser.
25 Remove and disinfect the hot tap.
26 Reassemble and refit the non-spill device.
27 Fit a replacement air filter if necessary.

28 Drain the reservoir of disinfectant solution through the cold and cook taps.

29 Remove the plug to the outlet from the reservoir to the hot tank.

30 Refit the reservoir baffle.

31 Fill reservoir with product or water from the designated supply.

32 Drain the reservoir through the cold tap. This is the rinse.

33 Check the rinse water for disinfectant with a test kit appropriate for the disinfectant used.

34 If no disinfectant is indicated taste the water.

35 Re-rinse until no disinfectant is detected and the water taste is satisfactory.

36 Replace the bottle if the cooler is in use.

37 Do not reconnect to the electrical supply and switch on the cooler until water runs from the hot tap.

38 Record the date and details of the sanitisation on the relevant forms.

39 Attach a label/sticker to the cooler bearing the sanitisation date.

40 Obtain the signature of the customer that the sanitisation has been completed (if working on customer's premises.)

41 If sanitised in a depot the cooler should be drained of all water and sealed in a clean plastic bag for storage.

42 No coolers or components should be packed wet.

43 Any stored, sanitised coolers should be inspected on a weekly basis and resanitised if showing signs of dampness such as condensation.

All sanitisation operatives **should** observe the instructions detailed in TM 2.1.5.

1 The new disposable reservoir unit should be in the original sealed plastic bag.

2 Ensure cooler is not plugged into the electrical supply and stands on a level water resistant surface.

3 Remove the bottle and allow the water in manifold to drain into the drip tray.
Note: If hot & cold cooler ensure water from hot tap is cool before proceeding.

4 If necessary water can be cooled by drawing water from hot tap.

5 Remove and empty drip tray and open the cooler to gain access to the reservoir.

6 Drain off water remaining in the disposable reservoir

7 Following the manufacturer's detailed instructions remove the disposable reservoir from the cooler taking care not to spill the water retained within it.

8 Remove the new or freshly sanitised reservoir from its sealed bag taking care not to damage or contaminate it.

9 Following the manufacturer's detailed instructions install the reservoir ensuring that none of the tubes are kinked or twisted.

10 Close the cooler casing.

11 Replace the bottle onto the cooler and ensure that water fills the waterways.

12 Draw off water from each tap to ensure operation is normal.

13 Sanitise drip tray and refit.

14 Clean the external/internal surfaces of cooler with a mild cleaning agent/sanitiser.

15 Dispense water sample from cold tap into a cup and taste as a final inspection.

16 If any taste noted drain off water until no taste remains.

17 Return cooler to location and plug into the electrical supply.

18 Maintain a record of the date and details of the sanitisation on the relevant forms.

19 Attach a label/sticker to the cooler with the sanitisation date.

20 Obtain the signature of the customer that sanitisation has been completed if working on customer’s premises.

Removable reservoirs give the option of taking components for sanitisation elsewhere but most makes may also be sanitised in the same way as fixed reservoir coolers. (TM. 2.1.6.)

a) Sanitisation in the Field
All sanitisation operatives should observe the instructions detailed in TM 2.1.5.

1 Components including taps, non-spill systems, baffles and reservoirs may be taken pre-sanitised to customer's premises in sanitised reusable containers or sealed clean plastic bags.

2 Disconnect the cooler from the electrical supply.

3 Remove the bottle from the cooler.

4 Remove the non-spill device.

5 Drain the water from the reservoir and hot tank (if fitted) through the taps.

6 Remove the taps.

7 Remove the reservoir in accordance with the manufacturer's instructions.

8 Place the removed components into a pre-sanitised container or a clean plastic bag for return to the depot.

9 Fit the pre-sanitised components to the cooler taking great care not to contaminate them. Wear one-time use disposable gloves.

10 Clean the outside of the cooler and drip tray using a mild cleaning agent or sanitiser.

11 Fit new air filter if required if not already installed in the non-spill device.

12 Replace the water bottle on the cooler and check that water flows from **all** taps.

13 Reconnect the cooler to the electrical supply.

13 Maintain a record of the date and details of the sanitisation on the relevant forms.

14 Attach a label/sticker to the cooler with the sanitisation date.

15 Obtain the customer's signature that the sanitisation has been completed.

16 Take used components back to depot making sure that they are labelled as used.

b) Sanitisation of Reservoirs and Components at the Depot
Sanitisation should take place in the **designated sanitisation area** which should conform to the standards detailed in TM 6.2.

Cleaning

1 Remove components, reservoirs etc from their transport container.

2 Examine for signs of damage, corrosion or staining and discard if unsatisfactory.

3 Remove air filters.

4 Disassemble all components especially taps and non-spill systems.

5 Place in a container of either descaling chemical or food grade detergent solution.

6 Leave to soak for the prescribed time ensuring that each part is fully immersed.

7 Brushing may be necessary to remove scale or stubborn soiling.

8 Rinse well with drinking water. **This is essential for safety.**

9 Do not leave components to soak in water for lengthy periods before disinfection.

Disinfection

10 Place cleaned, rinsed and drained components in a container of **freshly made** solution of the chosen food grade disinfectant at the specified concentration.

11 Leave for a minimum of 5 minutes and ensure total immersion.

12 Lift components from the disinfectant and drain.

13 Wearing clean disposable gloves transfer to rinsing tank containing drinking water.

14 Rinse well.

15 Drain and dry under hygienic conditions.

16 Reassemble components taking care not to contaminate them.

17 Fit a new air filter if appropriate at this stage.

18 Place components in clean plastic bags or a freshly sanitised transport container.

19 Label the container with the date of sanitisation.

20 Store in, clean, dry, dust and pest free environment.

c) Alternatives - Dishwashers
The use of industrial dishwashers is a very practical alternative if scaling is not excessive or after descaling.

Dishwashers disinfect by heat and offer more consistent sanitisation with much less risk of contamination by personnel.

Coolers fitted with carbonators are usually based on fixed or removable reservoir machines**.**

Points to Note:

- The reservoir, non-spill system, reservoir baffle and taps of these coolers can be sanitised as detailed in TM 2.1.6 and TM 2.1.7.

- The carbonating system may be made of materials that are degraded by strong oxidising disinfectants such as chlorine, peroxyacetic acid or ozone.

Always sanitise the carbonating system with a disinfectant **recommended by the manufacturer** for this purpose and follow the detailed instructions very carefully.

The following procedures should be observed:

- Coolers should be wrapped in plastic film/bags to prevent contamination from dust and dirt. Care should be taken to avoid the build up of condensation. Any coolers that have built up condensation in storage should be re-sanitised before use.
- First sanitization has to be done before putting the cooler in operation.
  The recommended frequency of sanitisation is regulated by the EBWA Code of Practice.
- Vans should be well maintained and kept in a clean condition internally and externally.
- Coolers should be transported vertically to prevent disruption of their refrigeration system.
- Coolers should be kept secured during transport to prevent damage or personal injury.
- No tainting materials should be transported with coolers as they may cause taint(s). Such materials include:-
    - Scented soap.
    - Disinfectants (especially pine and phenolic types).
    - Paraffin/diesel/petroleum.
    - Garlic/coffee/eggs.

The following procedures should be observed:

- Coolers should be inspected before loading onto the van to ensure that they are free from pest infestation. Those found to be infested should not be loaded on the van and special arrangements made for a collection.
- Should it be found that infested coolers have been transported the van should be emptied, cleaned and fumigated if necessary.
- Pest infested coolers should be sealed in a strong plastic bag and given warning labels before being transported.
- Pest infested coolers should not be stored in the distribution depot until dealt with
- Cooler reservoirs, drip trays and non-spill systems should be drained before being transported.

Coolers should be kept vertical and secure for transport.

The water in the bottle on a cooler can be adversely affected by any of the conditions listed below. Water coolers should not be located:-

- In the open air.
- In direct sunlight or any area that is brightly lit for long periods (i.e. 24 hours/day).
- Inside of, or close to, a lavatory.
- In laboratories.
- In a dusty, unventilated or excessively humid location.
- In front, or within 200mm, of a heating radiator or heating/air conditioning duct.
- In a restricted passage or on a fire escape route.
- On uneven or sloping surfaces.
- On weak floors or shelving.
- In areas which are subject to flooding or dampness underfoot.
- Where there is difficult access for cooler maintenance or care.
- Where there is potential for pest infestation.
- In the open (e.g. building sites)
- In the following locations in hospitals e.g.:-
    - Intensive care units
    - Neonatal units
    - Oncology units
    - Transplant units
    - Surgical wards
    - Operating theatres

The following practices should be observed by the relevant personnel when undertaking cooler maintenance:-

- Service Engineers must have a full understanding of hygiene standards. It is recommended that they receive full hygiene training as detailed in TM 7.1.
- The requirements with regard to Health, Hygiene & Safety as detailed in TM 1.2 are equally applicable to Service Engineers.
- Upon completion of any electrical or mechanical maintenance a water cooler must be cleaned and sanitised as detailed in TM 2.1.6-2.1.9.
- Inspection and testing of the electrical safety of water coolers using test equipment should be carried out on a regular 12 monthly basis and after maintenance work.
- Coolers undergoing maintenance on customer's premises must have a warning notice displayed on them to that effect.
- Maintenance **should not** be carried out in a cooler sanitisation area as it will threaten cooler hygiene.

There have been significant developments in the materials and equipment intended to make sanitisation either easier or less frequent. Buyers of those technologies intended to reduce the frequency of full sanitisation are advised to seek assurances that the manufacturer's claims are substantiated by tests carried out in accordance with the EBWA Sanitisation Protocols. Only those products with certification to this affect will be allowed a relaxation of sanitisation frequency when sanitisation is assessed during the course of EBWA Distribution Audits.

See section 2.1.1 regarding electrical standards

Steamers
These are intended to sanitise coolers by passing steam generated through the bayonet system, reservoir and out of the taps. Trials to EBWA protocol standards have shown that steamers can be highly effective on stainless steel reservoired coolers but that a minimum of 5 minutes exposure is needed. The steam flushes out the biofilm and then kills remaining bacteria.

- The efficiency of steamers depends on heating up the water contact surfaces and then maintaining the temperature at a level lethal to bacteria.

- Care is indicated with plastic reservoired coolers especially with a central refrigeration column. These require seven or more minutes steaming as they take longer to heat than stainless steel.

Ozone generators
There are a number of ozone generators on the market. Trials have shown that the types that blow ozone gas through the bayonet, reservoir and out through the tap are effective but only as part as of a fuller sanitisation process.

- The use of any ozonator should be preceded by physical cleaning to remove scale and biofilm.
- Ozonators only work well on wet surfaces

- This kind of ozonator is intended to give chemical free disinfection and thus be easier. It is unlikely that the method will make the sanitisation any quicker.

- There are Health and Safety concerns regarding staff working long periods in close proximity of ozone. It is recommended that staff are told to keep at least 3 metres away from the cooler whilst the ozone generator is running. Ozone dispels away from the cooler very quickly.

- There is no significant risk of bromate formation from this use of ozone as the volumes of water affected are very low.

- There is no need to rinse out a cooler after ozone treatment.

In Cooler ozonators
These devices dispense a small shot of ozone into the cooler reservoir for several minutes. This is intended to reduce biofilm build up. Testing of one make to EBWA protocols show that it is highly effective in controlling biofilm and can reduce the number of full sanitisations needed during the year

Silver impregnated plastics
These are intended to work on the principle that silver in the plastic of the reservoir reduce development of micro organisms into the water and as a consequence the build up of biofilm. They may either be in the form of impregnated water contact surfaces or a cartridge placed in the reservoir. No such materials have yet received EBWA Protocol Testing
The presence of silver into the dispensed water must comply with local regulations.

Introduction

There is a wide range of non-chilling dispensers available. These include;

- Crocks – ceramic/plastic
- Tilters + Taps
- Pumps - Manual /electric

Intended Use

These are primarily intended for the residential market and are mainly used in the kitchen. This market is characterised by

- Low water usage
- Difficulty of access for sanitisation and delivery
- Disinterest by users in sanitisation services
- Availability of dishwashers.
- Direct ownership of the dispensers

It is therefore concluded that the strict rules required for bottled water coolers can be relaxed, provided the user accepts responsibility for the hygienic care of the dispenser.

- Regulation (EU) No 10/2011 of 14 January on plastic materials and articles intended to come in contact with food.

Features

The following features are considered essential:

- Non-spill loading system
- Water contact surface materials conforming to European or equivalent standards i.e.
    - 2005/79/EC
    - FDA Code CRF 21 and related EU regulations
    - NSF Code F18
- CE marking for electrical safety if electrically powered

In addition the following features are of benefit:-

- Easy to dismantle and sanitise
- Dish washer proof

Supporting Literature

It is very important that dispensers are supplied with literature which covers the following;

- Commissioning information
- Frequency and method of sanitising
- Where to locate the dispenser
- Certification details for food contact surfaces.

Storage

These dispensers should be stored:-

- In their original packaging if new.
- In warehousing that conforms to the standards set out in Section 6.4
- Away from contaminating and tainting materials and foodstuffs.

Location

The water in the bottle on a cooler can be adversely affected by any of the conditions listed below. Water dispensers should not be located:-

- in the open air.
- in direct sunlight or any area that is brightly lit for long periods (i.e. 24 hours/day).
- In, or close to, a lavatory.
- in a dusty, unventilated or excessively humid location.
- in a restricted corridor/passage or on a fire escape route.
- on uneven or sloping surfaces.
- on weak floors or shelving.
- where the taps can become contaminated by animals.
- within reach of small children who may pull down the dispenser/bottle on top of themselves.
- Close to chopping boards and raw food handling surfaces.
- Close to from sinks used for domestic purposes.

Sanitisation - General

It is expected that the users will wish to sanitise these dispensers themselves.

In view of the wide variety of dispensers available it is recommended that the manufacturer's instructions on sanitisation are offered to the user.

These may include:-

- Boiling.
- Washing in a dish washer.
- Cleaning followed by treatment with a proprietary disinfectant.

Suitable Disinfectants

- Bleach intended for food use.
- Amphoteric sanitisers.
- Chlorine tablets (i.e. those intended for babies bottles).
- Peroxides –especially tap sprays.

a) Materials

Reusable bottles are usually made of polycarbonate. Only food grade materials that conform to EC Directive 2005/79/EC or an accepted alternative should be used. It should also comply with the regulation for bis-phenol A.

Bottles should satisfy the following criteria:

- Be strong enough for their purpose.
- Pass a drop test when filled with water.

b) Design

Bottles are available in either round or rectangular format in a range incorporating 11 litres, 15 litres, 19 litres and - (decreasingly)-22.7litres although other specialist shapes have been used. The following points should be noted:-

- Rectangular bottles are easier to stack.
- Round bottles require racks for stacking.
- Bottles sent out shrink wrapped on pallets can pick up contaminants and bad tastes from the pallet materials.
- Some bottles may be subject to heavy weights and be damaged if sent out on pallets stacked too deep.
- Rectangular bottles are more prone to leakage than round ones, due to moulding stresses and impact damage to corners.
- 22.7 litre bottles may infringe Heath & Safety lifting guidelines. 19 litre bottles come close to the limit.
- Bottles with hollow handles or moulded designs on their interior surfaces require extra care during internal bottle washing although a well adjusted bottle washer can cope easily with them
- Different makes of the same size of bottles may have different weights and neck lengths. This may cause problems during filling of mixed batches.
- Bottle necks should be well formed/machined to give a good seal with the cap. This is achieved by reaming or injection moulding the neck.

c) Bottle Life

Well cared for bottles will last for a long time. Factors that shorten bottle life include:-

- Bad handling.
- Bottle washing at very high temperatures (75°C+) and with aggressive detergents. This will lead to stress cracking. Strongly alkaline detergents can knock reduce bottle life by 80%...

- Polycarbonate bottles from the best manufacturers are intended to withstand washing at 70°C

- Allowing bottles to become green or excessively dirty/dusty during use. This demands that either the bottles are scrapped or are given an aggressive wash **before** the normal bottle washing cycle. This aggressive wash may shorten the life of the bottle and encourage leakers.

- Putting contaminated or tainting liquids into them.

d) Bottles and Taint
Properly treated polycarbonate is non-tainting but readily absorbs odour from the bottle contents or its surroundings especially solvents and petrochemicals. However there have occasional incidents with tainting polycarbonate.

e) Bottle Hygiene
It is strongly recommended that purchasers seek reassurance from their suppliers that bottles have been manufactured and handled hygienically. They should be free from foreign bodies (such as plastic reamings and mould) on receipt.

f) Other Materials
Bottles made from PET are now available. Quality varies but initial appearance can be impressive. Although cheaper than polycarbonate PET bottles scratch easier and have a significantly shorter life.

Needless to say they should be made from food grade materials and should be certificated as such by the supplier.

Be aware that PET bottles in general may loose volume when washed several times. PET is more sensitive to washing temperatures.

The labeling of bottled water is extremely important as this has to comply with both food and water legislation. The following points should be noted:-

a) Relevant Legislation
Bottles should be labeled in accordance with **all** relevant European and National Legislation. e.g.

- EU Directive 80/777 amended by 96/70 on the exploitation of Natural Mineral and Spring Waters
- EU Directive 98/83 for other bottled waters
- National legislation on food labeling

b) Markings
Bottles should display in a prominent position a:-

- unique 'Batch Number' for the purpose of traceability and identification.
- 'Best Before Date' which shall not exceed 12 months from the date of bottling.

c) Positioning
The markings should be positioned on the bottle so that they;-

- may be easily visible to the customer to aid stock rotation.
- are not disposed of at the time of removal of the protective label from the bottle cap.
- are easily available for inspection by the customer in the event of a quality complaint.

d) Materials
Labels and their adhesives should:-

- meet the relevant legislation in so far as they may contaminate the water by migration through the bottle.
- be able to withstand repeated hot wash cycles.

e) Bottle markings
Most bottles carry a clock style base stamp that gives the date of manufacture. This can be most helpful in tracing quality problems.

Safe storage of empty and full bottles is vital to ensuring the hygiene of the finished product. The following points should be noted:-

a) New/Washed Bottles

- Bottles can acquire taints from their environment especially if stored with tainting materials. Such taints will often not be removed by the bottle washer.
- Dusty bottles may pick up algal spores-especially if stored vertically without protection against dust entry.
- Bottles should be retained in their outer wraps until needed

b) Returned Empty Bottles

- Empty bottles stored in the open or unprotected will become contaminated by dust, dirt, rainfall and pests.
- Water residues in bottles will turn green with algal growth if left in sunlight.
- Returned bottles with their caps taken off will attract insects such as mosquitos which may lay eggs in the water residues.

c) Storage Rules

Do:

- store all bottles inside well constructed pest-proof buildings.
- store bottles out of direct sunlight.
- leave returned empty bottles with their caps sealed until immediately prior to loading onto the bottle washer.
- Remove caps from and drain all returned bottles not intended for immediate refill and store covered over and inverted.
- set up a pest control agreement for the storage building with a reputable contractor.
- ensure all storage is away from walls to allow access for cleaning and to discourage pests.
- leave new bottles in their sealed external packaging to prevent foreign-body contamination until immediately before use.
- ensure that all light fittings in the storage area are of the safety type to prevent contamination by broken glass.

Do not:

- store new or returned bottles in the open
- store bottles next to tainting materials such as petrochemicals, perfumed or aromatic disinfectants, cleaning chemicals, garlic, eggs or coffee etc.
- store bottles in freshly painted areas.

Caps used in Europe are mostly non-spill caps. Those caps are designed to avoid the water to splash when bottle is placed on the cooler (or removed from the cooler) also the cap design allows a probe to collect water directly from inside the bottle avoiding as much as possible the contact of water with the environment.
Caps are made out of one or two pieces for the body and inner valve. The part in contact with the probe is protected by a tamper evident. Foam or gasket is placed inside to reduce leakage.

a) Materials

- Cap materials should meets the relevant legislation standards for food or water contact e.g.
    - EC Directive 2005/79
    - FDA Code CRF-21 and related EU regulations
    - Regulation (EU) No 10/2011 of 14 January on plastic materials and articles intended to come in contact with food.
- The supplier should be able to provide a copy of a valid Certificate of Compliance for the product from an accredited laboratory.
- In addition EC Directive 2004/1 has forbidden the use of **Azodicarbonamide** as a blowing agent for plastic foams. Azodicarbonamide has long been used as the blowing agent for the foam liners used in many caps. As from August 2005 it has been illegal to use such caps within the EU. There is no such restraint on the use of these caps outside the EU and they are still widely available. The compound is thought to give off a weak carcinogen semicarbazide if heated (ie sterilisation by heat). This event is unlikely to occur to caps used for coolers so the potential hazard to health of using liners for caps would appear, given current knowledge , very low indeed.

  Members are strongly advised to get assurance from their suppliers.
- It is recommended that purchasers should request confirmation from the supplier that caps are manufactured hygienically

b) Design

- Caps should be compatible with the non-spill system in use on the cooler.
- The caps should be provided with an easy to remove label that protects the cap mechanism from dust and dirt. These labels may be
    - Flexible plastic
    - Flexible metal
    - Snap out rigid plastic

Caps should fit tightly and seal well when placed on the bottle.

It should be noted that the users should be strongly advise to remove the label when putting the bottle on the cooler.

Safe cap storage is vital to ensuring the hygiene of the finished product. The following points should be noted:-

a) Do:

- Store inside sound pest proof buildings.
- Store out of direct sunlight.
- Ensure that the storage building is subject to a pest control agreement with a reputable contractor.
- Ensure that storage is away from walls to allow access for cleaning and to discourage pests.
- Protect packs from dust and dirt during storage.
- Keep external packaging sealed to prevent foreign body contamination.
- Reseal all part used packs and always empty one pack before opening another.
- Use stock control to ensure that oldest packs are used first.
- Observe the manufacturers ‘use-by’ dates.
- Inspect all boxes received for signs of damage. If the outer is ripped, torn or holed check the contents before use. Rodents may have gained entry.
- Ensure that all light fittings in the storage area are of the safety type to prevent contamination by broken glass.

b) Do Not:

- Leave caps in the bottle filler hopper of the bottling machine overnight.
- Store caps in the open outside the building.
- Bring dust into the bottling plant on dusty cap boxes. Always remove the outers before bringing caps into the plant.
- Store next to tainting materials such as petrochemicals, perfumed or aromatic disinfectants, cleaning chemicals, garlic, eggs, coffee etc.

a) Materials

- These should meet the relevant legislation standards for food-grade materials e.g.
    - EC Directive 2005/79
    - NSF standard F-18
    - FDA Code CRF-21 and related EU regulations
    - Regulation (EU) No 10/2011 of 14 January on plastic materials and articles intended to come in contact with food.
- The supplier should provide a copy of a valid Certificate of Compliance for the product from an accredited laboratory - which should include a statement about the maximum temperature capability of the cups.
- Where cups are printed in ink, the conformity of the ink to appropriate legislation should be verified as it may migrate through the cup wall and contaminate the water.
- Cups should preferably be made of recyclable materials.
- Purchasers are advised to seek reassurance from the supplier that cups have been manufactured hygienically

a) Hot Water Usage

- Where cups are supplied for use with hot water provided by coolers, these cups should be of such specification that they will withstand the temperature of the water dispensed without excessive deformation or danger to the consumer.

  Some water coolers produce water at a temperature in excess of 90C. Since thermostats controlling the heating may have tolerances of +/- 5 C it is recommended that the maximum temperature attainable should be regarded as 100C.
- It is strongly recommended that the customer be advised of the temperature capability of the cups supplied by statements as below:-
  'For cold water use only.''
  'For cold and hot water use''

The use of cup holders and expanded/blown polystyrene cups for hot water dispensing is recommended.

Dirty cups can be the cause of customer complaints. Cup boxes have also been found to be rodent affected. It is recommended that the following points be noted:

a) Do:

- Store inside sound pest proof buildings.
- Store out of direct sunlight.
- Ensure that the storage building is subject to a pest control system. An agreement with a reputable contractor is recommended)
- Ensure that storage is away from walls to allow access for cleaning and to discourage pests.
- Protect packs from dust and dirt during storage.
- Keep external packaging sealed to prevent foreign-body contamination.
- Reseal all part used packages and always empty one pack before opening on another.
- Use stock control to ensure that oldest packs are used first.
- Observe manufacturers 'use-by' dates.
- Inspect all boxes received for signs of damage. If the outer is ripped, torn or holed check the contents before use. Rodents may have gained entry.
- Carry out a similar inspection before delivery to the customer.
- Ensure that all light fittings in the storage area are of the safety type to prevent contamination by broken glass.

b) Do Not:

- store cups in the open
- Store next to tainting materials such as petrochemicals, perfumed or aromatic disinfectants, cleaning chemicals, garlic, eggs or coffee etc.

c) Sub-packs

- It is preferable that cups are packed in small sealed sub-packs.
- Customers should be advised to reseal all part used cup packs and always empty one pack before opening another.

Introduction

Bottled water is regulated by the EU Directives 2009/54 and 2003/40 or 98/83 in general as well as by some local/national regulations to be considered as appropriate.

Definitions

There are, in effect, four main types of bottled water provided by the industry.

1. Natural Mineral Water.
2. Spring Water.
3. Other Waters. Primarily water from underground sources that receive treatments that have little effect on their mineral constituents (ie ozonation for microbiological reasons). Descriptions used include; pure water, drinking water, table water, water from the X hills etc., The title must not include the word 'spring' nor "natural".
4. Purified (remineralized) water. This category is regarded an 'Other Water but is so different in its origins and method of production that it warrants being considered separately

a) Natural Mineral Water

To meet the standard for Natural Mineral Water in the EU a supply must comply with EU Directive 2009/54 replacing 96/70 and 80/777 ('Natural Mineral Water Directive') and EU Directive 2003/40.

- Be registered with and be recognised by an appropriate authority as a Natural Mineral Water.
- Have been subject to period of intensive analysis and have hydrogeological report for the purposes of recognition.
- Originate from a **specified**, fully protected and pollution free underground source.
- Be bottled at source.
- Be of stable physical and chemical composition.
- Satisfy the microbiological criteria set out for Natural Mineral Water in EU Directive 2009/54, article 5.
- Be free from harmful bacteria and parasites.
- Receive no treatment that will alter its microbiological content.
- Receive only permitted treatments if these are necessary. See section 4.2.1
- Undergo regular testing by a qualified laboratory to confirm that it maintains its quality and stability.
- Comply with the labelling requirements of EU Directive 2009/54/EC and 2003/40/ECSee section 4.5.1
- Show its typical mineral content on the label

b) Spring Water

Spring Water must:

- Be taken from a protected underground source and may arrive at the surface either by its own volition or by pumping.
- Be bottled at source.
- Receive no treatment that will change its microbiological or mineral content (i.e. no chlorination, ozonation, ultra violet treatment, fine filtration, ion exchange etc). However please note that in the UK only chlorination and ozonation are not allowed as an antimicrobial treatment for spring water.

- Conform to the compositional requirements of EU Directive 80/778 or its successor 98/83.
- Declare its typical mineral analysis

Spring Water **may:**

- Receive only permitted treatments if these are necessary. See section 4.2.1
- Not be sold as another spring water
- May (in the UK) be sold under another designation or brand as long as it is not spring water.

Note The term Spring Water (or a related description) is a voluntary one. A company will declare its water to be a Spring Water by labelling it “Spring Water”.

c) Other (Table) Waters (from underground sources)

- Includes all water from protected underground sources which do not qualify for the descriptions Natural Mineral Water or Spring Water or perhaps, significantly where the owning company have not bothered to apply for NMW recognition nor use the description ‘Spring Water’.
- They must conform to the microbiological and chemical standards of the EU Directive 80/778 and its successor 98/83.

The following are permitted for ‘other waters’:

- Tankering.
- Blending (mixing) from different sources.
- Anti-bacterial treatments - including ultra violet light, ozonation and fine filtration.
- The alteration of the mineral content or the removal of impurities.
- Filling of the same brand from a number of different sources
- Selling of the same source under a number of different brands

c) Processed or Purified Water

- This water is subject to the microbiological and chemical standards of EU Directive 80/778 and its successor 98/83, just as (c) above.
- The water may come from a private or municipal source prior to processing.
- This water may have one or more treatment processes applied to it prior to bottling. See section 4.2.1
- It is most likely to have been subject to reverse osmosis

The following are **permitted:**

- Tankering.
- Blending (mixing) from different sources.
- The alteration of the mineral content or the removal of impurities.

Warning

- In some counties (e.g. UK) such water must have a minimum calcium level of at least 60 mg/l.
- This is usually achieved by remineralisation or blending.

The source of water used for bottling should be maintained in good condition and be kept free from contamination by the implementation of specific protective measures.

Ground Water Sources (springs, boreholes etc).

These sources will take water from below ground level where the passage of water through rock strata will have removed most or all of the microbiological contamination which may have been present in surface water. The sources should therefore be protected against re-contamination and pollution by surface water.

General
The **recharge area** is the land area where the water drawn from an underground source falls as rain. This land may or may not be under the control of the bottler. The following protection measures are recommended:-

- Bottler should obtain hydrogeological data that will enable them to determine:-
    - Where the recharge area is located.
    - The location, depth and type of the water bearing rock.
    - Any threats to water quality from neighbouring activities.
    - If the recharge area is under the control of the bottler then use of the land should be controlled to avoid the following threats to water quality:-
    - Use of pesticides and fertilisers if farmed – no farming preferably.
    - Ploughing in of arable land (this can lead to a big sustained increase in nitrate levels)
    - Excessive stocking with animals – no stocking preferably.
    - Dumping of industrial, domestic, or farming waste etc. – no dumping preferably.
    - Polluting activity – no industrial/domestic or farming activity preferred.
    - Major earthworks/building projects – no activity preferred.

Source Works

The source should be:

- Properly located i.e. not close to polluting activity.
- Accessible for easy maintenance.
- Properly protected from pollution of every probable type.

The area immediately around the source works must be protected against contamination and damage by:

- Preventing livestock access by building a strong cattle proof fence - at least 5 metres from the source.
- Constructing a surface water drainage ditch uphill from the source works to divert rain water run-off. This is especially important in hilly areas.
- Fitting of a lockable closure on the source works to prevent unauthorised entry.
- Erecting a small building over the source works for extra protection.
- Surveillance installations might be advisable

Springs

- Discharge at ground level and are therefore at much greater risk of contamination from surface water (run off, flooding etc) and shallow ground water than boreholes**.**
- Should be protected by a properly constructed collection chamber which will vary according to the type and location of the spring and should only be undertaken by a specialist.
- A sampling point at the source should be available to enable water samples to be taken for analysis.

Boreholes

- Vary considerably in depth and usually need lining to prevent collapse of the surface layers.
- Drilling/installation of the submersible pump etc. should be undertaken by a specialist.
- A sampling point should be available to enable water samples to be taken for analysis.
- The borehead and pipework should be fitted with a non-return valve to prevent the siphoning of water back down the borehole.
- Boreholes are especially prone to surface water collecting around the bore head and then finding its way down the outside of the bore to contaminate the underground source.
    - Ensure that the bore head is well protected and enclosed and that rain or flood water cannot get in
    - Check and maintain the seal around the bore head

Source Maintenance

- Should usually be left to a specialist. In particular:-
    - Relining boreholes.
    - Replacing or servicing submersible pumps.

- Redeveloping boreholes (to increase or restore output yields).
- Rebuilding or enlarging spring collection chambers.

General Requirements

a) Private sources

The source should be:

- Of satisfactory sanitary quality and conform to the requirements of the relevant legislation (see sections 5.2 and 5.3 for testing requirements)
- Operated with the knowledge and approval of the government agency having jurisdiction.
- The bottler should have on file the following information:
  - Depth of borehole (if appropriate).
  - Details of piping and sealing
  - Details of pumps, fittings etc.
  - Maintenance records.

b) Public supplies

Public supplies may be used as a water source for bottlers operating treatment plants (i.e. reverse osmosis), when the following are required:-

- Analytical data to prove that the supply conforms to appropriate legislation and is free from parasites such as Cryptosporidium and Giardia. Unfortunately this cannot be guaranteed for many public supplies. In such cases the company should adopt barrier treatments to prevent any possible/likely contamination passing to bottled water.
- Approval of the operation by the government agency having jurisdiction.

Pipework

Pipework connecting the source to bottling plant should be:-

- Made of materials that are certificated for drinking water contact use.
- Fitted with a facility to isolate from the source for cleaning/disinfection purposes.
- Maintained to remain leak free.
- Protected against mechanical damage (i.e. by vehicles) and freezing.

Storage tanks/reservoirs

See section 4.4.2

Introduction
For bottled waters other than Natural Mineral and Spring Water there are no restrictions concerning water treatments. Treatment is restricted for all natural waters
Restrictions are described in the EU Directives and by local/national Regulations.
As general rules followings could be considered:

Natural Mineral Water/Spring Water

Directive 96/70 does not permit any treatments to these waters that:-

- Change the natural heterotrophic microflora (microbiological characteristics) of the water but note the anomalous permission of the use of ozone enriched air to remove unstable elements. The use of ozone can be permitted by sanitary authorities only in case there is no risk of forming bromates.
- Alter the stable mineral content of the water.

a) Permitted treatments:

- Filtration to remove particles.
- Removal of the unstable elements iron, manganese, sulphur compounds and arsenic by treatment with aeration, filtration or ozone enriched air. For ozone the use must be notified to and controlled by the competent authorities.
- Other treatments to remove undesirable constituents may be permitted subject to approval and control by the competent authority - provided the constituents that give the water its characteristics are not affected. The Directive does not state what this treatment may be.

b) Treatments NOT permitted:

- Ozonation (if intended to disinfect the water).
- Reverse osmosis
- Microfiltration*(< 0.2 micron)* (obsolete term. Rather : **micrometers**)
- Ultra violet light*
- Deionisation/ion exchange/demineralisation
- Chlorination**/**disinfection
- Softening/ion exchange
- Remineralisation/mineral addition
- Fluoridation
- Carbon/charcoal filtration except after ozonation if and when used in a permitted manner.

* Permitted for Spring Water in the UK

Table Water and Purified Water

a) Permitted treatments:

- Ozonation
- Reverse osmosis
- Microfiltration
- Ultra violet light
- Deionisation/ion exchange/demineralisation
- Chlorination**/**disinfection
- Softening/ion exchange
- Remineralisation/mineral addition
- Fluoridation
- Carbon/charcoal filtration

b) Treatments not permitted

Any treatment which is not injurious to health is permitted

Health Effects

It is very important the equipment, chemicals and filter materials used to treat water have no harmful health effects.

Materials in contact with water should comply with European or equivalent standards (food grade quality). These include:-

- 2005/79/EC
- FDA code CRF21 and related EU regulations

Electrical and Electromagnetic Safety

Electrically operated equipment should be electrically safe and comply with local health and safety requirements and the following EU Directives:

- 89/336/EC (EMC)
- 73/23/EC and 93/68 EC.(LVD)

Newly acquired equipment should carry CE marking and have supporting documentation.

Use of Hazardous Materials

Please note that materials used must now conform to the requirements of the new RoHS Directives

- 2002/95/EC and 2005/618/EC

Please note that some bottling plant and water treatment systems originating from the Far East have left a lot to be desired. Buyer beware!

Particulate Filters

These filters are intended to remove small particles from water. They are of two main types:-

- Surface filters (e.g. pleated membrane.)
- Depth filters (i.e. sand, multi-media or compressed / woven fibre (cartridge) filters).

Filter performance will vary according to construction. Filters are available in a range of specifications from coarse screens (40 - 100 microns), medium (5 - 20 microns) to fine filters (0.2 - 0.5 microns) that will remove many microorganisms (sub-micron).

What filter?

This depends on:-

- Source water characteristics (sources may add sand or clay particles during abstraction).
- Presence of unstable elements e.g. iron, manganese, arsenic etc.
- Protection required against microorganisms e.g. parasites (Cryptosporidium/Giardia).
- Mechanical/Hydraulic factors: flow rate, temperature, and pressure-drop.
- Subsequent treatment.

For ground water source a number of types of filters may be used: -

- Coarse filters - used close to the source (sand can damage pumps and pipework).
- 2 - 5 micron filters to remove smaller particles and sediment.
- 1 micron filter to remove parasite cysts
- 0.2 or 0.5 micron filters to remove other harmful microorganisms. (not viruses)

Note: an underground water source must be microbiologically safe, i.e. free of pathogens and TPC not exceeding 20 at 37 C and 100 at 22 C. The types of filters necessary will depend very much on individual sources.

Filter Maintenance

- Maintenance will range from back-washing (sand filters) to replacement (cartridge filters).
- Depth filters such as sand or charcoal (carbon) filters which are usually used as pre-treatments to processes such as reverse osmosis or ion exchange are likely to become colonised by bacteria which can lead to taste or microbiological problems. In such cases appropriate chemical disinfection should be performed before or after filtration (may include chlorinated back washing). An ultra-violet unit may be used after the filters and before the R.O. This will avoid the possible formation of disinfection by products.

- The frequency of filter change/back-washing will depend on:
  - Water type & content.
  - Flow rates.
  - Filter capacity.
- Performance of a filter in any particular situation will only be determined by experience.
- The pressure drop across a filter will give an indication of its condition. An increase in pressure will indicate the need for replacement/back-washing.
- Follow the manufacturer's recommendation when maintaining filter.
- Integrity tests should be implemented for fine filters (0.2 µm, 0.45 µm)

Precautions when maintaining or replacing filters

- The filter must be isolated from the supply pipework in both directions.
- Strict standards of personal hygiene must be observed.
- Care should be taken not to release particles that have been trapped in the filter into the downstream pipework. This is most important because parasite cysts (i.e. Cryptosporidium and Giardia) will have been concentrated in the filter.
- Filter mismanagement has been the cause of some microbiological contamination of water - primarily in municipally treated water.

Introduction

A number of membrane separation systems are used to remove molecules and ions from water. These include, reverse osmosis (RO), nanofiltration (NF) and ultrafiltration (UF). As RO is by far the most widespread system only it will be referred to here.

Reverse Osmosis (R.O.) is often used as a means of purifying or improving water. It is usually used to reduce excess solids (e.g. high salinity) but may also be used to reduce the mineral content of mains water prior to remineralisation/mineral addition.

Some important points about R.O. equipment:

- It does not remove 100% of minerals - there will always be some 'leakage'. In general the higher the total dissolved solids of the **feed** (raw) water the poorer the quality of the **permeate** (product water) produced by the equipment.
- It will produce a considerable amount of **concentrate** (reject water) which must be disposed of by drainage or tankers. Discharge consent may be needed.
- It is an effective barrier against parasites such as Cryptosporidium and Giardia.
- It is only partially effective against nitrates (80 %+) although specialist membranes may improve on this.
- Some organic molecules e.g. pesticides may not be fully removed (depends on membrane type)

R.O. effectiveness/performance depends on:-

- The total dissolved solids (TDS) of the water being treated, pollutants, particlulates and microbiological contamination.
- Water temperature – lower temperatures appreciably reduce output.
- Condition of the membrane – fouling by organic matter/bacteria (biofilm) needs removal or prevention.
- Pressure of feed water – related to performance of R.O. equipment pump.
- Feed water pH – hardness must be conditioned/removed, as it will block membranes.
- Oxidisers in the feed water – chlorine must be removed, as it will destroy most membranes. This is especially important if mains water is used as a feed.

R.O. equipment will probably be part of a water treatment system and may be preceded by some or all of the following treatments:-

- Settling (not required for mains water)
- Sand and/or particle filtration (multi-media)
- Ion-exchange water softening, acidification or hardness conditioning ((polyphosphates)
- Chlorination/Dechlorination (carbon filtration) – (only if source is of questionable quality)
- Ultra-violet light

Post R.O. treatments may include:-

- Ion exchange/demineralisation/deionisation (if water heavily mineralised/saline)
- Remineralisation/mineral addition (may be necessary to comply with legislation)
- Ultra-violet light
- Ozonation
- Sub-micron filtration (0.2 micron)

A water treatment system incorporating all or some of these technologies is complicated and needs trained operatives, constant monitoring and ongoing maintenance if it is to be effective. It is essential to follow the specific maintenance recommendations of the equipment manufacturer and that the feed water pre-treatment methods be tailored to the feed water quality.

R.O. Membrane Types

There are three main types usually used for water treatment:

Type	pH Stability	Chlorine Resistance	Biofilm Resistance	Max Temperature
Cellulose Acetate/ TriAcetate	2 - 8	<1.5mg/l (Good)	Poor	35ºC
Polyamide	4-11	<0.1mg/l (Poor)	Good	35ºC
Thin Film Composite (TFC)	2-11	<0.1mg/l (Poor)	Good	45ºC

Problems and Solutions

a) Feed Water Quality

- This must be retained within reasonable limits by pre-treatment. A doubling of the feed water TDS will double the TDS of the permeate/product water and may have an adverse effect on taste. Membranes typically remove about 95%+ of TDS. Therefore with a feed water of 1000 mg/l the product water may contain less than 50 mg/l. Additional R.O. or demineralising treatment may be required to reduce the TDS further.

b) Membrane Fouling and Degradation

- Filtration of the feed water is essential to prevent fouling of the membrane. For municipal waters multi-media filtration followed by 5-micron filtration is usually sufficient.
- Activated charcoal filters will remove damaging chlorine from feed water.

- Hard feed water must be softened or treated with polyphosphates to prevent precipitates forming on the membrane.
- With cellulose acetate membranes, acidification of the feed water may be also be used to prevent the build-up of scale or calcium carbonate deposition on the membranes.
- The membranes should be regularly washed with a hot weak organic acid to remove the build up of solids, organics and biofilm. (Seek advice from manufacturer).
- Degradation can be spotted if product water flow rates increase significantly coupled with a decline in product water quality (increase in TDS). A fall in pump pressure may occur.

c) Water Temperature

- Membranes are temperature sensitive and will degrade at high temperatures. Low temperatures will reduce productivity by as much as 1.5% per degree below 24 degrees Celsius. Feed water temperatures should be kept relatively constant.

d) Membrane Hydrolysis

- High or low pH may cause membrane deterioration and breakdown. Care should be taken to ensure that pre-treatment does not alter the pH outside the membrane's tolerance.

Monitoring R.O. Equipment

The following tests are recommended as a routine and should preferably be checked hourly.

- Feed water and product water pH
- Feed water temperature
- Feed water TDS/conductivity
- Feed water turbidity (particulate level)
- Feed water pump pressure
- Polyphosphate/acid feed (if used)
- Product flow rate
- Product TDS/conductivity

Control monitoring instruments are available with built-in alarms to warn of readings outside of pre-set limits.

Ozone is a powerful, quick acting gaseous disinfectant with the following general properties:

- It is an unstable form of oxygen containing three rather than two oxygen atoms per molecule
- It must be generated at the point of use.
- Breaks down quickly to form oxygen (thus leaving no disinfectant residue in the product water).
- Its half-life (time taken for 50% to disappear) will depend on its concentration, temperature and chemical/microbiological analysis of water concerned.
- Above a concentration of 0.02-0.05 mg/l it can be detected by taste and smell.
- It can react with plastic pipes, valves, cooler components etc to give bad tastes.
- **IT WILL COMBINE WITH BROMIDES PRESENT IN WATER TO FORM BROMATES**. **AS BROMATES ARE THOUGHT TO CAUSE CANCER THERE IS A VERY TOUGH MAXIMUM ADMISSABLE CONCENTRATION OF 10µg/litre. IT IS VERY EASY TO EXCEED THIS CONCENTRATION SO CARE IS ADVISED. (SEE SECTION 4.2.6)**

Time taken for ozone to disappear e.g. 0.32mg/l ozone at 21ºC

Water TDS	Half life	Time for disappearance
400-450 mg/l	30 min	circa 3.0 hrs
1mg/l	2 hrs	circa 10.0 hrs

In order to be sure that ozone can not be detected by taste and smell in the product water and given that water at the time of bottling will be much cooler than 21ºC it is recommended that:

- **Ozonated water should be stored for at least 24 hours before distribution to customers.** In colder climates or winter it may be necessary to store the water for longer periods.

Uses and concentration of ozone

- Disinfection:
  - Bottled water 0.1 to 0.4mg/l in the bottle
  - Equipment/pipework CIP 0.4 to 1.0+ mg/l.
  - Washed bottles 0.4 to 1.0+ mg/l.
- Cooler sanitisation 5 min. (exposure of wet surfaces to ozone gas)
- Other Uses: (Concentrations will depend on many factors)
  - Control of algae in source water.
  - Removal of pesticides from mains water (at high levels of ozonation)
  - Removal of unstable elements e.g.iron and manganese.
  - Odour removal from water and air.
  - Colour removal in water.
  - Reduction of cooler sanitisation frequency (in cooler ozonators

Effectiveness of ozone

Microorganism	Effectiveness
Bacteria	Extremely Good
Viruses	Good
Parasites/Cysts	Fair
Algae	Moderate

Ozone cannot be relied on to totally eliminate parasites such as Cryptosporidium from water and is thus best used with other methods such as fine filtration.

Safety

- Ozone gas can be dangerous to humans if concentration is high or for prolonged time. National standards set a maximum permitted ozone concentration in air for continuous exposure during an 8 hour day (e.g. 0.1mg/l in USA)
- Ventilation must be capable of removing ozone gas rapidly – Note: ozone is heavier than air.
- If there is an obvious smell then the airborne level is too high.
- Ensure that ozone pipework is maintained in a leak free condition.

Ozone is capable of converting the bromide molecule (naturally occurring in most water also containing chloride) to the bromate molecule which is a carcinogen.

A study of ozonated bottled water by the BWCA in the UK has shown that even when no bromide was detected prior to ozonation, bromate could be still be detected after ozonation.

Operation of an Ozone Generator

- Ozone is generated electrically from air containing 20% oxygen or pure oxygen.
- Using pure oxygen gas will increase the yield.
- Moisture and dust in the air supply should be removed as these can seriously reduce ozone output and shorten the generator's working life.
- Generator design and mode of operation will vary with the supplier.
- Follow the manufacturer's instructions for operation, care and maintenance.

Introduction

For many years ozone appeared the perfect disinfectant for bottled water. Its use was the norm in many countries and it has been used in large amounts to solve hygiene problems without having to look at other aspects of production like plant hygiene and bottle washing systems. Those days are over. Because ozonation has been found to convert bromide to the suspected carcinogen bromate EU water laws have introduced a very tough maximum admissible concentration for bromate. A seminar amongst bottler members of the BWCA in the UK revealed that an alarming proportion of UK cooler water had, until matters were adjusted, carried illegal levels of bromate that were at or above the legal limit. This was with what was then accepted as normal ozonation levels. Trials showed that it did not take much of a variation on ozonation practice to give illegal levels-sometimes significantly so.

Bromate formation

Bromate (chemical formula BrO_3^-) is an unnatural compound that is formed by the oxidation of the naturally occurring ion bromide (Br^-). This is readily done at levels of ozonation currently used. It is not a simple immediate change but goes by a pathway that includes hypobromite (BrO^-) and bromite (BrO_2^-). This process is irreversible. This can take a while. Thus conversion depends on the length of time ozonation is carried out as well as the amount of ozone used and bromide present initially.

Bromide

Bromide is found in many rocks especially those laid down in the sea (i.e. limestones, chalk and sandstones) where it always accompanies the more abundant chlorides. It is thus found in many waters of natural origin. It is harmless. If you have chlorides in your water bromide is also likely to be found (but at a lower level than the chloride).

Unfortunately bromide is not normally tested for in water so most bottlers of natural water sources will have no idea of their bromide levels. Even if results apparently contain no bromide one cannot be complacent as bromide is relatively inert (unlike the active bromate ion) and cannot be detected chemically at the lowest levels than can yield unsatisfactory levels of bromate on ozonation. To put it simply you can detect very low levels of bromate but not bromide. Waters with no apparent bromide in them have yielded illegal levels of bromate.

The presence of bromide in purified water depends on how much is present in the water before treatment. Significant levels are unlikely unless the water to be treated has a high bromide level as RO will remove 90-95% of solids. However beware of bromide contamination of water treatment chemicals such as brine or calcium chloride. At least one well publicised commercial disaster was caused by unexpected bromide in calcium chloride used for remineralisation of purified water

Legal limits for bromate

The EU limit for the presence of bromate in bottled water is currently just 10µg/l (10 parts per billion). This is a very low limit indeed.

However new legislation which has been introduced to permit the ozonation of Natural Mineral Water to remove unstable elements such as iron, manganese and arsenic has set a permitted level of just 2.5µg/l !! – virtually at the limit of detection. If this is the way that official thinking is going then the use of ozone to treat bottled water of any kinds could become problematical.

Factors affecting bromate production

These include:

- Bromide levels in the source water. Please note that even undetectable levels of bromide can yield significant amounts of bromate
- Levels of ozone used.
- Contact time
    - Please note that this is cumulative. Reozonating water that has already been treated is a sure fire way to cause bromate issues.

Controlling Bromate

As a first step members should test their waters for bromate – even if there is apparently no bromide in the water. Take samples at different points on the production time. There could be a nasty surprise. At least companies will know if there is a problem. Do this several times.

If you do find you have a problem there are a number of steps can be taken.

- Cut ozone levels down to just 0.1mg/l
- Cut back on the time your water is exposed to ozone. Things to avoid are:
    - Running the ozonator up prior to bottling
    - Recirculating and thus reozonating already ozonated water
    - Running off of water that has been standing in the ozonator during meal breaks or periods of production suspension
- Stop ozonation. Do you really need it?
    - Use ultra violet light if you are uneasy about water quality
    - Pay more attention to your bottle washing instead

Monitoring Bromate

You are advised to check your product weekly or even more frequently until you find out the range of bromate formation you are encountering.

Once you have modified your practices to get the best results settle down to bromate testing once a month

Conclusion

Ozonation has a future providing it is used correctly and dosage and time of treatment are closely controlled. Good quality control systems are available. Consider installing them if you wish to continue ozonating your product.

Bottling equipment should comply with the following:-

- It should be suitable for its intended use, be well maintained, easy to clean and be kept clean and free from contamination.
- It should only be used for the bottling of water.
- Water contact surfaces should be made of materials that are approved for food or water use and documentation should be available to confirm this. All such components should be non-absorbent and easy to sanitise.
- The product water should be in a sealed piping system under pressure. All pipe-work and fittings should be in good condition and free from excessive leaks.
- The bottling line prior to bottle filling should be fitted with a filter of at least 1 micron nominal performance for the removal of parasites e.g. Cryptosporidium.
- Ventilation ducting, pipes etc. should not be positioned so that condensation or drippage threatens the product, empty bottles, caps etc.
- Any pressurised air used in the production process should be free from oil, water, grease, dust, rust etc. Any oil or water traps in compressed air lines should be emptied regularly and not be overfull.
- Electrical equipment, wiring and components should comply with electrical safety standards and be CE certified for electrical safety if applicable (i.e. for new equipment).
- All equipment should comply with the requirements of national health and safety standards.
- Detailed records of operations and maintenance of the bottle washer, filler and capper should be kept.

Bottles returned from the consumer may not always be ready for immediate washing.

The bottle washer cannot adequately wash some contaminated returned bottles.

Bottles may:

- Be scratched or otherwise damaged.
- Contain foreign matter.
- Leak due to small holes or cracks.
- Have been used by the consumer to hold unsuitable liquids (e.g. beer) or dangerous chemicals (e.g. petroleum).
- Be infected with algae ('green' bottles).
- Be covered in dust
- Smell.

ALL bottles should have their caps removed (decapped) and be visually inspected as well as being smelled or electronically 'sniffed' before being loaded onto the bottle washer. If they are suspected of having been incorrectly used by the consumer they should either be given a special cleaning treatment or destroyed.

Bottles that have been returned with their caps missing should be given a special inspection as they may have been misused by the consumer.

Decapping (Cap removal)

This may be undertaken manually or by machine which may be fully automatic.

- Mechanical decapping machines may pose a threat of injury to fingers and should be appropriately shielded.

Visual Inspection

This may be undertaken manually or electro-optically by a machine which may be fully automatic.

- **Every bottle should be closely visually inspected** for damage or the presence of staining, soling, algae or foreign bodies.
- Adequate lighting **should** be provided at the inspection point. This should be a minimum of 538 lux (50 foot candles) light intensity. It is advantageous to provide strong lighting and a light coloured background.
- Bottles with any noticeable smell **should be discarded**.
- Bottles which are greened will infect the bottle washer and cause consequential problems.
- **Under no circumstances should a bottle with any sign of greening be put in the bottle washer**
- It is sensible practice to discard any bottle which is excessively dirty. This is normal practice.
- If it is wished to save some affected bottles then

- prior to washing and re-filling bottles which are green can sometimes be pre-cleaned with appropriate chemicals before being placed on the bottle washer. Appropriate chemicals include aggressive dairy cleaners and caustic detergents (note these must be suitable for food use). Filling the bottles with the solution and leaving them to stand for a couple of days can prove effective.

- Pre-cleaning may be manual, use special equipment designed to deal with extra soiled bottles or be part of a bottle washer fitted with a special pre-cleaning section and a separate detergent tank to that of the main detergent wash tank.
- However unless the company is desperate for bottles or has access to cheap labour and chemicals then pre- cleaning is rarely economic.
- Note that use of aggressive chemicals may seriously shorten the shelf life of your bottles.

Smelling (Sniffing)

Smelling to detect odours especially organic solvents and other contaminants is an essential process**. Every bottle should be checked.**

This may be undertaken manually or by electronic detectors which may be fully automatic.

Electronic sniffers

Points to note are:

- Diesel fumes from vehicles, e.g. forklifts, will interfere with the electronic detection systems and should not be used in or near the bottle inspection area.
- Electronic detectors will need regular calibration and maintenance to ensure accuracy at least twice a year
- Electronic sniffers are very expensive – often beyond the means of a small to medium bottler. They are also more limited in what they can detect compared with the human nose.

Manual sniffing – safety precautions

Staff

1. Only staff who have been given practical training in safe sniffing should be used. Such staff should also have received full certificated EBWA approved hygiene training.
2. Sniffing is fatiguing. No sniffing session by an individual should exceed 1 hour without a half hour break between sessions.
3. Staff who are heavy smokers or who have bad colds/nasal congestion should be excluded from sniffing.
4. Staff should also be excluded if they have a pre-existing problem such as an allergy, asthma or chronic respiratory condition.

Pre-sorting of bottles to reduce risk to the operative

It is important to understand that there is a potential Health and Safety hazard to the sniffer but only if inappropriate liquids have been put into the bottle by the user. The infrequent incidence of such

chemical contamination means that, though the hazard may be quite high on occasions, the risk of it occurring is very low.

To put a liquid in the bottle it is essential to remove the cap. Virtually all of the hazard can therefore be eliminated by putting to one side any bottles where the cap has been tampered with.

1. Put to one side
    a. Any bottle where there is no cap
    b. Any bottle where the cap has obviously been refitted or where just the top snap on section remains.
    c. Any bottle containing coloured/discoloured liquid
    d. Any bottle containing oily or rainbow hued fluids
    e. Any bottle where the liquid therein appears of abnormal viscosity. This may be either thicker or thinner than water.
2. All bottles put to one side should be either discarded or examined tentatively with great care and expectation of a hazard of fumes at the end of the run.

Routine Sniffing

Having removed or put to one side abnormal bottles the remaining bottles should be sniffed thus:-

1. Remove the cap
2. Bring the bottle gently towards the nose as short sniffs are made to detect anything abnormal. At the first sign of abnormal taint sniffing should stop and the bottle be rejected.
3. Dangerous odours will be very obvious.

Under no account should staff put their noses well into the bottle neck and inhale deeply.

Dealing with suspect put aside bottles

1. Be very wary of any bottles with the caps removed with significant amounts (a few mls) of liquids in them. It could be dangerous to empty them. Do not sniff! Reject these automatically.
2. This must be done at the end of the run.
3. It may be decided to discard all bottles rejected because of appearance or because the cap has been removed. However some companies will wish to save some bottles that are not irremediable i.e. those that have been refilled with tap water.
4. Do not sniff any bottle where there is discoloration, unusual viscosity or rainbow hues! Reject these totally
5. If all appears OK then proceed tentatively as in section d above.
6. Reject anything that indicates there may be a problem.

Other suggested actions

1. Some companies have the policy of discarding any bottles with the cap removed and of charging customers for any bottles returned in that condition. **This is recommended.**
2. Drivers should be trained to report their suspicions of any doubtful cooler use where bottles may be under threat e.g. garages, paint shops, building sites, heavy industries, premises undergoing refurbishment etc. They should be instructed to quarantine and label any bottles that they have suspicions about.
3. Such bottles should not be mixed up with others and left for the bottling plant to detect.

All unsatisfactory bottles which will not be re-filled should be rendered unusable as soon as possible e.g. punctured or painted to prevent their re-use.

Bottler washers are a distinctive feature of the water cooler industry because of reusable bottles. During its life a bottle may be reused and undergo upwards of 50 refilling/dispensing cycles.

Bottle washers are essential because:-

- Bottles are in use for a long time allowing the build up of scale and biofilm formed by the normal microbial flora of water on bottle interior surfaces.
- Customer misuse of bottles is unfortunately common.
- Bottles may become contaminated whilst awaiting return.
- Bottles may have developed algal (green) growth.

Equipment types

There are a number of manufacturers of specialist bottle washers for water cooler bottles. Each make will have some individual features but generally all utilise similar principles. Installations of equipment will however differ based on several factors:

- Physical size/space available.
- Manual/semi-automatic/automatic.
- Bottle wash rates range from 20 (manual) to over 1000 (automatic) bottles per hour.
- Stand-alone (wash only) or fully integrated washer/filler/capper sealed systems.
- Capacity of detergent and hot water tanks (will dictate frequency of detergent change).
- Number of wash and rinse stations/stages.
- Pre-cleaning e.g. acid rinse for high calcium (hard) water.

Desirable features:

- Bottles remaining stationary over wash jets for at least a whole minute in total. The longer the better. Trials have shown that a properly run wash stage is far more effective in removing biofilm than the disinfectant rinse.
- Wash tank capability of continuously sustaining up to 65-70ºC. (be very wary of ambient temperature detergents –
    - The high wash temperature not only gives a better clean but it also kills algal; spores and stops bacteria like Pseudomonas aeruginosa from proliferating within the wash solutions
- Tanks which are easy to fill drain and clean.
- European pipe thread fittings.
- Electrically safe (CE marked if practicable).
- Ease of maintenance.
- Approved water contact materials.

- Good technical back up from manufacturers. This is getting increasingly difficult to obtain with an influx of new manufacturers from the Far East and some manufacturers now relying on sending support staff from the USA.
- **Should include a disinfectant rinse.**

Detergents

Many detergents are unsuitable and or ineffective for bottle washing.

- Opt for a detergent that has a proven track record for washing bottles. Ask around or seek guidance from the supplier of your bottle washer. There are now detergents specifically designed for bottle washers. Be wary of those with a high level of silicates as they can cause serious staining of the exterior of your washer.
- Avoid caustic disinfectants. These will attack polycarbonate and greatly shorten the life of your bottles through stress cracking
- Be very wary indeed of cold water detergents. There may be attractive energy saving but experience to date suggests that an increase in the incidence of Pseudomonas aeruginosa and green bottles may result.

Bottle wash problems:

- Bottle damage – physical/excessive heat of wash cycle – over70ºC for polycarbonate.
- Inability to cope with different size/weight of bottles.
- Microbial growth in the wash tank (most likely if not hot).
- Poor wash performance (e.g. blocked/damaged jets).
- Poor heater performance (scaling/blockage).
- Bacterial/mould growth (often occurs in rinse stations after disinfection. Most likely if peroxyacetic acid is used as a disinfectant).
- Build up of algae spores in wash tank if ‘green’ bottles are washed without pre-cleaning.

These problems may result in:

- Bad odours or taste in the bottled product.
- The presence of Pseudomonas aeruginosa. This can be found in mains water.
- Excessive bacteria counts/TVC.
- Visibly dirty bottles with or without mould growth.
- Incidence of green bottles - this can get progressively worse.
- Leaking bottles.
- Breakdown of the bottle washer

Maintenance and Performance Tests

Bottle washers should always be well maintained and operated in the best condition.

They should be subject to regular:

- Planned maintenance - which should be recorded.
- Inspection and service by the manufacturer or its agent if possible.

The following should be carried out at the indicated frequencies:

- Emptying and refilling of the detergent wash tank - preferably daily k. Optimum frequency depends on washer type and is dictated by volume.
- Checking and recording of detergent working strength - each production run and topped up or replaced as appropriate (see above).
- Checking and recording disinfectant strength - at start up and in production run *.
- Checking and recording wash solution temperature - at start up and in production run *.
- Washed bottles to be tested for carry over of detergent - start up and in production run *.
- Washed bottles and caps to be checked for bacterial levels *.

  See sections 5.3.3 and 5.2.1

Bottle Disinfection

This stage which should follow bottle washing is intended to kill off any microorganisms which may have survived the wash process.

Disinfectants used together with suggested dosage rates e given below:

- Ozone (0.4 to 0.8 mg/l)
    - Note that this is significantly higher than levels used to treat water. The use of (freshly ozonated) product water as a disinfectant rinse is not recommended if levels have been turned down to avoid bromate problems). In this case because of low volume of carry over of the rinse there is not a bromate issue
    - It is sensible practice to have a separate ozonator for bottle washing.
    - Bottles disinfected with ozone do not require a further rinse.
- Peroxyacetic acid (1-2 mg/l)
    - Very effective but has a strong taste.
    - Needs final rinse with clean water
- Chlorine (25-50mg/l)
    - Not as effective as above 2 treatments
    - Strong taste
    - Needs a rinse

Other chemicals such as chlorine dioxide are under evaluation but cannot be recommended yet.

Process water

This is the water used for bottle washing and rinsing. It may be source or product water. However in some situations there may be insufficient source or product water for this purpose and another (usually municipal) water supply is used. Irrespective of origin the following must apply:

- It must be potable and from an approved, properly located, protected, operated and accessible source.
- The plumbing installation must be such that there is no risk of cross contamination between process water and product water. This may require separate supply piping or non-return valves in the linking pipe-work.
- Be warned that municipal water, even if potable, carries the risk that Pseudomonas aeruginosa may be present. As this is banned in bottled water this can be a serious drawback

Cleaning and disinfection

The bottling equipment and the filler head should be sanitised daily. This may be done by:-

- Re-circulation of ozonated product water. Dedicated small ozonators to treat just process water are available and may be used even if the product is not to be ozonated (e.g. Natural Mineral Water).
- Hand application/spraying with chlorine solutions (100 mg/l available chlorine recommended).
- Soaking components in peroxyacetic acid.
- Cleaning in Place (CIP) of the filler head.

Cleaning in Place (CIP)

The **entire** equipment and plumbing should be given a full CIP on a regular basis.

- Installation/equipment varies considerably. For specific advice consult the manufacturers.
- Suppliers of cleaning chemicals will give specific advice on applicable chemicals and dosages to be used.
- Frequency will vary but it is not usually necessary to carry out CIP more than weekly.
- Frequency will be controlled by:-
    - Equipment and plumbing design and layout.
    - Flow rates.
    - Water type.

Rinsing after cleaning

- Always rinse the equipment and plumbing well after cleaning to remove all traces of cleaning chemicals as they are dangerous and may contaminate the product water.
- Test product water to ensure that it is free from cleaning chemical residue before bottling. This is especially important after full C.I.P.

Unlike most foods the microbiological quality of bottled water does not deteriorate with time provided that it is:-

- Kept in a sealed bottle.
- Stored in a cool and dark place.

Once a bottle is opened it is subject to contamination from the environment. The use of coolers with features designed to protect bottle contents as detailed in TM 2.1.1 means that water remains protected against contamination when on the cooler.

The following shelf lives are recommended:-

- Unopened bottles 6 -12 months
- Open bottles (uncapped) 1 day
- Open bottles on unprotected (open-reservoir) dispensers 1 week
- Open bottles on coolers protected to EBWA standards 2 - 3 weeks

These guidelines apply only if the cooler is suitably located and if the bottles have been stored in cool and dark conditions prior to being loaded onto the cooler.

Product storage tanks

Should be:

- Of sound construction.
- Fit for their intended purpose.
- Of approved water contact materials that are non-toxic and non absorbent.
- Smooth inside and self-draining.
- Fitted with covers and inspection hatches that are of a tight fit to exclude foreign matter.
- Sealed when in use and leak free.
- Fitted with filtered air vents if not designed for pressurisation. The air filters should be of a specified rating to prevent the entry of dust and spores (5 micron recommended). Filters should be renewed regularly and kept in good condition.
- Sanitised on a regular basis and inspected and maintained in good condition.
- Free from excess scale, sediment and oxidation residues.
- Used only for product water.
- Fitted with spray head inside
- Fitted with sampling taps

Sanitization of tanks

It is essential to sanitise tanks regularly from time to time to prevent the build up of sediment, scale, oxidation residues and biofilm. It may be necessary to enter tanks to clean them fully on occasions.

WARNING
Tanks are dangerous and must only be entered with strict safety standards and under close supervision of a person outside the tank. The following are the potential dangers:-

- Fumes from cleaning chemicals.
- Toxic gases, oxygen depletion or build up of carbon dioxide.
- Build-up of heat - heat exhaustion is possible.
- Slippery surfaces.
- Electricity.
- Risk of head injury on protruding cleaning devices etc.

Safety precautions on entering tanks

Before entering the tank the following precautions should be taken:

- Notify the Supervisor that the tank is out of commission and being maintained.
- Place a sign by the tank's access cover stating there is a person working inside.
- Ensure all valves are labelled and shut-off so that the tank is not inadvertently filled.
- Check the tank is fully drained before opening manway covers.
- Open manway covers with care. There may be a vacuum or pressure build up.
- Ensure that all electrical equipment is safely wired. Use a voltage trip device.
- A person outside the tank **must** supervise the welfare of the person inside the tank either continuously or very frequently.
- A forced air blower blowing fresh air into the tank is recommended.
- Respirator mask if necessary

Chemicals

Confirm the use of the chemical, concentration and contact time with the manufacturers of both the tanks and the chemical before use.
Thorough rinsing and testing for cleaning chemical residuals is necessary before the tank can be returned to use.

Methods – Non-manual cleaning

If no manual cleaning or entry to the tank is needed:

- Filling with chlorine solution at 100 mg/l available chlorine and leaving for a minimum of 5 minutes.
- Filling with ozonated water at 0.5-0.8 mg/l ozone and leaving min. 10 minutes.
- Filling with other bactericidal agents based on chlorine, bromine, iodine or peroxyacetic acid.
- Including the tank in the Cleaning In Place (CIP) system.

Methods – Manual cleaning

If manual cleaning or entry to the tank is needed:

- The safety precautions detailed above should be followed.
- The air filter should be removed, cleaned and reinstalled.
- Approx. 200 litres of 100-200 mg/l of chlorine solution should be poured into the tank. Please check according to the size of the tank. The concentration should be measured very carefully as too strong a solution will give off dangerous fumes**.** This is the 'scrubbing solution'.

- If the solution is pumped via the tank's spray heads, allow to circulate for 20 minutes before entering the tank.
- Never use volatile and dangerous chemicals such as ozone or peroxyacetic acid if the tank is being cleaned manually.
- Use a clean nylon bristle brush. This must not have loose or damaged bristles and have been used for any other purpose.
- Care should be taken not to drop tools in the tank as the tank lining may be damaged.
- Rubber boots should be sanitised in 200-400 mg/l chlorine solution and care should be taken not to contaminate them before entering the tank.
- The tank should be entered with care. Ensure tools and ladders are clean and suitable for the task.
- Spray heads if present should be removed cleaned and reinstalled.
- Sight glasses or plastic tubes should be sanitised if accessible with the chlorine solution or tubes removed for cleaning if necessary.
- Cleaning should be top down with frequent dipping of the brush into chlorine solution.
- On completion the tank should be exited carefully and all equipment removed.
- Manway cover and gasket should be sanitised, closed and sealed tight.
- Scrubbing solution should be completely drained from the tank.
- Tank should be rinsed with 100 mg/l chlorine solution via the spray heads for min. 5 minutes.
- Tank should be rinsed with product water (ozonated if permitted) until no chlorine residual is indicated on testing.
- Drains should be closed.
- The tank may now be recommissioned.

Frequency of cleaning

- This will vary according to water type and volumes passing through the tank. Purified and R.O water will require less frequent cleaning than other types of water.

A WARNING

Beware of overfilling the tank and getting the air filter wet. Any attempt to drain the tank could result in tank collapse owing to the vacuum created. THIS HAS HAPPENED!

Natural Mineral Water – EU 2009/54 and 2003/40

- Natural Mineral Water must only be sold under **one** brand name or trade description. When the trade description is different from the name of the spring or the place of exploitation the spring name or place of exploitation must 1.5 times bigger than the trade description.
- The label must show the registered name, location and country of origin of the source
- The bottle must display a statement of the analytical composition of the water giving its characteristic constituents.

Spring Water - EU 2009/54 and 2003/40

- Spring Water must only be sold under **one** brand name or trade description. The recorded name of the source or the brand name must be in letters at least one and a half times larger than any other letters used on the label.
    - Note that in the UK a Spring Water may be sold under another brand or description as long as it is not described as a Spring Water, i.e. 'Wessex Spring Water' could be sold as 'Acme Vending Pure Water'
- The label must show the registered name, location and country of origin of the source.
- The bottle must display a statement of the analytical composition of the water giving its characteristic constituents.

Other waters – EU 80/778 – amended by EU 98/83

- Multiple branding and trade descriptions are permitted.

Each bottle should have marked on it an indication of the following:-

- **Best Before Date** for customer information and to assist usage in age order.
- **Batch Code or Date of Production** to ensure traceability should a product recall become necessary.

Location

- Due to bottle re-use placing these markings on the bottle label is impracticable.
- Marking/labelling the bottle itself may lead to mis-information if the previous labels/markings are not removed before filling.
- Recommended placing is on the **side** of the **bottle cap or the bottle neck** - this may be either with adhesive label or by ink-jet printer.
- Placing of the coding on the peel-off label of the bottle cap is **not recommended** as this label is removed and disposed of when the bottle is placed on the cooler.
- Great care should be taken to ensure that the code is not rubbed off immediately after application by careless handling. It is not unknown for bottles with an inkjet code on the neck to have the ink rubbed off when the bottle is lifted.

Introduction

- Water is electrically polarised and is therefore a very effective solvent for inorganic and organic salts and some organic molecules.
- Water dissociates into oppositely charged **ions**
- $H_20 = H^+ + (OH)^-$

  (H) = Hydrogen ion (OH) = Hydroxyl ion)
- When a mineral salt is dissolved in water the water ions will combine with oppositely charged mineral ions and take them into solution.
- The mineral composition of waters varies geographically from slightly to very heavily mineralised.
- **Ground Water** will have its composition dependant on the underground rock strata that the water has passed through or been held in since falling as rain. Ground water is relatively stable in its mineral composition. Pollution and microbiological contamination is usually not found.
- **Surface water** may have its composition affected by both its original underground source and contamination from domestic, industrial and agricultural activity in the areas through which it has flowed or where it has collected. Mineral contents and contamination levels may vary considerably from day to day. Pollution and microbiological contamination is a virtual certainty.
- Water passing through a water treatment system may have its mineral and microbiological content altered considerably by design. Such water may become contaminated by inappropriate materials used in plant construction and careless use of sanitisation and other chemicals.

Common Terms

Total Dissolved Solids (TDS) is the amount of material dissolved in water.

- Water with a high TDS is not necessarily water of poor quality. Many high quality Natural Mineral Waters and Spring Waters have a high TDS that gives them their desirable taste and unique properties.
- High TDS may cause a build-up of scale in hot/cold tanks of water coolers.

Conductivity is the ability of a water to transmit an electrical current.

- Conductivity depends on the number and types of ions dissolved in the water.
- Conductivity and TDS are closely related. Generally high TDS = high conductivity.

Cations are positively charged ions. They include:-

- Ammonium
- Iron
- Magnesium
- Sodium
- Potassium
- Calcium

Anions are negatively charged ions. They include:-

- Fluoride
- Sulphate
- Nitrate
- Nitrite
- Chloride
- Bicarbonate
- Carbonate

Cations and anions combine to form crystalline salts once the water is evaporated e.g.

Na^+ (sodium) + Cl^- (chloride) = NaCl (sodium chloride)

pH is a measure of acidity or alkalinity. It is indicated on a scale from 0 to 14 with pH 7 being neutral (neither acid or alkaline).

- pH = 0 to 6.9 is **acid.**
- pH 7.1 to 14 is **alkaline.**
- pH 7 is **neutral.**
- pH 1 is strong acid.
- pH 13 is a strong alkali.
- Liquids of extreme pH are dangerous and corrosive/caustic.

Introduction

The majority of the mineral and pollutant analysis required by EU legislation:

- Is required to be done infrequently (e.g. once a year).
- Requires sophisticated and expensive equipment, considerable laboratory facilities and well trained staff.
- Requires very precise determination.

For these reasons testing has usually to be done by an **approved/accredited outside laboratory.**

Additionally, **in-house** testing is advisable because:-

- Frequent tests to monitor product quality and safety are needed.
- Results are needed quickly.
- Inexpensive test kits are available.
- A very high degree of precision is not needed.

For this reason, it is recommended that each bottling plant should have:

- A laboratory that is located away from the production area.
- Suitably trained staff to carry out tests and understand the principles involved.

Terms used in analytical reports:

Parameter

Something e.g. ion or pollutant, that has tests specified for it.

Parametric Value

A value for a parameter specified in legislation that should not be exceeded.

This applies to many full Chemical and Microbiological Parameters listed in Directive 98/83.

Other parameters are deemed to be indicator parameters.

Full parameters

These are linked with safety. Compliance with the parametric value is compulsory

Indicator Parameters

These are used of indicators of quality and not safety in water and have advisory parametric values.

Units/expressions used in reports:

mg/l = milligrams per litre = parts per million (ppm)

µg/l = micrograms per litre = parts per billion (1000 million) (ppb)

ng/l= nanograms per litre = parts per trillion (million million)

1 mg/l =1000µg

1 µg/l = 1000ng/l

< = less than,

> = greater than.

Note: analysts rarely express results as zero.

They prefer the expression **"less than" i.e**. 'less than 0.2 mg/l' - this effectively means **undetected. (below the detection limit of the analytical method used)**

Test equipment

Test kits are available from a number of manufacturers which have the following features:-

- They rely on colour changes caused by a reaction between a tablet or liquid with the parameter being tested.
- The tests can often be undertaken in the field by relatively untrained staff.

The intensity of the colour is relative to the concentration of the parameter being tested for and can be estimated/measured by using:-

- **A colour chart** and reference table.
- **Comparato**r - test solution is held alongside standard coloured windows in a disc.
- **Colorimeter** - measures colour intensity and gives a direct reading through a calibration chart
- **Spectrophotometer -** measures colour intensity and gives a direct reading through a calibration chart

Test kits are available for almost everything including more popularly:

- pH
- Minerals - Chloride, Nitrate, Iron, Magnesium, Calcium etc.
- Disinfectants - Ozone, Peroxyacetic acid, Chlorine etc.
- Detergents (some).

pH testing

This can be carried out using:

- Test papers which change colour according to pH – a colour chart is used.
- Indicator solutions which change colour according to pH.
- Titration - a more accurate measurement where accurate reagent volumes need to achieve a colour change are measured.
- pH meter – Electronic measurement requiring regular and careful maintenance.

Conductivity

This is measured using an electronic Conductivity Meter.

Detergent

Detergent strength and **detergent carry over** are tests required during bottling.

The manufacturer of the detergent used will recommend the preferred method.

Some significant parameters:

There are a number of minerals and other parameters which appear to be of concern to consumers. References parametric values are taken from EU Directive 98/778.

The figures below refer to EU 98/83 parametric values

Iron and Manganese -Parametric values –

Iron

200 µg/l an indicator parameter

Manganese

500 µg/l (a full parameter for bottled water)

50 µg/l as an indicator parameter

These two ions are usually found together and are common in ground water.

- Iron is not harmful but has nuisance value
- When exposed to oxygen (i.e. at bottling) they precipitate out of solution.
- Iron gives a hazy yellow brown precipitate in the bottle.
- Manganese gives a black/brown precipitate in the bottle.
- Both impart unpleasant bitter astringent taste to water.
- Both can be removed by aerobic filters or ozonation or aeration and sedimentation. Iron precipitates more readily.

Nitrate-Full parametric value

50 mg/l

- This ion is found in the majority of waters but may be absent from very deep ground or remote upland supplies.
- Normally found in high concentrations where there is/has been farming with excessive use of fertilisers.
- Nitrate is a very soluble ion and requires special methods for removal.
- Nitrate converts in the body to nitrite which combines with haemoglobin in the blood in a similar way to carbon monoxide and prevents/reduces the take-up of oxygen.
- At very high levels can cause 'blue baby syndrome' or methaemoglobinaemia - dangerous to newborn babies.

Sodium- Indicator parametric value

200 mg/l

- High levels may be of concern to those with high blood pressure or heart disorder/disease.
- Majority of bottled waters have low levels that are insignificant compared to the amount of sodium consumed in food. This is important when dealing with customer concerns re low sodium diets.
- Mineral Waters can contain several hundred mg/l of sodium. There is no limit value for sodium in NMW

Sulphate - Indicator parametric value

250 mg/l

- Harmless but an effective laxative at higher concentrations.

Lead Full - parametric value

10 µg/l

- A poisonous metal contaminant affecting the nervous system.
- Occasionally found in ground water where lead ore is to be found.
- Mostly associated with water of low pH (acidic) and lead pipework.

Aluminium- Indicator parametric value

200 µg/l

- Health concerns relate to Senile Dementia.
- Not commonly found in ground water.
- Can be influenced by treatment of the water supplier (flocculation)

Introduction

Water is exceptionally vulnerable to microbiological contamination yet may appear and taste perfectly normal when dangerously contaminated. Many of the classic illnesses such as typhoid, cholera and dysentery are often waterborne.

For reasons of safety it is vital that regular **microbiological testing** be undertaken on **source water** and **product** as well as any water supply used as **process water** for bottle washing, plant cleaning etc.

Testing will give the assurance that:-

- Source water has not become contaminated.
- Anti-microbial water treatments have been effective.
- Process water is uncontaminated.
- There is no build-up of microbiological growth in the bottling plant and storage tanks.

Micro-organisms (and problems they may cause) include:-

- Bacteria (taste, odour, illness)
- Moulds (foreign bodies)
- Yeasts (foreign bodies)
- Algae (greening, odour, taste.)
- Parasites (illness)
- Viruses (illness)

Recommended testing

Please note: national legislations may differ from country to country.

The following tests are recommended to be carried out at the frequency stated as a **minimum**:

a) Source Water and Process Water

Weekly

- Coliforms and E.coli – (can be in house)

Yearly

- Cryptosporidium/Giardia (outside lab)

b) Product (of each type bottled)

Daily

- Coliforms and E.coli - in house recommended

Weekly (to be carried out by an outside laboratory)

- Heterotrophic Plate count (HPC) @ 22ºC
- HPC @ 37ºC
- Coliforms and E.coli
- Enterococci
- Pseudomonas aeruginosa

Yearly (Natural Mineral Waters only as required by 80/777EC and 96/70EC)

- 'Pathogens' – In the absence of further indications by the Directives it is suggested that the following will suffice, subject to national regulations:-
    - Aeromonas
    - Vibrio species
    - Salmonella
    - Shigella
    - E. coli type 157
- 'Parasites' - In the absence of further indications by the Directives Cryptosporidium/Giardia testing required for the source should suffice in most countries although in some parts of Europe testing for Entamoeba (amoebic dysentery) may be appropriate

Investigational Testing

Sometimes investigational testing with sampling at various points may be required to solve the following problems:-

- Poor microbiological results.
- Taints and odours.
- Pseudomonas aeruginosa in the product water.
- Visible microbial growth (e.g. white or black/green matter) in the bottled product.

Useful tests are:

- HPCs (a, b, and d)
- Pseudomonas aeruginosa (b and c)
- Moulds and yeasts (d)

Washed Bottles and Caps

The following tests are recommended to be carried out on 4 bottles and 4 caps taken just prior to filling once a quarter:-

- HPC @ 22ºC (rinse taken by the test laboratory)
- Coliforms/E.coli (swab or rinse taken by the test laboratory)

Standards

a) Water (bottled and process)	**Natural Mineral Water**	**Other waters**
HPC @ 22ºC	<100/ml	<100/ml
HPC @ 36ºC	<20/ml	<10/ml*
Coliforms/E. coli	0/250 ml	0/250 ml*
Enterococci	0/250 ml	0/1250 ml*
Pseudomonas aeruginosa	0/250 ml	0/250ml

b) Washed bottles and caps

Guideline results are shown below:-

11 litre bottles	19 liter bottles	22 liter bottles

< 100 / empty bottle HPC@22ºC – excellent
100 to 1000 / empty bottle HPC@22ºC – satisfactory
1000 to 1500 / empty bottle HPC@22ºC – to be improved
> 1500 empty bottle HPC@22ºC – unsatisfactory

A minimum of 250 ml of sterile water is filled into the washed bottle to be tested.
After shaking thoroughly all the water is to be filtered and evaluated for HPC.

No pathogens on washed bottles and caps!

c) Caps: Average 2 HPC per cap – max. 5 HPC per cap @ 22°C.

Total Viable Count - TVC (also known as the Heterotrophic Plate Count – (HPC))

This is a non-specific method of enumerating bacteria in water by culturing them on an agar (nutrient) gel so that they form visible countable colonies after a period of incubation.

- Incubation at different temperatures causes different types of bacteria to grow.
- 22ºC incubation facilitates the growth of the **heterotrophic** bacteria that are normal**,** harmless, inhabitants of water.
- 37ºC incubation will permit the growth of bacteria capable of growth at higher temperatures.
- As 37ºC is the human body temperature, it can be deduced that this group of bacteria **may** include undesirable and possibly dangerous bacteria.
- In the absence of indicators of faecal contamination (see 5.2.3 and 5.2.4) a raised 37ºC count is more likely to indicate that the water has been warm at some stage rather than that it contains any specific threat.
- Pseudomonas aeruginosa may make up the majority of an unexpectedly high 37ºC count and such a finding should always be investigated.

Heterotrophic bacteria

These bacteria live in water and grow on the small traces of carbon, nitrogen and oxygen found in bottled water. Their colonies are counted at 22ºC.

- They are harmless. A World Health Organisation / NSF Conference in Geneva concluded this in 2002
- They can reach what may be perceived as high numbers in disinfectant free bottled water over time. Numbers reached are primarily influenced by the amount of nutrient present in the water. Counts higher than expected may indicate excessive nutrient in the bottle from inadequate bottle washing. High TVCs do not indicate a health issue.
- They may be found in very low levels in deep ground water and other well protected sources.
- They often grow in cycles in the bottle. A high count may be followed a few days later by a low one and vice versa. Counts are usually highest within a month of bottling. Thereafter numbers decline significantly as the bacteria present die out.
- Some types of water experience higher levels of microbiological growth than others.
- Although apparently eliminated by anti-microbiological treatment such as ozonation sufficient damaged (undetectable by routine methods) heterotrophs may survive to give the types of counts described above within a week or two of bottling. These will eventually disappear after a year or so.
- Standards for TVCs for heterotrophs are based on samples taken **within 12 hours of bottling.** Subsequent growth in the bottle is expected and permitted.

WHAT ARE COLIFORM BACTERIA?

These are a group of bacteria that are likely to have originated from soil, plants or faeces. Their presence in bottled water is unacceptable because it may be indicative of faecal or environmental contamination. E. coli is particularly significant as it indicates faecal contamination.

Escherichia coli (E. coli)

- Indicates recent faecal contamination and is the major indicator organism of such contamination used in testing food and drink.
- If found in a sample of water, it indicates that dangerous and pathogenic bacteria/viruses may also be present in the water.
- Most strains of E. Coli do not cause health issues. Indeed they are an essential factor in maintaining a healthy gut flora. Nonetheless because of their indicator value the presence of E. Coli strains in water is forbidden
- Rare strains such as E. coli type 0157 do cause serious disease in humans.

Action to be taken if E. coli is found in product water

- Hold all water produced since previous negative test. (See section 9.1)
- Carry out a full product recall if the water has reached the consumer.
- Notify authorities if product has been supplied to clients.
- Investigate to ascertain source of contamination and remedy if possible. The problem may be confined to one bottle, the plant, or the source.
- Dispose of contaminated water. Check permissible methods with local health authority.
- Stop the use of all coolers that may have received the affected water.
- Resanitise all affected coolers

Coliforms

- Found throughout the environment and may not be linked with faeces.
- Often found in surface waters and in biofilm in drinking water distribution systems.
- Presence is undesirable but if E. Coli is absent they are not necessarily a health threat.
- May be found in bottling plants and cooler taps contaminated from the environment.
- Returned bottles and used coolers may contain these organisms.
- Presence in bottled water is forbidden by regulations. Positive results require action.
- No longer have a parametric value in bottled water

Action to be taken if found in product water (but no E. Coli):

- **DO NOT** distribute product.
- Test other bottles to confirm contamination. Release if no other bottles affected. The contamination may be confined to one bottle.
- Test to determine source of contamination paying special attention to taps and pipework.
- Check the bottle washer and the source.
- CIP plant immediately or when source of contamination is found.

Testing frequency for coliforms / E. Coli:

- Members are expected to carry daily tests for coliforms on product water and weekly tests on the source and process water. These may be done in-house.
- Weekly tests of product water should be undertaken by an accredited outside laboratory.

Testing methods:

The following methods are suitable:-

- Membrane filtration.
- Most probable number (MPN) multiple tube method.
- Colilert ™ Test (PA – Presence/Absence test)

Note:

- Methods 1 & 2 should only be performed by a trained microbiologist in a properly equipped laboratory.
- Colilert ™ is a simple test that can be performed with minimal laboratory facilities by relatively untrained staff. It is recommended for in-house and investigative testing because of its accuracy and speed.
- No other rapid method is accepted

Enterococci

- Organisms are **indicators of faecal contamination** like E. coli.
- Survive much longer in water than E. coli.
- Presence in the absence of E.coli indicates historic contamination of the source.
- May indicate other long lasting contamination by Cryptosporidium/Giardia is present.
- Are rarely found unaccompanied by E.coli.

Pseudomonas aeruginosa

- It is termed 'an opportunistic pathogen'. It may cause health related problems e.g. skin and eye infections and, sometimes, severe, respiratory problems.
- A water bacteria growing well at 37ºC.Thrives where there is organic matter in the water
- Can reach very high counts in water where it may cause unpleasant odours.
- Grows best where there are no other water bacteria present.
- Quite common in municipal water supplies where it can spread along pipework.
- Presence in bottled water is not permitted.
- It is permitted in tap water
- Can contaminate boreholes.
- Has been found in water coolers where it has usually entered via the tap.
- Presence, at low levels, in water is harmless.
- Often found in taps, pipe joins, sight glasses, valves and blind ends of pipe-work.
- Very difficult to eliminate. Source of infection of a bottling plant must first be located.
- Resistant to some disinfectants - especially quaternary ammonium compounds (QACs)
- Can be found in liquid soaps. This has proved to be the source of contamination of bottled water on occasions where hand capping was used.
- It is considered an indicator or unsuccessful CIP procedures in water plants or inadequate returnable bottle washing.

Algae are the cause of **green bottles** - one of the major quality problems for water coolers.

- Algae are simple microscopic plants.
- They can grow using only light, carbon dioxide and a nitrogen source.
- Exposed to light they grow well in cooler water bottles.
- The green algae found in water cooler bottles are not harmful.
- Algae growth forms organic matter which provides food for a subsequent excessive development of water bacteria which can lead to taste taint and bad odour or an elevated TVC.
- The presence of algae in a bottle is **unacceptable** to the consumer and will damage the suppliers' reputation.

How do algae spread?

- Algae can be either waterborne or airborne. They are also found on surfaces such as walls and plants where they can dry out.
- When algae dry they form tough cysts (external shells) that are resistant to drying.
- The cysts become part of airborne dust and can be spread by air movement.

How do algae enter water cooler bottle?

- Via an inadequately protected source - from surface water.
- Through fissured rock.
- As dust in air entering storage tanks when they are emptied.
- As dust on poorly stored/exposed caps and open bottles.
- **On/in soiled returned bottles - the main cause!**
- **Dirty bottle wash detergent (from dirty bottles)**
- During filling.
- When the bottle is loaded onto a cooler – often by not removing the peel-off label - dust is carried into the bottle.
- From algae contaminated coolers.

Avoiding greening of bottles

- Deprive full bottles of light at all stages of storage, distribution and use. Even if there are algae present in a bottle they will not grow unless exposed to sun or sustained artificial light.
- Well protected source works.
- Air filters on storage tank and tanker air-vents.

- Dust free, storage of caps and open bottles.
- Not re-using returned green bottles, even when thought to be “cleaned”.
- Separate pre-washing with hot-alkaline solution of returned green bottles before putting them in the bottle washer. **Never put green bottles directly into the bottle washer.**
- **Discarding of greened bottles is the BEST POLICY!**
- Frequent (preferably daily) change of bottle wash solutions.
- Regular maintenance of the bottle washer.
- Cleaning and disinfection of the bottle wash tank every day
- Customer education on bottle loading and cooler siting.

Effect of ozonation on algae

- Ozone will help control algae but at least 0.3-0.4 mg/l of ozone should be present **in the product at bottling.**
    - **This is likely to lead to bromate problems-monitor closely!**
    - **Do not rely on ozone alone to control a green bottle problem.**

Source water

- Natural Mineral Waters should be analysed annually for the full parameters required by the Natural Mineral Water Directives 2009/54 and 2003/40. The parameters are in parts only summarized as groups e.g. pesticides. Actual requirements should be discussed with the external lab and/or local authorities.Spring and all other bottled waters should be analysed annually for the full parameters set by the Drinking Water Directive 98/83.Water in non EU states should conform to national regulations. It should be recommended that EU requirements should be fulfilled as well if exceeding the national laws.
- Analysis of the source is to be preferred
- This analysis may be carried out on a sample from the bottled product water provided that any of the treatments given did not affect the chemical constituents of the water. BUT
- Use special bottles provided by the testing laboratory if available
- If the source water prior to treatment comes from a municipal water supply then the analytical data provided by that supplier is acceptable.

The following process controls are recommended:

Iron and Manganese Filters

- Pressures before and after (pressure-drop) to indicate blockage or 'channeling'.
- Iron and manganese levels in filtrate to warn of filter exhaustion or overload.

Particulate/Sediment Filters

- Pressures before and after (pressure-drop) to indicate blockage or 'channeling'.
- Turbidity in filtrate indicating exhaustion or overload.

Reverse Osmosis/ Ion exchange/Remineralisation

- These processes make significant changes to the mineral content of a water
- RO is a complex and sophisticated method of water treatment and requires monitoring at several stages within the process. (See 4.2.4)
- For all these processes, **the end product** should be checked for:-
  - pH
  - Conductivity
- Media filters should preferably operate continuously as stop/start operation may cause retained particle release
- Frequency of testing is recommended to be:-
  - Once at start up and every three hours.

Ozonated water (if permitted in specific water category)

- Ozone levels should be checked in the bottled product.
- Frequency of testing is recommended to be:-
  - Once at start up and every three hours

Municipal water

- Conductivity and pH levels should be checked at the point of entry into the plant.
- Frequency of testing is recommended to be:-
  - Daily.
- Disinfection-by-products quarterly to yearly.

Air filter	Used on coolers to remove airborne particles from the air entering to replace water drawn off. It should be of at least 5 micron nominal performance
Algae	Microscopic, often single celled, plants that cause bottle greening. Spread by dust
Ambient	Room temperature.
Bacteria	Single celled microscopic organisms.
Baffle	Device that may be present in the reservoir of a cooler to keep chilled water separate from ambient or warm water.
Bayonet system	See spike system
Biofilm	Slimy bacterial growth on water contact surfaces.
Bottled at Source	Where water is bottled at its place of issue from the ground.
Bottled Water Cooler	Water chilling device that receives its water from a bottle.
CE marking	Self certification by a manufacturer that EU standards have been achieved.
CIP	Cleaning in Place - a means of cleaning equipment without dismantling it.
Cleaning	Physical removal of soiling and dirt. May use physical effort or chemicals (detergents).
Descaler	Food grade acid used to dissolve limescale
Detergent	Cleaning chemical that lifts grease and dirt.
Disinfection	Process of reducing microbial numbers to a safe level using chemicals or heat.
Direct Chill	Coolers where water is chilled in a coil passing through an ice bath or in close proximity to chiller liquids
Distributor	Company that supplies coolers and bottled water to clients.
Drip tray	Part of cooler intended to collect spillages and drips when water is dispensed from a cooler.
E.coli	Bacteria that it consists of an indicator of faecal contamination
EU 80/777	'Natural Mineral Water Directive'.

EU 80/778	'Drinking Water Directive'.
EU.96/70	'Modification of 80/777'.
EU 98/83	'Revision of 80/778'.
EU 2004/41	New EU Food Hygiene Directive
Greening	Algal growth in bottles and coolers caused by direct-or-indirect exposure to light.
Ground water	Water taken from underground. Has usually been purified by its passage through underground rocks. Must be protected against contamination.
HACCP	Hazard Analysis Critical Control Point. A formal way of carrying a risk assessment of the safety of food production. Legal requirement for food production under Directive 93/43. Bottled water is considered a food.
Hardness	Term used to describe the inhibitory effect of dissolved calcium and magnesium salts on the effectiveness of soaps and detergents.See **softening**
High Risk Area	Designated area in the bottling room where the bottle is open between washing and capping. Area is subject to controls on hygienic protection and restricted staff access/behaviour.
Hot Tank	Tank provided in some coolers to dispense hot water.
Ion Exchange	Process whereby cations and anions from dissolved minerals are replaced by hydrogen and hydroxyl ions which then combine to form water. Good way of controlling the levels of minerals. Uses filter medium. Media need recharging on regular basis
In cooler ozonator	Device fitted into cooler reservoirs that dispense small shots of ozone to the reservoir contents each day. The intention is to prevent biofilm build up though bromates forming must be takeninto account.
Micro-organisms	Microscopic life forms - include: - bacteria, algae, some parasites, yeasts, moulds and viruses.
Natural Mineral Water	Underground water supply that has been **recognised** by appropriate National Authority. Conforms to requirements of EU 80/777 and EU 96/70.
Non chilling dispensers	Devices intended for the dispensing of water from cooler bottles (i.e. 19 litre) that do not chill the water.

Non spill loading	Systems, usually combining cooler and cap features that enable bottles to be loaded onto a cooler without contamination.
Ozonation	Disinfection method using gaseous ozone
Ozonator	Device that generates ozone, Different types are used to treat water and help sanitise coolers
Pathogen	Micro-organism capable of causing disease.
Pests	Animal life undesirable in food premises - includes: - insects, reptiles, birds, rodents and other mammals, including pets.
Potable	Safe to drink.
Public supplies	Usually refers to municipal mains water supplies.
Recognition	Process whereby a protected underground supply is given approval to carry the designation Natural Mineral Water. Can take up to 2 years intensive analysis to prove consistent mineral content and microbiological wholesomeness.
Reservoir (cooler)	Container in cooler where water is chilled.
R.O.	Reverse osmosis - a method of water treatment.
Sanitisation	The combined process of cleaning and disinfection.
Sanitizer	A chemical that both cleans and disinfects.
Sanitisation area	Designated room at the depot for cooler sanitisation
Scale	Mineral deposit left on water contact surfaces by minerals dissolved in a water. A problem in both hot and cold tanks in coolers.
Sealed reservoir	Cooler feature that prevents airborne contamination from entering the cooler and the bottle when water is drawn off from the cooler.
Shelf life	Period for which a food product can be stored unopened without losing its safety and wholesomeness.
Softening	Replacement of calcium and magnesium ions with sodium by ion exchange. Used to remove hardness but leaves high sodium level. Not usually suitable for drinking water but useful for bottle washers
Source	An underground water supply. Usually refers to point of issue from ground.

Source works	Protection given to source as it issues from ground plus supporting engineering and plumbing.
Spike system	Form of non spill device. May be called bayonet.
Spike well	Inset in cooler top that houses the spike. Should be kept clean.
Spring Water	Water from underground source. If this designation is used the water becomes subject to EU Directives 80/777and 96/70 as well as 80/778 and 98/83. A voluntary description.
Surface water	Water from surface run off that will be contaminated. Includes ponds, lakes streams, rivers, floods, rainwater or even shallow underground water such as found in land drains. May affect **ground water** (qv) quality. Hence need for **source works** (qv)
Taint	Unacceptable taste and/or odour.
Tankering	Road or rail transport of water from source to bottling plant
Treatment	Process that changes the physical characteristics, mineral content or microbiological quality of a water.
Wholesome	Fit to drink or eat.