Guide to Good Bottled Water Standards

3rd edition, December 2010

BOTTLED WATER

BRITISH Soft Drinks ASSOCIATION

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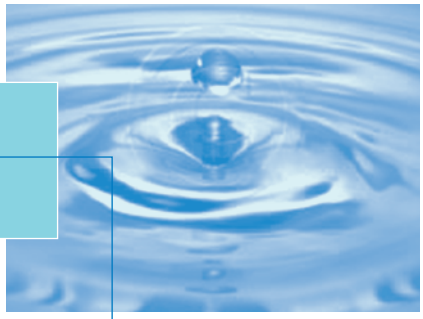

1 Introduction

This Guide has been prepared by a working party drawn from members of the British Soft Drinks Association who are experienced in the development and exploitation of waters for use in bottling, bottled water production and distribution, the legal requirements facing producers, and the application of modern techniques of quality management.

The Guide deals with three categories of bottled water:

- Natural Mineral Water
- Spring Water
- Table Water

The working assumption is that these waters will be marketed in bottles, cans or similar containers. However a significant market has been established in the UK in water coolers, and so the Guide incorporates a section which deals with aspects peculiar to this form of distribution.

It is important, in the manufacture of bottled waters, that liaison should take place with appropriate Environmental Health and Trading Standards Departments who may provide advice and assistance with queries relating to legislative requirements. Licensing and protection of an underground source is the responsibility of the Environment Agency. Information on mains water quality may be obtained from the local water supply company or, for more general matters, from Water UK.

From September 2010 responsibility for bottled waters reverted to DEFRA from the Food Standards Agency (FSA). DEFRA is also responsible for mains water.

The contents of the Guide bear relevance to the Food Safety Act 1990 and the EU Food Hygiene Regulations 2004. The Food Safety Act 1990 allows a defence of Due Diligence to the producers if a Food Safety issue arises. Following the Guide may help to establish Due Diligence.

1 Introduction

The BSDA Guide to Good Bottled Water Standards was prepared by a working party of BSDA's Bottled Waters Committee, with a contribution from the Bottled Water Cooler Association (BWCA).

BSDA wishes to thank the original working party (as listed in the first edition, October 1995) and the revision working party (as listed in the second edition, August 2002)

This revision has been edited by

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Mrs J Broad	British Soft Drinks Association

Under the guidance of the BSDA Bottled Waters Group.

2 Different types of bottled water

All Bottled Waters are now regulated in England by The Natural Mineral Water, Spring Water and Bottled Drinking Water Regulations (England) 2007 SI 2785. There are separate versions for Scotland, Wales and Northern Ireland **(for a list of relevant regulations see Chapter 3).**

The above Regulations implement Directives 80/777/EEC, 96/70/EC and 98/83/EC and 2003/40/EC, now recast as Directive 2009/54/EC. As the UK regulations derive from the EC Directive it is useful to possess the Directives in order to fully follow the requirements.

The principles of regulation for Natural Mineral Water differ from those for other drinking water. Natural Mineral Water is regulated through a process of source recognition and catchment protection - only certain sources are suitable, subject to expert evaluation. All other Drinking Water is regulated through parametric standards - the water, as delivered, has to be within limits for a wide range of parameters.

Thus **Natural Mineral Waters** are bottled at source[1] from officially recognised sources of underground water which have to be naturally free from pollution and from harmful micro-organisms, stable in mineral analysis, temperature and rate of flow. The water may not be treated in a way intended to alter its natural microbiological state or its essential chemical composition. It must demonstrate stability against a set of chemical parameters, and in addition meet microbiological and chemical standards. In practice, the regulatory authorities adopt the Drinking Water Standards for routine monitoring. The Bottled Waters (England) Regulations 2007 SI 2785 lay down maximum limits for 15 constituents in Natural Mineral Water, conditions for the use of ozone and maximum limits for Bromate and Bromoforms. Some treatments may be permitted for removal of undesirable trace elements, where necessary. EU Regulation 115/2010 permits removal of flouride by means of activated alumina.

The process of recognition can take up to two years, and once designated, the water must carry the proper description - "Natural Mineral Water" - which cannot be used by any other bottled waters. Other specific labelling regulations apply, intended to ensure that the consumer can clearly identify the source and not be confused by the same source being given different names, or by waters which are not Natural Mineral Waters being labelled like a Natural Mineral Water. A consolidated list of registered Natural Mineral Waters is published in the Official Journal of the EU.

1. With specific exemptions for Natural Mineral Water sources using tankering before 1980

2 Different types of bottled water

In order to recognise a water source as a Natural Mineral Water, very comprehensive and rigorous criteria would have to be fulfilled. The FSA Guidelines contain useful advice on other data required. Information on the catchment area, hydrogeology of the source, microbiological and chemical analysis data must be submitted for approval to the local Environmental Health Department. The analysis should demonstrate that the water is of suitable quality, free from any contamination/pollution and that the composition is constant, i.e. it is independent of seasonal/climatic variation, pumping rate etc. On approval the recognition would be published in the London Gazette and Edinburgh Gazette. It will also be noted by the Food Standards Agency (FSA) and passed to the Commission for publication in the Official Journal.

Spring Waters were subjected to many of the requirements for Natural Mineral Waters by the Directive 96/70/EC. For example, they must be from a single named underground source and bottled at source (subject to a dispensation for those being transported and bottled prior to 13 December 1996), but are not subject to the recognition procedure. Although Spring Waters do not undergo an official recognition process, registration with and approval by the local Environmental Health Department is required.

Spring Water must not require disinfection at source but national provisions on treatments are effective until EC regulation on the subject is introduced. Spring Waters must comply with a comprehensive list of chemical and biological parameters as laid down in The Bottled Water (England) Regulations 2009 SI 2785.

All other **Bottled Drinking Waters**, which in this guide are referred to collectively as **"Table Waters"**, do not need to come from a single named source or go through a source recognition procedure but instead have to meet the same chemical and microbiological standards as Spring Water. The quality of the water is the prime issue. To meet the high standards set by the regulations the water may, if necessary, be subjected to chemical treatment or disinfection.

Certain waters are subject to purification followed by re-mineralisation with the required salts. In the UK water which has been softened must have a minimum calcium concentration of 60 mg/L.

Whilst the term "Table Water" is widely used by the industry, it has no legal status.

Labelling of all bottled waters is governed by the regulations that apply to food

2 Different types of bottled water

products, and bottled water production is subject to the requirements of the Food Safety Act, and EU Hygiene Regulations (EC) 852/2004.

This Guide contains recommendations for standards to maintain water quality through the production process, which are greatly in excess of the legal standards and which apply to all product descriptions.

3 Legislation and codes of practice

Bottled water has to meet standards for water quality and packaging as well as more general requirements for food products.

Water quality and packaging have been prime interests of the European Commission since the mid-1970s, which means that the UK legislation in these fields derives from European legislation. A Directive is an instruction to a member state to create a national law, whereas an EU Regulation is directly applicable.

Transcription of Directives sometimes causes confusion, because the UK law is often not exactly the same as the Directive. For a UK producer the UK law will always be the governing instrument, if the product is consumed in the UK.

Nevertheless it is recommended that members hold and review copies of European legislation as well as the UK laws.

The tables overleaf give the titles of relevant legislation for England and Wales, Scotland and Northern Ireland. Although this was up to date at the time of going to press, legislation changes rapidly and Members are advised to maintain an up to date list as part of their quality system (see Section 7).

All packaged waters have to satisfy the requirements of the Natural Mineral Water, Spring Water and Bottled Drinking Water Regulations 2007 SI 2785. The Private Water Supply Regulations, which amongst other matters specifies sampling intervals, will also apply to most bottled water sources.

3 Legislation and codes of practice

Table 1 Legislation and codes of practice which apply to bottled water production in the UK

EU Legislation	UK/English Legislation	Codes of Practice
Council Directive of 18 June 2009 2009/54/EC	The Natural Mineral Water, Spring Water and Bottled Drinking Water Regulations (England) 2007 SI 2785	
	The Natural Mineral Water, Spring Water and Bottled Drinking Water (England)(Amendment No 2) Regulations 2010 SI 896[1]	
Council Directive of 3 November 1998 98/83/EC	Private Water Supply Regulations (England) 2009 SI 3101 (England) Joint Circular, DOE and Welsh Office 24/91 and 68/91	
Council Directive 89/396/EEC as amended by 91/238/EEC	The Food (Lot Marking) Regulations 1996 SE 1502	
Parliament and Council Directive of 18 June 2009 2009/54/EC	The Food Labelling Regulations 1996 SI 1499	
	The Food Labelling (Amendment) Regulations 1999 SI 1483	
	Weights and Measures (Packaged Goods) Regulations 2006 SI 659	

1. Permit use of activated alumina to remove fluoride from Natural Mineral Water.

3 Legislation and codes of practice

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EU Legislation	UK/English Legislation	Codes of Practice
	Food Safety Act 1990	
	Materials and Articles in Contact with Food (England) Regulations 2005 SI 898	
	Plastic Materials and Articles in Contact with Food (England) Regulations 2008 SI 916	FSA Guidance on the Plastics Materials and Articles in Contact with Food (England) Regulations 2009
"Plastics" Directives 90/128/EEC 92/39/EEC 85/572/ EEC 82/711/EEC 2002/17/EEC	Plastic Materials and Articles in Contact with Food Regulations 2009 SI 205	Plastics in Contact with Food - A Guide (BPF) June 2000
	Plastic Materials and Articles in Contact with Food (Amendment) (England) Regulations 2000	

3 Legislation and codes of practice

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EU Legislation	UK Legislation	Codes of Practice
	Food Premises (Registration) Regulations 1991 SI 1825	
	Food Premises (Registration) Amendment Regulations 1993 SI 2022	
	Food Premises (Registration) Amendment 1997 SI 723	
Regulation on Hygiene of Food Stuffs (EC) No 852/2004	Food Safety (General Food Hygiene) Regulations 1995 SI 1763	Food Industry Guide to Good Hygiene Practice - Bottled Water Guide, published by The Stationery Office (TSO) 2008
	The Food (Miscellaneous Revocations and Amendments) Regulations 1995 SI 3267	
	Control of Substances Hazardous to Health (COSHH) Regulations 2002	General COSHH Approved Code of Practice by HSE
	Health & Safety at Work Act 1974	
	The Health and Safety (Emissions into the Atmosphere) (Amendment) Regulations 1989 SI 319	
	Health & Safety (First Aid) Regulations 1981 SI 917	
	The Control of Industrial Major Accident Hazards Regulations 1999 SI 743	

3 Legislation and codes of practice

Table 1 Legislation and codes of practice which apply to Bottled Water Production in the UK

EU Legislation	UK Legislation	Codes of Practice
	The Health & Safety (Miscellaneous Amendments) Regulations 2002	
	The Management of Health & Safety at Work Regulations 1999	
	The Workplace (Health, Safety & Welfare) Regulations 1992	
	Environmental Protection Act 1990	
	Water Resources Act 2007	
Council Directive 92/59/EEC on General Product Safety	General Product Safety Regulations 2005 SI 1803	

Codex Alimentarius Commission[2]	Codes of Practice
Codex Alimentarius Commission	
Codex Standards for Natural Mineral Waters - Alinorm 1981 - 108 - Rev 1- 1997 - Rev 2 - 2001	Code of hygienic practice for the collecting, processing and marketing of Natural Mineral Water - Alinorm 85/13A - Appendix VII
Codex Standard for Bottled / Packaged Waters (other than Natural Mineral Waters) - Alinorm 01/20 - Appendix II	Code of hygienic practice for bottled/packaged drinking waters (other Natural Mineral Waters) - Alinorm 01-13 Appendix II

2. These are included as important background - they have no force of law in the UK for a UK producer

3 Legislation and codes of practice

Table 2 UK legislation specific to Scotland, Wales and Northern Ireland

Scotland	Northern Ireland
Private Water Supply (Scotland) Regulations 2006 SSI 209	Natural Mineral Water, Spring Water and Bottled Drinking Water Regulations (Northern Ireland) 2007 SR No 420 amended by SR 2009 No 260
The Natural Mineral Water, Spring Water and Bottled Drinking Water (Scotland) (Amendment No 2) Regulations 2010 SSI 2010 No 127	The Natural Mineral Water, Spring Water and Bottled Drinking Water (Amendment No 2) Regulations (Northern Ireland) 2010 No 68
The Natural Mineral Water, Spring Water and Bottled Drinking Water (Scotland) (Amendment No 3) Regulations 2010[1]	Private Water Supply Regulations (Northern Ireland) 2009 SR 413 as amended by SR 181 2010
Natural Mineral Water, Spring Water and Bottled Drinking Water Regulations (Scotland) 2007 SSI 435	The Food Labelling Regulations (Northern Ireland) 1996
Water Resources (Scotland) Act 1980	Food Safety (Northern Ireland) Order 1991
Water Environment and Water Services (Scotland) Act 2003	
Plastic Materials and articles in contact with food (Scotland) Regulations 2009 SSI 30	Plastic Materials and Articles in Contact with Food Regulations (Northern Ireland) 2009 SR 56
Wales	Materials and Articles in Contact with Food (Amendment) Regulations (Northern Ireland) 2009 SR 377
Natural Mineral Water, Spring Water and Bottled Drinking Water Regulations (Wales) 2007 SI 3165 (w.276)	
The Natural Mineral Water, Spring Water and Bottled Drinking Water (Wales) (Amendment) Regulations 2010 SI No 748 (W76)	
Private Water Supplies (Wales) Regulations 2010 N066 (w16)	

1. require sale description eg carbonated Natural Mineral Water to be in English in addition to any other language.

4 Water sources

4.1 General

In the context of this Guide, a water source is defined as providing the raw product water and delivering it to the production line, where it is combined with packaging to create the final product. The source works may in some circumstances incorporate forms of treatment.

A source for a Natural Mineral Water will normally be either a borehole or works which capture a spring flow before it reaches the ground surface. A Spring Water source will be of the same kind. A Table Water may use more than one source, or use water from the public supply to which purification treatments are applied. Table Water may be subject to purification and restoration or addition of minerals.

This section considers the general principles governing source development, treatment processes and the development of a groundwater source in detail since most bottled waters are from this type of source.

4.2 Principles of source development and operation

Whilst all sources at some point draw from a natural water system, each source is different. However it is always important for the producer to investigate and understand the characteristics of each particular source or sources. This investigation should be geared towards:

- Identifying the physical characteristics of the source which govern the quantity and quality of water delivered by it. For Natural Mineral Water or Spring Water, the investigation would include the catchment area and the hydrogeology. For water from the public supply, it would include the local configuration (which treatment works, supplying mains) and methods of operation.
- Measuring the physico-chemical and microbiological characteristics of the water.
- Identifying any factors arising from the physical characteristics of the source, or any treatment systems, which represent risks to the source water quality. These can be summarised in a Source Vulnerability Profile (SVP).

4 Water sources

- Establishing the variability of the source.

- Designing a strategy for protecting against the risks identified in the Source Vulnerability Profile, within the context of the source variability. This is called a Source Management Strategy (SMS).

The need for this approach can be illustrated by example:

Example 1: A spring on a high moor catchment

The Source Vulnerability Profile (SVP) identifies the water as short travel time. It is important to control land use on the catchment to maintain the water quality. Also suspended solids vary with rainfall; filtration systems must be geared to sudden loadings.

Example 2: A deep seated spring in a valley location

The travel times are long and the catchment very diffuse. Catchment land use is not an issue but conditions at the point of emergence are. It is important not to over pump, otherwise shallower waters may intermingle. Local source protection measures should be constructed, and appropriate monitoring put in place.

Example 3: A Table Water Source from the public supply

The public supply uses two sources, A and B. Normally these are in a blend which is an acceptable input to a treatment chain consisting of ozonation followed by an activated carbon filter (designed to remove chlorine residuals and tri-halomethanes). However under certain circumstances the water company switches entirely to source B. Unblended this provides a feedstock which is out-of-spec for the treatment chain. Liaison needs to be set up with the water company, and the feedstock main fitted with appropriate automatic monitoring and alarms

4.3 Developing a groundwater source

4.3.1 Background

The objective of this section is to provide guidelines on how to develop a protected source that is both chemically and bacteriologically safe. Ground water is the source that is both chemically and bacteriologically safe. Ground water is the principal raw

4 Water sources

material for the bottled water industry. It is a finite resource that can degrade in quality due to poor borehole construction and maintenance, over exploitation and poor land use management. The bottled water bottler needs to be aware of the need to adequately manage the resource to ensure its long-term integrity and quality.

Ground water is naturally better protected from environmental degradation than surface water. But it can be susceptible to mismanagement. It can become chemically and microbiologically contaminated. The bottled water bottler needs to be aware of how to avoid this as a result of his own exploitation of ground water and the activities of others in the area of the well.

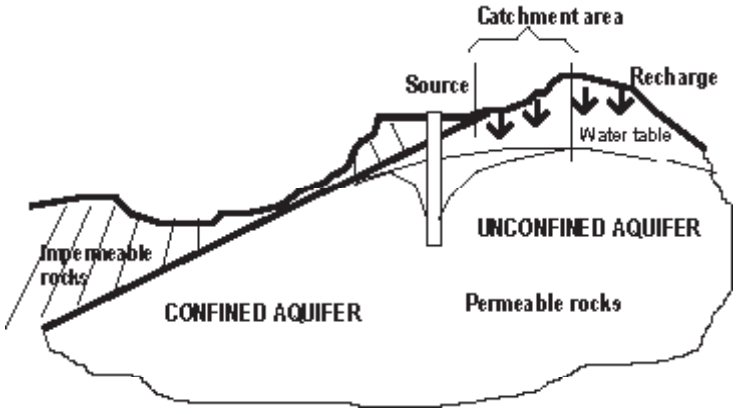
The development of a bottled water source is expensive. For the experienced bottler, it is hoped that this section will provide guidelines on how to develop further the resource without compromising the existing quality of the water. For the investor new to bottled water, it is hoped that this section will provide an overview of what is involved and how best to develop a ground water source for bottled water.

This section has been set out in the format of a possible sequence of work that could be followed if developing a pristine source.

4.3.2 Definitions

Terms used in groundwater development are defined in the Glossary on page 56, whilst the major concepts are illustrated in Figure 1.

Figure 1: Terminology of groundwater development



4 Water sources

4.3.3 Groundwater catchment area

For the purposes of this document it may be assumed that groundwater is derived from rainfall. For a given level of abstraction, a certain area of ground must be contributing this water through rainfall. Thus if in a particular area and geology 300 mm depth of water infiltrates on average each year, the area contributing to a 200 m^3/day source will be:

$$\frac{\textbf{200 m}^3\textbf{ / day x 365 days}}{\textbf{0.3 m rainfall per annum}} = \textbf{243,000 m}^2\textbf{, or 24.3 Ha}$$

The ground water catchment area is not only the size of the contributing area but also its location. This should be defined and assessed by a professional survey. The survey should include:

- Geological map of the area
- Surface water catchment map in which the source is or is to be located
- Hydrogeological map of the area
- Identification of the recharge area(s)
- Conceptual model of the hydrogeological system of the well field accounting for the response of the aquifer to rainfall; the change in water quality in terms of chemistry and microbiology as a result of recharge or as a consequence of no recharge; the relationship, if any, between surface water flows and the aquifer; the extent of the zone of influence during high and low water level conditions
- Detailed walk-over survey
- Contamination Hazard Survey, the survey should identify all potential third party sources of contamination to the aquifer with an assessment of the risk. Mitigation measures should be included as part of the survey

A copy of all data, surveys and reports should be maintained for inspection for as long as that ground water catchment area is exploited.

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4.3.4 Groundwater protection area

Once the catchment area and geological profile have been established, the potential for pollution can be assessed. For this, an aquifer vulnerability map of the ground water catchment area is recommended. A useful guide is the methodology in the Environment Agency (EA) publication, Policy and Practice in the Protection of Ground Water, Environment Agency (2006). The reader should be clear that this document only applies to public policy in England and Wales, not to private developments and not at all in Scotland or Northern Ireland. These are the responsibility of the Scottish Environmental Protection Agency (SEPA) and the Northern Ireland Environment and Heritage Service (NIEHS).

Methods in aquifer protection are all based on the concept of the travel time of water which infiltrates an area of ground, from the moment it reaches the water table until it arrives at the point of abstraction. A second concept is that of a recharge area at a certain proportion of the long-term abstraction. The recharge area can be termed as the rainfall or surface water that percolates into the water table. This can be calculated using 25 per cent of the long-term abstraction rate to ensure that an adequate definition of zones is achieved in all types of sources.

The EA policies are based on zoning, applying stricter policies closest to the source, as illustrated in Figure 2 overleaf. However Natural Mineral Water producers, for example, are currently not allowed to treat their source water and have to bottle at source. In which case, the standards of aquifer protection required are higher than those for the public supply. Most producers would require no risks of pollution anywhere in the catchment, in order to protect their investment.

4.3.5 Standards to be established with contractors before borehole construction

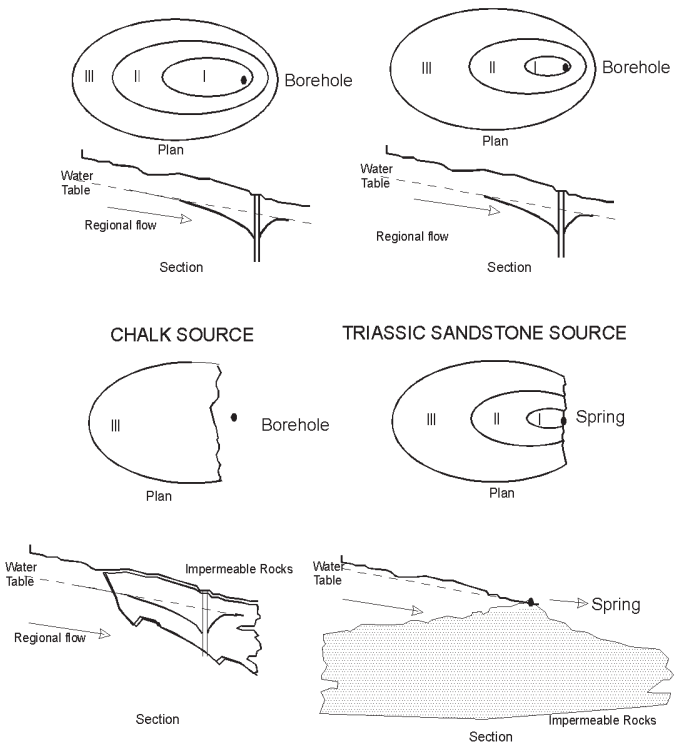
Before any well or bore is sunk it will be necessary to carry out a hydrogeological assessment and feasibility study (a Hydrogeological Report is a regulatory requirement in the case of Natural Mineral Water). In order to be able to abstract water an application to the Local Authority must be made for an abstraction licence. Additionally, in England and Wales the consent of the Environment Agency is also required for any well, bore or extraction from existing sources, as well as for trial bores. Scottish and Northern Irish Members will need to consult their relevant Department of the Environment.

It is not the intention of this Guide to define methods of borehole and wellhead construction as this will necessarily depend on various factors such as depth of hole, geological strata, etc. A useful reference is *Well Construction Specification for the Water Industry (1985).*

4 Water sources

It is recommended that the drilling contractor is a member of the British Drilling Association or the Water Well Drillers Association. The contractor should liaise with the hydrogeologist and standards of construction must be established before drilling commences. The driller must be aware at the outset that he is constructing a bore for the extraction of potable water. Further recommendations on borehole development appear in Annex 1.

Figure 2: EA source protection zones



Zone I: Inner Source Protection - 50 day travel time from any point below the water table to the source, and as a minimum 50 m radius

Zone II: Outer Source Protection - 400 day travel time, or larger in high storage aquifers, (e.g. sandstone) and the recharge area calculated using 25 % of the long term abstraction rate

Zone III: Source Catchment - complete catchment area of the groundwater source

4 Water sources

4.4 Forms of treatment

Forms of permitted treatments can be divided into three classes:

- Those that remove unstable constituents or undissolved matter (a)
- Those that influence the microbiological population (b)
- Those that influence the characteristic chemical composition (c)

Natural Mineral Waters are limited to treatments of type (a), whilst Table Waters may use any form of treatment. The permitted treatments for Spring Waters are subject to review at European level. For the time being, Spring Waters can be subjected to treatments (a) and (b). The use of ozone to disinfect Spring Water was specifically prohibited from 1 July 2004.

Treatment of Natural Mineral Waters and Spring Waters to remove unstable elements, arsenic and fluoride, is being reviewed by the EU Commission at the time of writing. Legislation to permit the removal of fluoride from Natural Mineral Water and Spring Water has now been published as an amendment to the Bottled Water Regulations in England, Scotland, Wales and Northern Ireland (see pages 10 and 14). Regulation or guidance is expected late 2010. Alternatively, the Commission may amend the Bottled Waters Regulations 2009/54/EC

The microbiological content of water can be altered by micro-filtration (at smaller filter sizes), ultra-filtration, ozonation and UV radiation. Common means of altering the chemical composition of water include reverse osmosis, ion exchange, precipitation, ultrafiltration and activated charcoal filtration, or a combination of treatments. Ozonation can also affect the chemical composition.

More details of these treatments are given in Annex 2.

5 Materials in contact with water

All pipework, tanks and bottling equipment should be constructed of material approved for contact with food. These should not impart anything to the water or promote the growth of micro-organisms and should be capable of being easily and effectively cleaned.

Useful references in this area include:

- Food Industry Guide to Good Hygiene Practice - Bottled Water, FSA publication.
- Water Regulations Advisory Scheme's Water Fittings and Materials Directory (Materials found to have passed the requirements for BS 6920* are listed in the directory)

It is recommended that bottling equipment is constructed mainly from high quality food grade stainless steel. Various grades are available and different grades may be suitable for different applications.

Other materials which might be considered are:

- Polythene
- Polypropylene
- Acrylonitrile-Butadiene-Styrene (ABS)
- Glass Reinforced Polyester (GRP)
- Unplasticised Polyvinyl Chloride (uPVC)
- High Density Polyethylene (HDPE)

Where plastic materials are used reference should be made to the "Plastic Materials and Articles in Contact with Food (England) Regulations 2009". Suppliers of such materials should be asked to provide appropriate documentation to prove that approved "food grade" materials are being used. FSA provide guidance to the Regulations on their website (www.food.gov.uk).

It should be noted that Polythene, ABS, and GRP, uPVC and oPVC have all been seen to promote the growth of bacteria, For this reason it is recommended that the bacteriological characteristics of materials and especially plastics should also be assessed in the context of the bacteriological characteristics of the water and the type of water being produced. For example, more detail would be required in this assessment for a Natural Mineral Water which may not be disinfected, than for a Table Water which may have been subjected to treatment.

*** BS 6920 = suitability of non metallic products for use in contact with water intended for human consumption with regard to their effect on water quality.**

6 Packaging materials

For product quality purposes materials can be separated into two groups. Material which comes into immediate contact with the product can be termed primary packaging (e.g. container and closure). Packaging which does not (e.g. label, glue, cartons, shrink-wrap, pallets, etc) may be called secondary packaging.

Secondary packaging should not normally have a direct effect on product quality. However its choice and handling should minimise any risk of contamination to the product. For example, wet cartons have been known to produce musty taints by migration of phenolic compounds past the cap into product.

Bottled water manufacturers must consider primary packaging materials as an integral part of their product and its choice and handling must ensure that it protects the quality of water and is not a source of contamination or taint due to the material or method of manufacture.

All primary packaging must at least comply with the Plastic Materials and Articles in Contact with Food Regulations 2006. Low taint varieties of some plastics (e.g. PVC) are available and may be required to comply with more stringent regulations in certain countries.

The container/closure combination and the materials they are manufactured from will be the most significant factor in determining the shelf life. Chapter 8 on labelling illustrates guidelines for shelf life of bottled water based on these factors together with the size of container.

If carbonated product is to be packed, specific attention needs to be paid to the container/closure combination to ensure retention of adequate carbon dioxide levels throughout the shelf life. The closure and container must also withstand the internal pressures which may develop in carbonated product yet release this pressure in a controlled, safe manner on opening.

Any gases used in the bottling process (e.g. carbon dioxide, nitrogen) should be regarded as packaging materials and should be stored and distributed in such a way as to maintain relevant food grade quality standards. Further guidance on carbon dioxide specifications can be obtained from instruction manuals prepared by the International Society of Beverage Technologists **"Quality Guidelines and Analytical Procedure for Bottlers of Carbon Dioxide"** or the European Industrial Gas Association's **"Carbon Dioxide Source Certification, Quality Standards and Verification".**

6 Packaging materials

As some water bottlers may not manufacture their own packaging materials, to ensure that they would be able to mount a 'due diligence' defence (ref. the Food Safety Act 1990) they must satisfy themselves that their supplier meets all the above requirements. This can be best achieved by agreeing a detailed specification, which documents, and wherever possible quantifies standards for all areas of concern, particularly compliance with all relevant legislation and the conditions of materials on arrival. Guarantees that all deliveries comply with this specification should be obtained. Adherence to this specification should be assured by regular audits and/or inspection and testing on arrival.

Once received from a supplier, or if manufactured on site, the handling and use of packaging materials should be in accordance with the **Food Industry Guide to Good Hygiene Practice - Bottled Water**, a Food Standards Agency approved TSO publication.

Glass containers should be inspected prior to use and discarded if any evidence of damage is visible.

Returnable containers should be inspected, thoroughly washed, heat treated where possible and rinsed prior to refilling. They should be discarded in the event of any suspicion of use for storage of any other materials.

It is recommended that containers are inverted and rinsed with air or water immediately prior to filling. Excellent control of the quality of air or water used for rinsing is essential. Rinsing with product water is preferred.

Closures must be of a tamper evident design. BSDA has produced a manual for plastic closures on plastic bottles (Closure Manual - Plastic Closures on Plastic Bottles).

Producers must ensure they comply with environmental regulations relating to packaging.

The "Producer Responsibility Obligations (Packaging Waste) Regulations" 2007 requires producers to record and report the quantity of packaging produced, used and wasted and a levy is charged on these quantities. Companies may wish to join one of the non-profit registered compliance schemes.

6 Packaging materials

The Packaging (Essential Requirements) Regulations 2003 and 2009 Amendment require

- The minimisation of the quantity, and hazardous content of packaging, setting maximum levels for heavy metal content.
- That packaging may be reusable and recoverable.

7 Quality Management

7.1 General

A comprehensive Quality Management System will incorporate not only the means to control the quality of inputs, processes and outputs, but also confidence in the means to verify such controls.

At a minimum, measurement of key parameters on-line (e.g. carbonation, capping torques, etc) by trained personnel gives some confidence in the reliability of operating procedures and information upon which remedial action can be taken. This Quality Control approach has a part to play in a full Quality Management System but as it is a "test and fix" philosophy it does not necessarily provide the means to build quality in to the product. A full system is more pro-active in its approach and incorporates several key areas as illustrated in points 7.2 - 7.12.

7.2 Supplier assessment, packaging and product-contactable materials

Packaging has been dealt with in Section 6: however, assessment of suppliers' abilities to meet the water producer's requirements and those of legislation should be included as part of the Quality Management System. Such "vendor rating" should take into account not only the professionalism and standards of the supplier (including the Standard(s) to which they produce) but also their ability and willingness to meet specific requirements - e.g. microbiological standards applied to primary packaging materials. The "Technical Standard and Protocol for Companies Manufacturing and Supplying Food Packaging Materials for Retailer Branded Products developed by the Institute of Packaging (IoP) and the British Retail Consortium (BRC) lay down guidelines to assist retailers and food manufacturers in the fulfilment of their legal obligations. Applying this standard and gaining accreditation to it is to be encouraged as part of "Due Diligence".

7.3 Process control / Hazard Analysis of Critical Control Points (HACCP)

It is a requirement of the Food Safety Act that risks to consumer safety are identified and controlled. A satisfactorily documented HACCP should meet this requirement.

7 Quality Management

The principles of HACCP as defined by "Codex Alimentarius - Food Hygiene, Basic Texts CAC/RCP 1-1969 Rev.3 (1997)" can be applied to bottled water production in the evaluation of risks to consumer safety. Being a good management tool, its principles may also be applied to other quality issues distinct from food safety but, where this is done, it is important to distinguish between the two.

The implementation and operation of a HACCP system is a requirement of the EU Hygiene Regulations (EC) 852/2004.

Operating procedures, from source to the finished pack, should be designed to facilitate maximum control of steps critical to food safety. HACCP is a system which can be used to examine both the design and subsequently the operation of the plant to ensure that appropriate controls are applied throughout. Figure 3 overleaf illustrates the steps required to create and implement a HACCP scheme, ideally carried out by a multi-disciplinary team.

Methods of analysis may differ, but the end result is the establishment of Critical Control Points (CCPs) where control measures are established, and monitoring and the frequency of monitoring are determined. CCPs may be product or (quite frequently) plant related, e.g. temperature, pressure or some other condition. The responsibility for monitoring is written into the system and may vary according to location, level of expertise required, operating procedures and so on. It is also essential that a Corrective Action Procedure is set up within which any non-conformances or problems are addressed and the monitoring/control scheme amended accordingly. Without this part the HACCP plan has little value.

Experience in recent years has shown that producers need to consider an extra dimension to hazards in the factory, which is the storage and use of chemicals. Only approved chemicals should be allowed in the factory. Every chemical that is used in the factory should be assessed not only for operator safety (COSHH regulations) but also for its risk of product contamination. This risk may need to be assessed assuming unconventional pathways into finished product such as airborne contamination of bottles or migration across cap seals. Prerequisites for the HACCP scheme should include specific provisions for monitoring the presence and handling of chemicals that present a risk, however small. Suppliers of packaging material may need to provide evidence of the same kind of risk assessment.

Training in the application of HACCP is recommended and is available from various associations and local authorities - details can be obtained from BSDA.

7 Quality Management

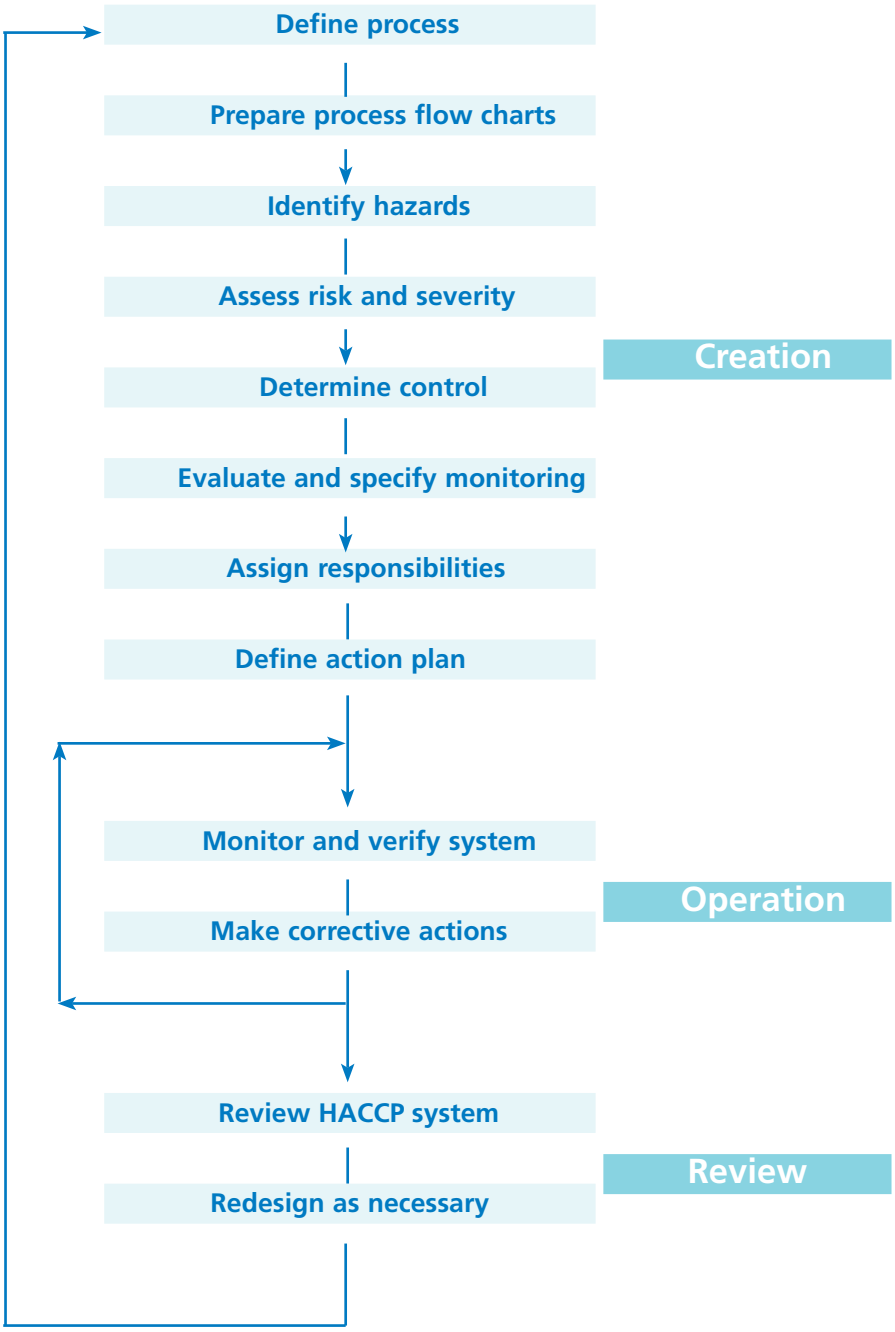


Figure 3: Creation and implementation of a Hazard Analysis by Critical Control Points (HACCP) scheme

7 Quality Management

7.4 Auditing

Whether or not the Quality Management System is formally recognised by an external body, the use of auditing is an invaluable tool for monitoring the performance of the system itself.

Auditing (assessment of procedures, conditions, etc against a known objective standard) can be of several different types:

- **Third Party Audits -** carried out by an independent body or regulating agency often on behalf of a customer or a certification body
- **External Audits -** carried out by a supplier on its own suppliers or agents
- **Internal Audits** - carried out by a supplier on its own system, procedures, practices, facilities or products

It is recommended that at a minimum, internal audits are conducted to assess compliance with industry guidelines.

Refer to: BS EN ISO 19011: 2002 Guidelines for quality and/or environmental management systems auditing.

7.5 Inspection and testing

7.5.1 Materials (including carbon dioxide and nitrogen)

Assuming that a supplier assessment procedure has been carried out, the level of inspection for incoming materials may be quite minimal, depending on this assessment. Furthermore, many of the parameters agreed in the materials specification may not be easily measurable on receipt - hence a supplier's certificate of conformance, supplied along with delivered goods, is useful evidence of their fitness for purpose. Note however, that a Certificate of Conformance (C of C) does not provide a Due Diligence defence in the case of a prosecution arising from the use of inadequate materials. The preferred approach is one where supplier and producer enter into a partnership agreement, whereby detailed information from both the supplier and the producer is available to the producer's quality system.

7 Quality Management

7.5.2 Process

The detail and level of in-process inspection and testing of product will depend on how many critical items and/or processes are involved and the level of confidence in the process control. (See 7.3 Process Control, Hazard Analysis by Critical Control Points).

7.5.3 Water

The testing regime for water will depend on several factors, including source (type and level of protection), water status (NMW or other, treatments applied - physical and chemical), flow rate and volumes bottled. EC Directive 98/83/EC on the quality of water intended for human consumption sets out frequencies and parameters for testing bottled waters. The Private Water Supply Regulations (PWS) stipulate parameters, standards and frequencies of analysis for local authorities to monitor all private supplies including those used for bottling. It is recommended that bottlers carry out additional testing to ensure adequate control throughout their bottling process. PWS Regulations were published in 2006 in Scotland, 2009 in England and 2010 in Wales.

7.6 Microbiological analysis - suggested requirements

The NMW, SW & BW Regulations 2007 implement the requirements of EC Directive 98/83/EC on the quality of water intended for human consumption. This Directive includes requirements for parameters and standards for microbiological testing of waters offered for human sale in containers in Annex 1 part A (see Table 4) and the frequencies of testing in Annex II (see Table 5).

The Private Water Supply Regulations (2006 and 2009) set some standards for the monitoring of borehole sources and other private supplies. This monitoring is carried out by the local authority. These results can be used to complement the producer's own quality programme but for microbiological parameters the number of tests is small compared to industry norms and applies only to the source.

An understanding of the microbiological characteristics of the water from the source, through the production process and into the bottle is a fundamental part of a bottling operation. Each producer will over time adapt its own testing schedule to

7 Quality Management

its own particular circumstances, through continuing application of HACCP and continuous improvement. Table 3 (p.32) provides a matrix for basing an initial assessment of the microbiological characteristics of a new bottling operation. The tests in this table are given abbreviated titles. Full meanings are detailed below:

Abbreviation	Meaning
TVC	Total Viable Colony count per millimitre -
	• at 22° C in 72 hours
	• at 37° C in 24 hours
Coliforms	Total coliforms in 250 ml
E.coli	*Escherichia coli* (faecal coliforms) in 250ml
Faecal streptococci	*Faecal streptococci* (Enterococci) in 250ml
Ps.aeruginosa	*Pseudomonas aeruginosa* in 250ml
Clostridia	Sporulated sulphite reducing anaerobes in 50ml
Other pathogens	Bacteria *(e.g. Campylobacter)*, viruses, parasites
	(e.g. Cryptosporidium, Giardia, Helminthes)

It is recommended that the frequency of sampling of the source for microbiological parameters is the same as the frequency for finished product. The reason for this is that if there is an issue with finished product, then the source will have to be sampled anyway in order to rule it in or out as being the source of the infection.

Methods to be employed can be found in *Microbiology of Drinking Water (2002) - A Report by the Environment Agency* and (in less detail) in Directive 98/83 EEC - Council Directive relating to the Quality of Water intended for Human Consumption. Annex 3 lists some examples of microbiological methods used by BSDA members.

As legislation is constantly updated, it is recommended that guidance should be sought on current legal requirements from the local authority.

Bottled waters should be positively released, based on satisfactory completion of microbiological monitoring.

7 Quality Management

Table 3: Suggested matrix for microbiological testing of a new bottled water operation

Sampling point	Test	Suggested frequency daily production volume for sale m3		
		Less than 10	10-60	Greater than 60
At source or at point of receipt of plant	TVC	Weekly	Daily	Daily
	Coliforms / E.coli	Daily	Daily	Daily
	F.streptococci	Monthly	Weekly	Weekly
	Ps.aeruginosa	Weekly	Weekly	Daily
	Clostridia	Monthly	Weekly	Weekly
	Pathogens	Annually	Annually	Six monthly
During production (In process sampling, number of sampling points dependant on process)	TVC	Weekly	Daily	Daily
	Coliforms / E.coli	Daily	Daily	Daily
	F.streptococci	Monthly	Weekly	Weekly
	Ps.aeruginosa	Weekly	Weekly	Daily
	Clostridia	Monthly	Weekly	Weekly
Final product (each line)	TVC	Weekly	Each day - start, middle and end of production	
	Coliforms / E.coli	Daily		
	F.streptococci	Monthly	Weekly	Weekly
	Ps.aeruginosa	Weekly	Weekly	Daily
	Clostridia	Monthly	Weekly	Weekly
	Pathogens	Annually	Annually	6 monthly
Bottles	TVC	Monthly	Weekly	Weekly
Closures	TVC	Monthly	Monthly	Weekly

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7.7 Chemical analysis

The appropriate level of monitoring will depend on water status, the level and nature of treatment (if any) and the likelihood of parameters exceeding pre-determined values: increased monitoring may well be required for a parameter close to a Maximum Admissible Concentration (MAC). Waters with a tendency to fluctuate significantly may also require increased monitoring.

To gain recognition, a Natural Mineral Water must demonstrate absence of pollution and have a constant composition. It is the duty of the relevant regulating authority subsequently to audit such compliance - the frequency of auditing being a matter of its judgement.

Not withstanding the above, the bottler should initiate its own level of monitoring, to ensure compliance and to maintain an awareness of any fluctuations and trends in water quality. This is equally applicable to a packer of treated water, which may be significantly different in composition from that at source. Table 5, taken from Annex II of the Council Directive 98/83/EC on the quality of water intended for human consumption, shows the number of samples and the monitoring regime required for different sizes of operation.

Illustrated below are some of the determinants for the tests referred to in table 5 (this is not an exhaustive list):

Major and minor ions and metals	Toxics, VOCs, pesticides, PAHs, miscellaneous
Calcium , Magnesium, Potassium, Sodium, Ammonium, Fluoride, Carbonate	Arsenic, Cadmium, Cyanide, Chromium, Mercury, Nickel, Lead, Antimony, Selenium
Nitrate, Chloride, Silicate, Sulphide, Sulphate, Phosphate, Hydrogen Carbonate (Bicarbonate)	Volatile organic compounds according to Council Directive 98/83/EC Oxidizability, Kjeldahl nitrogen, Total Organic Carbon, Surfactants, Dry Residues, Silver
Nitrite, Iron, Aluminium, Zinc, Manganese, Copper, Lithium,	Atrazine, Simazine plus pesticides in use locally (ask EA for advice) PAHs as in Council Directive 98/83/EC
Bromate, Iodine, Borate, Barium, Cobalt, Molybdenum Strontium	Radioactivity parameters[3] in Council Directive 98/83/EC

3. Analysis is not compulsory unless the water originates from or is influenced by surface water

7 Quality Management

Table 4: Microbiological parameters for water intended for sale in containers

Parameter	Parametric values
Escherichia coli (E.coli)	0 / 250 ml
Enterococci	0 / 250 ml
Pseudomonas aeruginosa	0 / 250 ml
Colony count 22°C	100 / ml
Colony count 37°C	20 / ml

Table 5: Minimum frequency of sampling and analysis for water in bottles or containers intended for sale

Volume of water produced for offering for sale in bottles or containers each day[4] m^3	Check monitoring number of samples per year	Audit monitoring number of samples per year
< or = 10	1	1
> 10 and < or = 60	12	1
> 60	1 for each 5 m^3 and part thereof of the total volume	1 for each 100 m^3 and part thereof of the total volume

NB: Table taken from the Council Directive 98/83/EC, see Annex 1, part A and table B2 in the Directive

4. The volumes are calculated as averages taken over a calendar year

7 Quality Management

7.8 Packaging

7.8.1 Primary packaging - microbiological analysis

The hygiene of bottles and caps must be maintained: good control of storage conditions will obviously minimise the risk, but it is prudent to carry out regular checks to monitor their condition (See 7.6 Microbiological Analysis - Suggested Requirements).

7.8.2 Process control checks

Below is a simplified list of the areas which it is appropriate to record on a regular (suggest hourly) basis, and any corrective actions:

- Pallet No / Code
- pH
- Taste / Odour / Appearance
- Absence of chemicals if used in plant
- Flavour (if flavour added)
- Efficiency of rinsing/washing of bottle
- Caps/cap application
- Cap removal by hand
- Capping torques
- Carbonation
- Conductivity
- Fill levels/volumes - (Average Contents Legislation)
- Labels/labelling
- Date coding/Best before
- Carton/tray erection
- Shrink-wrapping where used
- Tray/carton date coding/Best before
- Stack integrity

7.8.3 Lot marking / indications of minimum durability

It is a legal requirement to include a lot mark - (minimum requirement - date of production) and a "Best Before End" indication. There are various ways of indicating

this, including "notching" of pre-printed labels and ink-jet or laser coding of cap, bottle or label: the latter two have the advantage that the actual time of production can be incorporated. The Hygiene Regulations (EC) 852/2004 require a record of traceability from supplier to customer, so called "one up-one down".

Similarly it is helpful if the outer pack (carton/shrink-wrap tray etc) is also coded.

See:

- Food (Lot Marking) Regulations 1996 SI 1996 No 1502 Food Labelling (Amendment) Regulations 1996 SI No 1483)

- Section 8 of this Guide

7.9 Positive release systems

A positive release system is one in which goods are not permitted to pass to the consumer prior to confirmation of their compliance with prescribed company or legislation requirements. In the case of bottled water this is only likely to apply to microbiological analysis, the results of which may not be available until 3 days after bottling. Positive release should always be applied, meaning a positive decision should be made, based on test results, for product to continue through the distribution chain. Some producers may find it convenient to actually hold stock. However this is not mandatory. In other circumstances it may be appropriate to allow the initial distribution from the bottling plant prior to results being available.

7.10 Documentation / records

In a complex production environment such as the bottling of water, working instructions need to be sufficiently well documented to ensure that operating procedures are understood and followed. The level of detail is a matter of individual requirements, but the key factors involved are:

- Proper document control - both for first issue and modifications

- Instructions available to appropriate personnel. Records of tests/inspections in a form appropriate to operating procedures

- Records held in an organised manner to permit subsequent review of non-

7 Quality Management

conformances (complaints etc) and as evidence of Due Diligence in the case of a potential section 21 defence - Food Safety Act 1990

A checklist of the major requirements to ensure high quality practice in the production of bottled water is given in Annex 4: Guide to Good Bottled Water Standards - Checklist of Best Practice.

7.11 Plant hygiene

See:- "*Food Industry Guide to Good Hygiene Practice- Bottled Water*" TSO publication, ISBN: 978-0-11-24 3100-8.

This Guide contains recommendations for standards to maintain water quality through the production process, which are greatly in excess of the legal standards and which apply to all product descriptions.

7.12 BS EN ISO 9001:2008

This standard provides a comprehensive system for Quality Management which may be applied to the bottled water industry.

Its elements are:

1 Scope
- 1.1 General
- 1.2 Application

2 Normative reference

3 Terms and definitions

4 Quality management system
- 4.1 General requirements
- 4.2 Documentation requirements

5 Management responsibility
- 5.1 Management commitment
- 5.2 Customer focus
- 5.3 Quality policy
- 5.4 Planning
- 5.5 Responsibility, authority and communication
- 5.6 Management review

6 Resource management
- 6.1 Provision of resources

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NB: The full text of standard BS EN ISO 9001:2008 is available from British Standards Institute. For contact details see p61.

8 Crisis protection (Often referred to as risk management)

8.1 Overview

The risk management and product quality systems described in Chapter 7 not only ensure high quality production but also form the core of crisis protection. Crisis protection is more than crisis management, and covers three main areas of activity:

- Before an incident occurs (normal activity)
- During an incident (crisis management)
- After an incident (post mortem)

Crisis protection is recommended to producers because it minimises risk to consumers. However it is also in the interests of a producer because crises, be they major or minor, damage shareholder value. The expense of crisis protection is low compared to the potential costs of a poorly managed or avoidable product quality incident. The external costs of crisis protection can sometimes be offset by a reduction in insurance premiums.

Crisis protection for a bottled water producer is likely to be focussed on product safety and quality. However other risks may need to be taken account of, particularly for larger producers, including extortion, bomb threat, fire and computer failure.

8.2 Before an incident

Normal activity should have the following elements to it:

- Risk management - making sure that risk management systems such as HACCP, product traceability, supplier audits, site security and insurance give the required level of protection and information.

- Situation monitoring - a formalised means of reviewing information which comes into a company via various routes such as consumer response, customer response, press activity and supplier information. The aim is to pick up an incipient early, keep it under review and then mobilise the Crisis Management Team at an appropriate moment. Key managers and support staff should have defined responsibilities for this process.

- The existence of a Crisis Protection Procedure with various elements to

8 Crisis protection

it including composition and training of Crisis Management Team, a Crisis Management Procedure and Product Recall Plan, preparation and maintenance of Contact Lists and Position Statements, ancillary procedures for management of extortion incident, bomb threat etc. The Management Procedure might include contingency planning for communications, technical investigation, public relations management, high level public domain experts and dealing with insurers. The Management Procedure is a set of rules, based on the prediction of several possible scenarios, which enumerates how a Management Team should be set up. It will identify emergency call out procedures and give guidance on priority actions, as well as the use of communication materials.

- The ability to update continually the various elements of the Crisis Protection Procedure.

- Periodic systems review and training by simulation, perhaps supplemented by media training for nominated spokespersons.

8.3 During an incident

The aim during an incident will be to mobilise resources as quickly as possible to meet the level of threat. This may be minor - for example, being prepared with specific microbiological analysis when a scientific study may reach the press - or major when it is clear that a product quality fault is in the market place.

It can be very important to inform insurers, making sure that they agree with proposed activity whilst taking decisive action.

8.4 After an incident

A major incident will probably cost a company dearly, and one way to get best value is to communicate about the recovery from the incident and improve crisis protection systems for the future. It may be necessary to carry out post mortem investigations whilst the incident is fresh, either internally or by using an external agency.

Post mortem investigations should focus on how early the incident was picked up, whether there was a failure of risk management systems, how the Crisis Management

8 Crisis protection

Procedure worked including all the materials associated with it, and what changes should be put in place for the future.

In addition, the insurers and loss adjusters should be satisfied that the company kept within the terms of insurance and that losses are recoverable. Record keeping is invaluable, particularly in initiating a claim.

9 Labelling

9.1 Regulations and BSDA guidelines

'Labelling' in this guide includes not only the contents of the label itself, but other marking perhaps on the cap.

Labelling of all bottled waters is governed by the following regulations:

- The Food Labelling Regulations 1996 SI 1499
- The Natural Mineral Water, Spring Water and Bottled Drinking Water Regulations 2007 SI 2785 and parallel for Wales, Scotland and N Ireland
- Weights and Measures (Packaged Goods) Regulations 2006 SI 659
- The Food (Lot Marking) Regulations 1996 SI 1502

This BSDA Guide adopts particular rules for naming product Spring Water or Table Water. Members also provide a mineral composition in a particular form although this is not a legal requirement for these categories of water. All aspects of labelling are subject to agreement by the producer's local Trading Standards Office, or Environmental Health Office in Scotland.

9.2 Lot marking and best before

These provisions are dealt with separately, because they are applied during the production process, often to the cap.

9.2.1 The lot (batch) mark

The lot or batch mark provides a useful source of identification to enable product recall along the whole food chain, for instance where there may be the subject of dispute or health hazard. The size of the batch is for the person deciding on the lot mark to determine, but must relate to a batch packed under the same conditions. For water, a day's production is generally considered appropriate. Each container produced must have a batch mark. If it is not obviously a batch mark it must be preceded by the letter "L". In all cases the mark must be easily visible, clearly legible and indelible. The customer need not understand the meaning of the mark but must be able to distinguish it from other information on the label. A code edge without a printed calendar is not sufficient.

9 Labelling

A lot or batch mark is not required if an indication of minimum durability or "Best Before" date is used which includes the day as well as the month and year. In this case the day represents the batch.

However this Guide recommends a lot mark separate to the Best Before date which (perhaps together with the Best Before date) gives the date, time of bottling and line number, as being an essential element of the producer's quality system (see Section 7: Quality Management).

9.2.2 Best before

The Food Labelling Regulations 1996 (SI 1499) set out requirements for marking food durability.

The words "best before" followed by a date up to and including that which the drink can reasonably be expected to retain its specific properties, if properly stored, together with any special storage instructions should be clearly stated. The date may be expressed in terms of a month and year only for drinks expected to retain their specific properties for more than three months and if the words "best before end" are used.

In the case of drinks retaining specific properties for over 18 months the year only is sufficient if the words "best before end" are used. The date may be separate from the words "best before" or "best before end" if the words are followed by a reference to the place where the date appears.

This guide recommends the following shelf lives. These are maximum shelf lives based on industry experience and take into account normal distribution systems:

It is also recommended that distributors be informed that storage conditions should be cool, dry, non-odorous and away from direct sunlight.

Pack	Type	Shelf life
Glass	Still or carbonated	2 years
PET	Still	12 - 24 months (according to bottler's experience)
PET	Carbonated >1 litre	12 months (according to bottler's experience)
PET	Carbonated < 1litre	less than 12 months (according to bottler's experience)
PVC	Still	12 - 24 months (according to bottler's experience)
Cans (aluminium or steel)	Still or carbonated	1 year

9 Labelling

9.3 The label (excluding date and lot marking)

One of the problems in interpreting labelling regulations is that different regulations use different terminology. This guide uses the following terms:

Term used	Includes
Trade description	The commercial name by which the consumer would recognise the product, typically including the name or location of the source
Sales description	The technical description of the product, defined separately for each category (see below)
Description	Additional text about the product, source or place
Place	Place of exploitation for Natural Mineral Waters or Spring Waters or Origin in general regulations
Volume	Volume
Composition	Composition for Natural Mineral Waters and List of Ingredients in general regulations
Instructions for use	Instructions for use including special storage conditions
Name and address	Name and address of a bottler, or of a seller within the European Union
Country	Country of origin

9.4 Trade Description and Sales Description

9.4.1 Natural Mineral Water

Each Natural Mineral Water has a recognised and named source, which is registered in the Official Journal of the European Union. All production from the source must carry the name and location of the source on the label, and must have the same trade description. If the trade description of the NMW is different from just the name or location of the source, then either the name or the location of the source must be printed in letters at least *one and a half times larger* than any part of the trade description.

9 Labelling

Here are some examples of possible trade descriptions for a Natural Mineral Water registered as the Glincorrie source exploited at Tankbrae - in each case, the trade description is in italics, and must be the same for all production from the source even if other aspects of the label are different.

GLINCORRIE
Natural Mineral Water
Bottled in Tankbrae

Shaftsbury's
GLINCORRIE
Natural Mineral Water
Bottled in Tankbrae

TANKBRAE
Natural Mineral Water
From the Glincorrie Spring

Scottish
TANKBRAE
Natural Mineral Water
From the Glincorrie Spring

In the following example, the name and/or location of the source must be at least 50 per cent bigger than the trade description.

Original Scottish
Natural Mineral Water
From the GLINCORRIE Spring, Tankbrae

9 Labelling

The sales description must be one of:

- "Natural Mineral Water" referring to a still or non-effervescent product
- "Naturally Carbonated Natural Mineral Water" meaning an effervescent Natural Mineral Water whose carbon dioxide content is the same after bottling as it was at source
- "Natural Mineral Water Fortified with Gas from the Spring" meaning an effervescent Natural Mineral Water whose carbon dioxide content derives from the same ground water but the carbonation level after bottling is greater than that in the source
- "Carbonated Natural Mineral Water" meaning a sparkling Natural Mineral Water which has been carbonated at least in part with carbon dioxide from another origin.

Note that the words "Natural Mineral Water" may only be used on waters which have been recognised by a local authority and registered in the official gazettes and Official Journal of the European Union. Even if a water satisfies all the criteria required for Natural Mineral Water but it does not have official recognition, not only can it not be sold as a Natural Mineral Water, but it must not be labelled in such a way that it could be confused with a specific Natural Mineral Water.

9.4.2 Spring Water

As with Natural Mineral Water, each Spring Water has a recognised and named source, although unlike NMW the source does not have to be officially registered with the EU. The name and location of the source and the same trade description must always appear on the label. If the trade description of the Spring Water is different from just the name or location of the source, then either the name or the location of the source must be printed in letters at least one and a half times larger than any part of the trade description.

Because there is no official list of Spring Water sources, the bottler may change the name of the Spring Water at any time, but only one name may be used at any one time.

In addition to being labelled as one Spring Water, it may also be labelled as any number of Table Waters. Again, this is different from Natural Mineral Water, because

9 Labelling

Spring Water is a characteristic of the product whereas Natural Mineral Water is a characteristic of the source.

For a Spring Water, the sales description is Spring Water with any reasonable qualifier such as "sparkling" or "carbonated". It should not include the words "natural" or "mineral" in order to prevent possible confusion with Natural Mineral Water.

9.4.3 Table Water

The legal name of the product is "water". The law requires the name to be sufficiently precise to inform the purchaser of the true nature of the food and to enable the food to be distinguished from products with which it could be confused, and can include a description of its use. The names "Table Water" or "Bottled Drinking Water" are sometimes used, according to the definitions in Section 2 - Different Types of Bottled Water. There are no restrictions on how a source name or place are to be included for table water or even whether they should be included at all. However there is a general requirement that the consumer should not be misled, and that there should be no confusion with any Natural Mineral Water or Spring Water.

The sales description might include one or more of the following (this list is not exhaustive):

Sales description	
Blended	a mix of more than one source
De-ionised*	water in which most of the major ions have been removed by de-ionisation
De-mineralised*	water which has been subjected to distillation, reverse osmosis or de-ionisation
Purified	water which has been treated to remove pollutants or disinfectants
Re-mineralised*	water which is made up to a particular chemical composition
Sparkling	can be used where the product is carbonated
Still	can be used to indicate a non-carbonated product
Flavoured	water with a flavouring as a minor constituent **(Note the product is then legally a soft drink)**

The sales description should not include the words "Natural", "Mineral" or "Spring", to avoid possible confusion with Natural Mineral Water or Spring Water.

*NB must be >60mg/L Ca hardness

9 Labelling

9.5 Composition

A statement of analytical composition is mandatory **only** for Natural Mineral Waters.

Table Waters and Spring Waters may not always have a stable enough composition to give a representative analysis. However re-mineralised Table Water may have a stable composition.

The standard format appears below :

MINERAL ANALYSIS	
TYPICAL VALUES	Mg/L
Calcium	30
Magnesium	2
Potassium	2
Sodium	2
Bicarbonate	95
Chloride	12
Sulphate	25
Nitrate (as NO_3)	12
Dry residue at 180°C	156
pH (at source)	6.8
e.g Iron, aluminium, fluoride and	
silica	

It is recommended that values are included in this order

Discretionary maximum 3

9.6 Other provisions

9.6.1 Volume

A typical mark is: 2 Litre e

9 Labelling

The volume must be marked in letters of a certain size:

The 'e' mark (signifying filling to average volume) must be 3 mm in size. The 'e' mark is optional. Producers may fill to a minimum content. Details of the 'e' mark are given in the Weights and Measures (Packaged Goods) Regulations 2006 SI 659.

9.6.2 Instructions for use

For carbonated water, it is recommended that the cap should include directional arrows and appropriate wording such as “Open this way” or “Open by hand” may be included.

9.6.3 Name or business name and address of packer, manufacturer or seller in the EU

This should be sufficient for the consumer to make contact.

9.6.4 Origin

The country of origin should be clear.

9.6.5 Labelling as suitable for Infant feeding

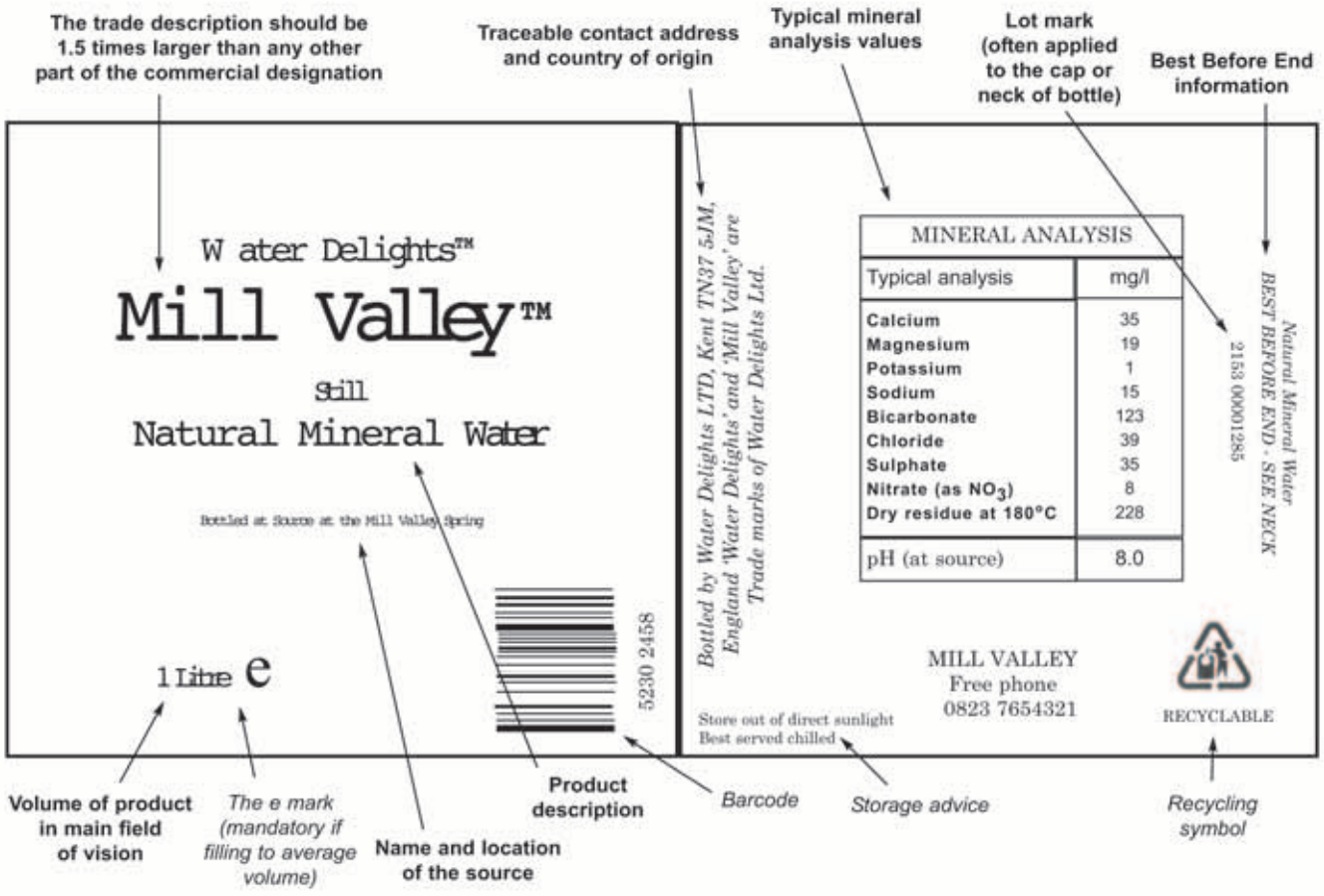
In place of any specific regulations the FSA has stated that provided a NMW complies with the requirements of the Food Safety Act and Labelling Regulations, it can be labelled as being suitable for infant feeding. The Department of Health recommends that all water is boiled before such use.

9.7 Examples of good labelling practice

An example is given below for each category of water. The labels have been annotated and the legal requirements are denoted in the bold type font. The labels are only intended to act as guidelines. Reference should be made to the appropriate legislation and advice sought from the local trading standards office (local Environmental Health department, if in Scotland) before designing new labels.

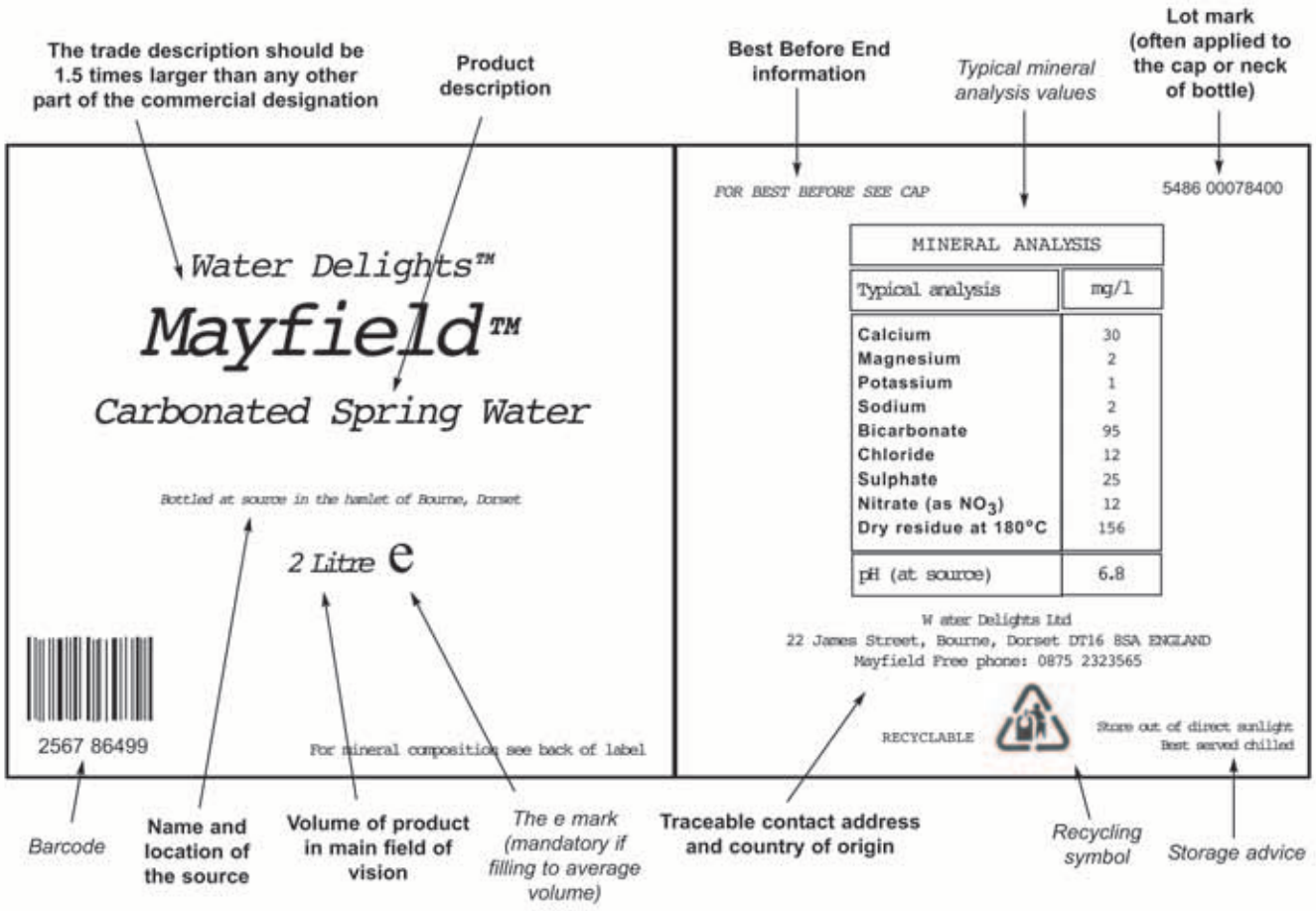
9 Labelling

Natural Mineral Water (Still)



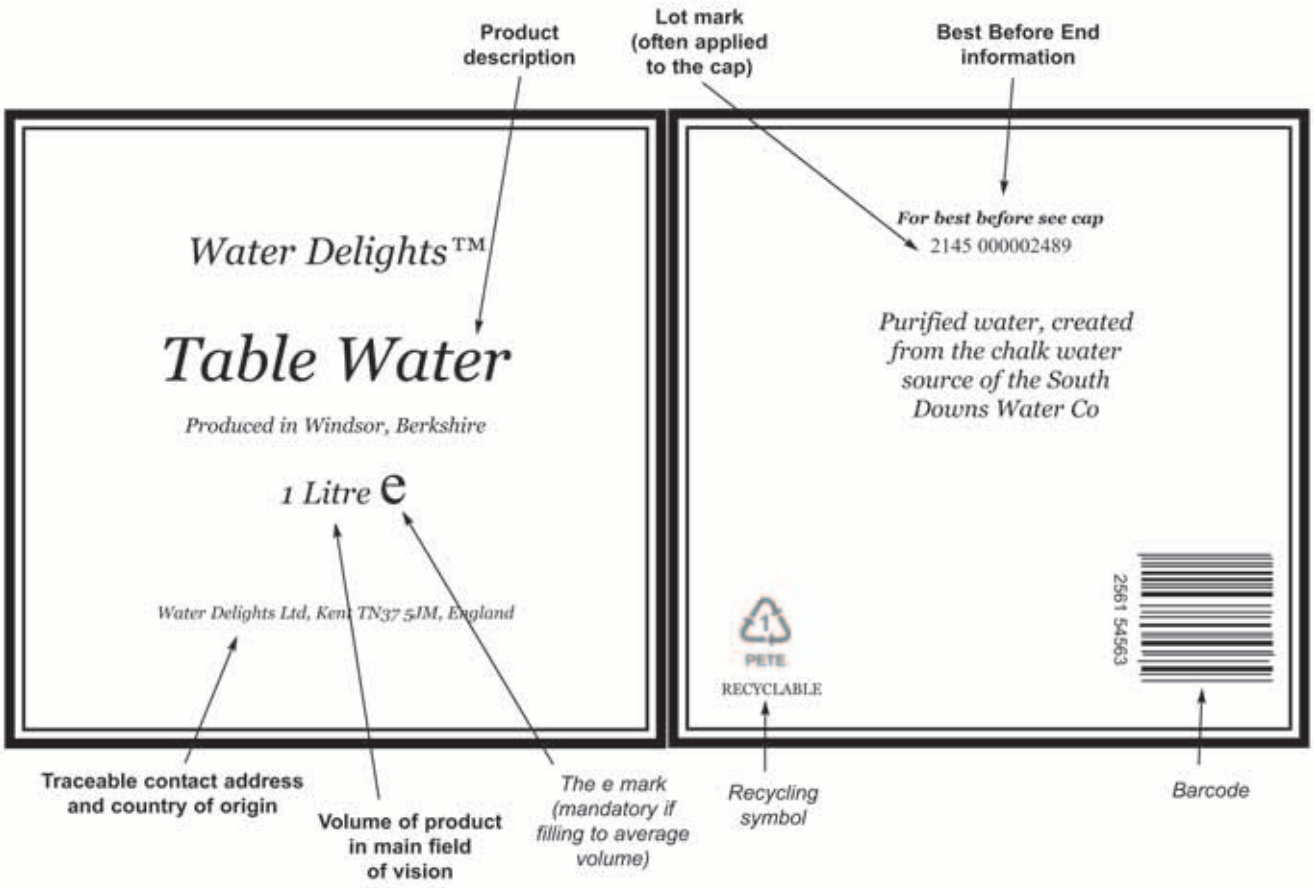
9 Labelling

Spring Water (Sparkling)



9 Labelling

Table Water (Still)



10 Water coolers

10.1 General

Water coolers are a means of dispensing water from larger bottles, and at the same time cooling the product. Some coolers will also produce hot water, suitable for making coffee and other beverages. The product may be a Natural Mineral Water, Spring Water or Table Water.

Quality issues for cooler products include:

- The source - including treatment where applicable
- Bottling plant - sterilising and filling
- Bottles, closures and coolers
- Distribution and cooler operations

This section highlights matters to be considered over and above those in the preceding sections. Item (1) "The Source" and source treatments are not discussed as there are no issues special to water coolers which relate to source development and exploitation.

The British Water Cooler Association (BWCA) is a trade association for water cooler distributors, separate from BSDA. The BWCA has developed a Code of Practice and third-party certification requirements for its members appropriate to this specialist activity.

10.2 Bottle sterilisation and filling

The unique feature of water cooler bottles is that they are all returnable to the service provider for refilling and recycling (when required). Therefore the standards of washing, filling and sterilising prior to refilling are key quality criteria. Additionally, Purified waters are often ozonated - a process of sterilisation - to ensure that the microbiological quality of the product water, bottle and closure is maximised. The use of ozonation to disinfect Spring Waters was prohibited from 1 July 2004 by The Bottled Waters (Amendment) (England) Regulations 2004 SI 656 (since replaced by the 2007 Bottled Water Regulations SI 2785).

With the BWCA mandatory bayonet-and-valve closure system (see later) the bottles are returned to the bottling plant with the closure in place, thereby ensuring that even the empty bottles are free of foreign bodies and other types of contamination. Despite these safeguards, members of the BWCA are required to pass strict plant and distributor audits inspected by a third party organisation.

10 Water coolers

The bottling plant for these larger bottles associated with coolers is similar to that used for the smaller measures, and is therefore not discussed.

10.3 Bottles, closures and water coolers

The quality issues in design are:

- The bottle closure
- The water bottle
- The means of transfer of water from bottle to cooler's reservoir
- The water cooler reservoir
- The intake of replacement air into the system

The BWCA make it mandatory on their members that they use only water coolers incorporating the bayonet-and-valve system for transferring water from the bottle to the cooler reservoir. This renders the water transfer and cooling a 'sealed system' thereby reducing the possibility of product contamination. Replacement air into the system is filtered by a 0.5 micron filter.

10.4 Distribution and cooler operations

QA procedures are required for the disinfection (sanitisation) of new or reconditioned coolers before they are delivered to site.

Once a cooler is installed, the internal reservoir should be sanitised regularly. BWCA recommend a 13-week cycle; customers receive this chargeable service for the service provider. Alternatively they may undertake it themselves, with materials provided; however, this is not recommended by the BWCA. Details of the BWCA recommended procedures are given in Section 14, Annex 5.

Distribution personnel should be fully conversant with health and hygiene standards appertaining to their function and properly trained in inspection and sanitisation.

11 Abbreviations and glossary of terms

ABS: Acrylonitrile-Butadiene-Styrene

BSDA: British Soft Drinks Association

BPF: British Plastics Federation

BWCA: British Water Coolers Association

C of C: Certificate of Compliance

COSHH: Control of Substances Hazardous to Health

CCP: Critical Control Point

EA: Environment Agency

EU: European Union

FSA: Food Standards Agency

GMP: Good Manufacturing Practice

HACCP: Hazard Analysis of Critical Control Points

HDPE: High Density Polyethylene

MAC: Maximum Admissable Concentration

MC: Maximum Concentration

NF: Nano-filtration

NMW: Natural Mineral Water

NSF: National Sanitation Foundation

oPVC: Orientated Polyvinyl Chloride

11 Abbreviations and glossary of terms

PAH: Polycyclic Aromatic Hydrocarbon

PET: Polyethylene Terephthalate (plastic used in bottles)

pH: Hydrogen ion concentration (measure of the acidity or alkalinity of a solution)

PVC: Polyvinyl chloride (plastic used in bottles)

RO: Reverse Osmosis

SMS: Source Management Strategy

SVP: Source Vulnerability Profile

SW: Spring Water

TOC: Total Organic Carbon

TW: Table Water

UF: Ultra Filtration

uPVC: Unplasticised Polyvinyl Chloride

VOC: Volatile Organic Compounds

WRC: Water Research Council

Confined Aquifer: A formation or group of formations or part of a formation overlain by very low permeability material that cannot be recharged directly by rainfall or by surface water and containing sufficient saturated permeable material to yield economical quantities of water to wells and springs.

Ground Water: Subsurface water that occurs beneath the permanent water table in soils and geological formations that are fully saturated.

11 Abbreviations and glossary of terms

Ground Water Protection Area: The surface and subsurface area surrounding a source or well field, supplying a bottling plant, through which contaminants are reasonably likely to move toward and reach such a source or well field.

Guide Level: A concentration, which, if exceeded, requires examination for the cause. Exceedance does not contravene the regulations

Maximum Concentration (MC): A concentration which must not be exceeded. If it is, the regulation concerned is contravened.

Primary Packaging: Containers and closures.

Recharge: Rainfall that infiltrates into the water table or surface waters that percolate into the underlying water table.

River Catchment Area: The natural unit over which hydrological processes are integrated and for which a water balance may be constructed to show the disposal of precipitation into a number of subsequent forms, i.e. interception, soil moisture, ground water storages, evapo-transpiration and run-off.

Secondary Packaging: Labels, glue, cartons, shrink wrap, pallets, etc.

Source - General: The origin of product water, including any treatment chain.

Time of Travel: The time required for water to move in the saturated zone from a specific point to a well.

Unconfined aquifer: A formation or group of formations or part of a formation not overlain by very low permeability material, which can be recharged directly by rainfall or surface water and contain sufficient saturated permeable material to yield economical quantities of water to wells and springs.

11 Abbreviations and glossary of terms

Underground Source: Construction at one or more points which allows the removal of ground water to the surface. This could be a borehole or spring collection system. Different boreholes sited quite close together may be different sources if they are exploiting groundwater bodies which are hydrogeologically and hydrochemically distinct. Applies only to Natural Mineral Water and Spring Water.

Zone of Influence: The area surrounding a pumping well that encompasses all areas or features that supply ground water recharge to the well.

Zone of Recharge: The portion of the aquifer where the recharge enters the water table.

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13 Addresses

British Drilling Association: Wayside, London End, Upper Boddington, Daventry, Northhamptonshire NN11 6DP. Tel: 01327 264622, Fax: 01327264623, www.britishdrillingassociation.co.uk

British Glass: 9 Churchill Way, Chapeltown, Sheffield S35 2PV. Tel: 0114 290 1860, Fax: 0114 290 1861, www.britglass.co.uk

British Plastics Federation (BPF): 5-6 Bath Place, Rivington Street, London EC2A 3JE. Tel: 020 7457 5000, Fax: 020 7457 5620, www.bpf.co.uk

British Retail Consortium (BRC): 2nd Floor, 21 Dartmouth Street London SW1 9BP. Tel: 020 7854 8900, Fax: 020 7854 8901, www.brc.org.uk

British Soft Drinks Association (BSDA): 20/22 Stukeley Street, London WC2B 5LR. Tel: 020 7430 0356, Fax: 020 7831 6014, www.britishsoftdrinks.com

British Standards Institute (BSI): 389 Chsiwick High Road, London W4 4AL. Tel: 020 8996 9000, Fax: 020 8996 7001, www.bsi-global.com

British Water Coolers Association (BWCA): Forsyth Business Centre 77 Clarendon Road, Watford, Herts WD17 1LE Tel 01923 813523, Fax: 01923 897346, www.bwca.co.uk

Codex Alimentarius Commission: The Secretary, Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme, FAO, Viale delle Terme di Caracalla, 00100 Rome, ITALY. Fax: 00 39 06 57 05 45 93, www.codexalimentarius.net

Department of the Environment, Food and Rural Affairs (DEFRA): Water Supply and Regulation Division, DEFRA, 2nd floor, Ergon House, Horseferry Road, London SW1P 2AL Tel: 020 7238 5098/5547, water.resources@defra.gsi.gov.uk

Drinking Water Inspectorate (DWI): Room M03, 55 Whitehall, London SW1A 2EY Tel: 030 0068 6400 Fax: 030 0068 6401, www.dwi.gov.uk

European Industrial Gases Association (EIGA): Avenue des Arts 3-5, B-1210 Brussels, BELGIUM. Tel: 32 2 217 7098, Fax: 32 2 219 8514, www.eiga.org

13 Addresses

Environment Agency (EA): Rio House, Waterside Drive Aztec West Almondsbury, Bristol BS32 4UD. Tel: 01454 624400, Fax: 01454 624409, www.environment-agency.gov.uk

Food Standards Agency (FSA): Aviation House, 125 Kingsway, London WC2B 6NH. Tel: 020 7276 8000, www.food.gov.uk

Health and Safety Executive (HSE): P O Box 1999, Sudbury, Suffolk CO10 2WA. Tel: 01787 881165, Fax: 01787 313995, www.bookshse.gov.uk

International Society of Beverage Technologists (ISBT): 14070 Preston Road, Suite 100, LB9,Dallas, TX 75244-3601, USA Tel: 972 233 9107 x208 Fax: 972 490 4219 www.bevtech.org

Local Authorities Co-ordinators of Regulatory Services (LACORS): Local Government House, Smith Square, London SW1P 3HZ Tel: 020 7665 3888, Fax: 020 7665 3887, www.lacors.com

Metal Packaging Manufacturers' Association (MPMA): The Stables, Tintagel Farm, Sandhurst Road, Wokingham, Berkshire RG40 8JD Tel: 0118 9788 433, www.mpma.org.uk

Water Regulations Advisory Scheme (WRAS): Fern Close, Pen-Y-Fan Industrial Estate, Oakdale, Gwent NP11 3EH. Tel: 01495 248454, Fax: 01495 236289, www.wras.co.uk

Water UK: 1 Queen Anne's Gate, London SW1H 9BT. Tel: 020 7344 1844, Fax: 020 7344 1853, www.water.org.uk

Annexes

1 Development of a borehole source

1.1 The borehole and catchment protection

This section considers the relationship between the well location, aquifer protection zoning, types of permitted activity and precautions to be taken. As explained in section 4, aquifer protection is based on two concepts:

- Water appearing at the borehole will have infiltrated the ground from rainfall (or streamflow), and the area of land which so contributes water to the borehole is called the catchment area.

- In a given area and geology a certain depth of rainfall will infiltrate over a period of time, the higher the rate at which a borehole is pumped, the larger the catchment area at a given location. Infiltrating water will percolate downwards until it reaches the water table, then travel laterally to reach the borehole. The time taken to travel laterally is called the travel time.

The following points are considered **essential** (see Figure 2 in Section 4):

- The area within 50 day travel time or a minimum radius of 50m of the borehole should be designated Zone 1. It should be completely fenced off and made secure to prevent access by animals or unauthorised people. There should be no activities whatsoever permitted in this area, except abstraction at the source.

- Zone 2 should include at least the zone of influence of the pumping borehole, and should not be less than a 400-day travel time or the recharge area based on 25% of long-term abstraction.

- Zone 3 is the zone of contribution for the borehole, from where its water derives. It should be the area immediately outside Zone 2 in the case of an unconfined aquifer and it should include the recharge area to the aquifer. It should be the recharge area for a confined aquifer.

- Hydrocarbon tanks should not be permitted within 100 metres of the borehole or observation boreholes. Any tanks outside this limit should be bunded.

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- Monitoring of land use in Zones 2 and 3 should be carried out at least seasonally. (Records should be maintained for inspection that indicate compliance to this).

- Monitoring of planning applications within the ground water catchment area should be carried out continually. The location of other bores should also be monitored. (Records should be maintained for inspection that indicate compliance to this).

- An incident management plan should be drawn up for all perceived risks to the aquifer and the borehole.

1.2 Wellhead housing

The following points are considered **essentia**l:

- The wellhead should be securely locked to prevent unauthorised access and distribution of keys restricted.

- All observation boreholes should be secured and locked to prevent unauthorised access.

- Records should be retained for inspection to indicate that all boreholes and observation boreholes are regularly checked for security.

The following points are **recommended**:

- The possibility of alarming the production well head should be considered with a 24 hour monitoring service.

- All pipework should be protected from weather damage and vandalism.

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1.3 Borehole construction

1.3.1 Drilling

The following points are considered **essential**:

- The design and construction of all drilled boreholes should be under the supervision of a competent and suitably qualified person.
- The drilling and construction process should not compromise the natural quality of the ground water in the area.
- Drilling logs recording depth and thicknesses of lithology or alluvium, and depth and yield of any water bearing zones should be recorded.
- Penetration rates should be recorded.
- Water quality samples for conductivity, temperature and pH should be taken and recorded at each new water yielding zone.
- A composite borehole log should be produced indicating method of drilling, drilling diameters, lithology, borehole construction, occurrence of water bearing fractures, water quality data and estimates of yield from each zone.
- Each production borehole should be grouted down as deep as possible without impinging on the yield of the borehole or without compromising the quality of the water at depth. The cement/water ratio should be professionally determined. Only sulphate-resisting cement meeting BS 4027 should be used.
- All materials used in the borehole construction should be resistant to corrosion. Stainless steel (grade 316) or thermoplastic casing and screen should be used in the borehole.
- The top of each borehole should be secured temporarily until all testing and monitoring is completed and then secured permanently according to the essential requirements in Section 2.2.

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- Borehole development should be carried out on both observation and production boreholes. Borehole development should be carried out by a driller and/or suitably qualified person. The duration of the operation should be determined by a suitably qualified person. Records of the procedure should be maintained for inspection.

The following points are **recommended**:

- Investigation prior to drilling by a geophysical resistivity survey and/or an electromagnetic survey should be carried out to assist in the correct location of boreholes, if the site and geology allow this.
- It is recommended that no drilling muds, fluids, foams or additives should be used. They can be very difficult to remove, are a source of energy for microbial growth and a potential source of trace organic contamination.
- All equipment associated with drilling should be steam cleaned off site to prevent carry over of materials from other sites and to identify leaking pipes, hoses and valves.
- All leaking pipes, hoses, valves and filters should be tightened or replaced to prevent hydrocarbon contamination of the well head.
- Refuelling should be carried out off site if practicable or with extreme care if on site. The ground should be covered with impervious material before refilling.
- All fuels, chemicals and greases should be stored off site.
- The flush water should be allowed to settle before it is discharged. It should be prevented from infiltrating into the ground in the area of the borehole.
- The completed borehole should be logged using down hole geophysical logging tools to determine variations in temperature and salinity, presence of fissures and flow rates from each fissure.

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1.3.2 Short duration pumping tests (step tests) and water quality monitoring

The following points are considered **essential**:

- A minimum of four short duration step tests should be carried out on all new production boreholes. Each step should last a minimum of 60 minutes.
- The quality of water should be monitored at the end of each step. These water quality parameters should be microbiological and chemical. The microbiological parameters should be TVC @ 22°C and 37°C, total coliforms and E.coli. The chemical parameters should be temperature, pH, electrical conductivity (Eh), alkalinity, all of which should be measured at the well head, and Ca, Na, K, Mg, SO_4, NO_3, Cl, total hardness and TDS (dry residue) which should be analysed by a suitable laboratory.
- All short duration pumping test records should be retained for inspection.

1.3.3 Long duration constant discharge pumping tests

The following points are considered essential:

- A constant rate pumping test should be carried out, for a minimum of 72 hours or at least until a constant level is established.
- All observation boreholes should be monitored for the duration of the pumping test.
- The water quality should be monitored as per Drinking Water Directive 98/83/EC daily for the first two days and then every second day for the first week and, finally, every three days during the second and subsequent weeks.
- The final sample should be taken to test for the absence of any microbial contamination.

Temperature, pH, conductivity, alkalinity (which should be measured at the well head), and total hardness, Ca, Mg, K, Na, SO_4, Cl, NO_3, NO_2, NH_4, PO_4, SiO_2, F, Fe, Mn, TDS, TOC and trace metals.

Pesticides, PCBs and related compounds, monocyclic aromatics, polycyclic aromatic

hydrocarbons, halogenated aliphatic hydrocarbons, halogenated ethers, phthalatephthalate esters, nitrosamines and cyanide.

Radioactinological analysis.

- All records of the pumping test and water quality for the production borehole and observation boreholes should be retained for inspection.

1.4 Long term catchment and water quality monitoring

The following points are considered **essential**:

- The water from the production borehole should be analysed for those chemical and microbiological parameters which will demonstrate the stability of the source. Recommendations are made in Section 7 of the Guide.

- The level of monitoring should be increased appropriately should there be any unexplained change in any parameter. This increased monitoring should be continued until the parameter has returned to normal levels or the reason for the change has been determined.

- The water level in the production borehole and all observation boreholes should be monitored each day of production.

- Pumping rates, duration of pumping, and abstracted volumes should be recorded on each day of production.

- Records of all monitoring should be retained for inspection.

The following points are **recommended**:

- It is recommended that a ground water professional be engaged to investigate any incident of a parameter being out of specification to satisfy both the manufacturer and the inspector that sufficient corrective action has been taken.

- It is recommended that a professional familiar with hydrochemistry and ground water flow be engaged on a quarterly basis to access the data collected on a daily and weekly basis for any long-term trends that may be appearing.

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1.5 Abbreviations

Ca: Calcium

Cl: Chloride

Eh: Conductivity

F: Fluoride

Fe: Iron

K: Potassium

Mg: Magnesium

Mn: Manganese

Na: Sodium

NH_4: Ammonium

NO_2: Nitrite

NO_3: Nitrate

PAH: Polycyclic Aromatic Hydrocarbons

PCB: Polychlorinated Biphenyl

pH: Measure of the acidity or alkalinity of a solution

PO_4: Phosphate

SiO_2: Silicate

SO_4: Sulphate

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TDS: Total Dissolved Solids

TOC: Total Organic Carbon

TVC: Total Viable Colony

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2 Forms of treatment

2.1 Introduction

At the time of going to press the labelling issues concerning the removal of unstable constituents for Natural Mineral Water were still under discussion at European level.

Treatments can be divided into three classes:

- Those that remove unstable constituents or undissolved matter (a)
- Those that influence the microbiological population (b)
- Those that influence the characteristic chemical composition (c)

The treatments permitted to Natural Mineral Water are limited to type (a), Spring Waters to types (a) and (b) and Table Waters may use all three types of treatments.

It should be noted that carrying out treatments introduces elements of risk which must be properly addressed. These include a failure of treatment, contamination because of chemicals used for treatment, and residual taints. Treatment processes should be subjected to hazard identification and the results incorporated into the quality system.

The Bottled Water Regulations have been amended in 2010 to permit removal (or reduction) of fluoride by means of an activated alumina filter (see Section 3).

2.2 Removing unstable constituents

Some elements (if present in the source water) are relatively easy to extract, as although they are dissolved in the source water whilst it is underground (or within the mains system), they begin to sediment out as solids as soon as they contact the outside air. Because of this property they are known as 'unstable constituents'. Examples are iron and manganese, which are sometimes effectively extracted by bubbling air (or ozone) through the water and then capturing the resultant sediment in filters. In order for this process to be effective the pH of the water must be higher than about 7.6, which is slightly alkaline.

If an unstable constituent is present in a source whose pH is lower than about 7.6, filtration systems are available which will extract the chemical by means of a catalyst. In this method, a vessel holds a quantity of finely ground powder through which the

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water is pumped, the filter medium absorbing with the unstable constituent to cause sedimentation through catalytic conversion. The medium itself then acts as a filter to trap the sediment. Usually these filters need to be back-washed regularly to clean the medium of sediment.

Depending on the geological composition of a water-bearing rock structure (or in the case of mains water used for bottling then the quality of the mains pipe work), there may well be sand, sediment or other inert solids present in water at the source. Removing this solid matter is permissible for all bottled water producers, and invariably takes the form of mechanical filtration.

The usual form of filtration is through replaceable cartridges, designed to fit into specially made housings. Re-usable (back-wash) filters may also be used.

The grade of filter cartridge chosen will depend on the nature of the matter to be extracted. Most manufacturers can supply cartridges of almost any pore size, ranging from over 10 micron to well below 0.1 micron.

When choosing a filter system for removing solid matter, the following points should be borne in mind:

- The choice of cartridge pore size is very important. The smaller the pore size, the more expensive the cartridge, the greater the restriction to flow so larger cartridges (or more of them) will be needed, and the quicker the cartridge will become blocked and require replacement.

For this reason, if very small particulate matter needs to be removed, it is advisable to have a series of two or more filters, of progressively finer pore size, so that larger particles are trapped before they reach the more expensive fine cartridges.

- If a pore size smaller than approximately 1 micron is chosen, then the filter may well remove some microbiological organisms from the water and the particular circumstances should be investigated. **It is not permitted to alter the microbiological population of a Natural Mineral Water from source.**

2.3 Removing microbiological organisms

The removal of undesirable microbiological organisms from water before bottling is usually accomplished by one or more of the following techniques: filtration, UV

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irradiation or ozonation. Each is reviewed below. The introduction of other oxidising agents in solid or liquid form (such as chlorine compounds, common in the public supply), although effective in killing micro-organisms is virtually never used in bottled water, due to residual taint.

2.3.1 Mechanical filtration

As in the filtration of solid particles in section A2.1 above, a replaceable cartridge filter is used to trap organisms before bottling. In this case, cartridges with an absolute pore size of 0.45 micron or 0.2 micron are usually chosen, depending on the nature of the contamination. The points made in 14.2.2 above should be considered.

2.3.2 Ultra violet radiation

Passing water through an ultra violet (UV) treatment system is a relatively efficient and economical way to kill micro-organisms. In this method, the water is passed over an ultra violet lamp (the lamp is usually at the centre of a tube through which the water flows), and the radiation from the lamp destroys the DNA structure of the organisms. The effectiveness will depend upon the water, the type of lamp and the state of maintenance.

However the following points should be considered when using UV disinfection:

- UV lamps need to be replaced regularly as their intensity reduces with age. The instruction manual which accompanies the unit will recommend replacement intervals, and it is prudent to fit an electrical time counter in the control circuitry to monitor lamp usage.
- Each system is designed for a maximum flow rate. This is quoted for water with a UV transmittance of 100%. Flow rates for water with a lower transmittance should be reduced accordingly.
- If the contamination or turbidity of the water is very high, the system may not work at full efficiency.
- If sodium hypochlorite is used periodically to sanitise bottling lines, care should be taken that the UV system is switched off during this process, otherwise the translucent barrier between the lamp and the water can become opaque over time, due to a chemical reaction of the radiation on the hypochlorite.

The UV system should be used to the manufacturer's recommendations.

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2.3.3 Ozonation

Ozone is a form of oxygen made up of three oxygen atoms to the molecule. Oxygen in this state is very unstable. The usual stable state for oxygen is two atoms per molecule. Ozone is continually trying to shed one of its atoms and return to a stable state. Any organic matter (such as microbiological organisms) which comes into contact with ozone will cause the third oxygen atom to be transferred. This process, known as oxidation, may kill the organism depending on its species and the concentration of ozone.

Ozonating machinery produces ozone gas, which is then bubbled through the water and is absorbed. Any bacteria in the water are oxidised and killed. Because of the instability of ozone, all of it will have converted back to oxygen within a few days of treatment.

Note: Ozone, being an oxidising agent, can change the chemical state and hence solubility of some constituents, such as iron and manganese. This can result in the elements being precipitated out as unsightly solids. It can also alter some organic compounds, making them more assimilable by micro-organisms. It will also oxidise Bromide to Bromate. A maximum level of 3ppb Bromate is enforced for water treated with ozone.

2.4 Altering the chemical composition

The following techniques are available (not an exhaustive list):

- Reverse osmosis, used for a fairly non-selective reduction in the concentration of dissolved ions
- Nano-filtration and ultra-filtration, through pore sizes smaller than the size of the ions to be removed
- Ion exchange, usually used to remove one or two selected ions
- Activated carbon filtration, used to remove organic molecules

These may sometimes be preceded by powerful oxidation, usually by ozonation.

A short explanation of each technique is given below.

2.4.1 Reverse osmosis, nano-filtration and ultra-filtration

Osmosis is a process where, if a semi-permeable membrane separates two different solutions of salts in water, water will move across the membrane until the two solutions have the same concentration of dissolved salts. In reverse osmosis a high pressure is used to force water through the pores of a membrane which are too small

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to allow most metal ions and aqueous salt ions to pass. Thus the solution on the concentrated side of the membrane becomes more concentrated, reversing the normal osmotic flow.

In fact reverse osmosis is a filtration process on a molecular scale. Reverse osmosis (RO) uses the smallest pore membrane, whereas nano-filtration (NF), ultra-filtration (UF) and micro-filtration (MF) use progressively larger pore sizes.

Reverse osmosis systems can remove viruses, bacteria, parasites, salts, heavy metals and molecules larger than water. RO employs synthetic membranes (usually polyamide). These membranes allow water molecules to pass through, but block most ions or organic molecules. The amount of pressure required to reverse the osmotic flow depends on the concentration (ppm) of ions.

Nano-filtration and ultra-filtration are progressively less efficient at filtration, and remove only the larger ions and molecules, but will still remove both viruses and bacteria.

Some details of RO are given below, to illustrate the range of issues which arise in the practical application of these techniques.

There are several types of membrane:

- Polyamide
- Thin film composite (TFC) constructed of polyamide-type materials
- Cellulose acetate (has been known to support bacterial growth)
- Cellulose triacetate

Each type of membrane has its advantages and applications, e.g. pH stability, chlorine resistance, biological resistance and temperature limits.

Pretreatment of "feed" water is essential to prevent membrane fouling or scaling. For mains water a filter in the region of 10 micron would be sufficient. For a cellulose acetate membrane, an acid feed may be needed to prevent the formation of carbonate scale. With hard "feed" water a softener may be used.

RO units are temperature sensitive. Membranes will degrade more rapidly at elevated temperatures. Membrane hydrolysis can occur with lack of pH control of feed water or with high temperatures. Chemical oxidisers and microbial growth can lead to degradation. Ozone and chlorine can degrade many membranes and bacteria can degrade cellulose acetate membranes.

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2.4.2 Ion exchange

In ion exchange the water is passed across the surface of a resin which captures a particular ion from the water, and gives up another ion in return. This can be useful for treating a particular problem such as excess nitrates. However the chemistry of the water may be altered in a way which itself produces problems, and so careful evaluation is required. Also resin regeneration can involve the use of strong chemicals.

2.4.3 Activated carbon

Activated carbon is charcoal, treated so as to increase its adsorptive capacity. Activated carbon is particularly effective at trapping organic molecules, and so is commonly used in water treatment for removing organic contaminants. Halogenated compounds created by the disinfection of water by chlorine (an important group of which are known collectively as tri-halomethanes or THMs), are also removed in this way. It is also commonly used as part of a treatment chain for the removal of pesticides and herbicides, usually in conjunction with some form of oxidising process. Activated carbon will often be effective in removing an organoleptic defect, although the producer is recommended to identify the exact cause, as the defect may be an expression of a process which has other important consequences.

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3 Summary of some suggested microbiological methods

Organism	Method type	Medium	Incubation time and temperature	Confirmation method
Total coliforms + E.coli	Membrane filtration	Membrane Lauryl Sulphite Broth (MLSB)	4 hrs @ 30°C +14 hrs @ 37°C = Total coliforms	Biochemical - lactose peptone, water, oxidase test, tryptone water
			4 hrs @ 30°C + 14 hrs @ 44 C = Presumptive faecal coliforms (E.coli)	Commercial test kits may be used
Total coliforms + E.coli	Multiple tube	Minerals Modified Glutamate Medium (MMGM) or Lauryl Tryptose Lactose Broth (LTSB) NOT MacConkey Broth	48 hrs @ 37°C	Subculture to isolate then biochemical similar to above
Faecal streptococci	Membrane filtration	Membrane Enterococcus Agar (Mea / Slanetz + Bartley)	Chlorinated water 48 hrs @ 37°C Untreated 4 hrs @ 37°C + 44 hrs @44°C	Hydrolysis of aesculin in bile Aesculin Agar (BAA) or Kanamycin Aesculin Azide Agar (KAAA)
Faecal streptococci	Multiple tube	Glucose Azide Broth (GAB)	48 hrs @ 37°C	Hydrolysis of aesculin in bile Aesculin Agar (BAA) or Kanamycin Aesculin Azide Agar (KAAA)

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Organism	Method type	Medium	Incubation time and temperature	Confirmation method
Sulphite reducing clostridia (Cl. perfringens)	Membrane filtration	Tryptose Sulphite Cycloserine Agar (TCSA), Shahidi-Ferguson Perfrigens Agar (SFPA) or Oleandomycin-Polymixin Sulphadiazine Perfringens Agar (OPSA)	47 hrs @ 37°C	Biochemical in litmus milk medium (LMM) or Crossley's milk medium (CMM)
Sulphite reducing clostridia (Cl. perfringens)	Multiple tube	Differential re-inforced Clostridial medium	48 hrs @ 37°C	Biochemical in litmus milk medium (LMM) or Crossley's milk medium (CMM)
Total viable count @ 22°C	Pour plate or spread plate	Yeast Extract Agar (YEA) or R2A agar	YEA 72 hrs @ 22°C R2A - 7 days @ 22°C	Not required
Total viable count @ 37°C	Pour plate or spread plate	Yeast Extract Agar (YEA) or R2A agar	YEA 24 / 28 hrs @ 37°C R2A - 72 hrs @ 30°C	Not required
Pseudomonas aeruginosa	Membrane filtration	Modified Kings Broth (MKB) Pseudomonas Agar (PA)	48 hrs @ 37°C	UV fluoroscence
	Multiple tube (not recommended)	Asparagine Broth + Ethanol (ABE)	48 hrs + 96 hrs @ 37°C	UV fluoroscence

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4 Checklist of best practice

NB: For some of the listed measures expert advice may be required. Please refer to definitions of different categories of bottled water as given in Chapter 2 - Legal Definitions

1. Legislation / regulatory framework	Natural Mineral Water	Spring Water	Table Water
Nominate responsible person(s)	Yes	Yes	Yes
Hold copies of all legislation (see BSDA Route Map to Legislation)	Yes	Yes	Yes
Use legislation to establish list of regulation-based critical parameters	Yes	Yes	Yes
Carry out recorded check of compliance minimum every 12 months	Yes	Yes	Yes

2. Water source - integrity[1]	Natural Mineral Water	Spring Water	Table Water
Nominate responsible person(s)	Yes	Yes	Yes
Survey source characteristics[2]	Yes	Yes	Yes
Establish source vunerability profile (SVP)	Yes	Yes	Yes
Establish source variability			
- based on source protection	Yes	Yes	Possibly
- based on source selection	Not applicable	Not applicable	Possibly
- based on source treatment	Not allowed	Possibly	Possibly
Review source management strategy at least every 12 months	Yes	Yes	Yes

3. Water source - development	Natural Mineral Water	Spring Water	Table Water
Obtain consents according to legislation in force	Yes	Yes	Yes
Create design to achieve SMS	Yes	Yes	Yes
Employ accredited / quality assured contractors	Yes	Yes	Yes
Supervise construction	Yes	Yes	Yes
Check materials are food grade, suitable for use with water	Yes	Yes	Yes
Review bacteriological characteristics of materials	Yes	Yes	Yes

1. Water source in this checklist means the origin of the product water. This may be boreholes or spring capture works for Natural Mineral Spring Water and/or Table Water (including the public supply).

2. Source characteristics for a borehole or spring capture works will include catchment identification, hydrogeology, chemistry and microbiology. For a public supply, source characteristics will include identifying the supplying treatment works and network, chemistry and disinfection residuals.

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4. Water source - operation	Natural Mineral Water	Spring Water	Table Water
Establish Critical Control Points (CCPs) - Physical treatment	Yes	Yes	Yes
Establish CCPs - purification	Not allowed		
Establish CCPs - natural bacteriology	Yes	Possibly	Possibly
Monitor and report at required frequency	Yes	Possibly	Possibly

5. Bottling and packing - development	Natural Mineral Water	Spring Water	Table Water
Carry out hazard analysis of conceptual design	Yes	Yes	Yes
Prepare design to maximise benefit of hazard analysis and incorporate			
good manufacturing practice	Yes	Yes	Yes
Check materials are food grade, suitable for use with water	Yes	Yes	Yes
Review bacteriological characteristics of materials	Yes	Yes	Yes
Employ accredited / quality assured contractors	Yes	Yes	Yes
Supervise construction	Yes	Yes	Yes

6. Bottling and packing - materials	Natural Mineral Water	Spring Water	Table Water
Agree detailed specifications with suppliers	Yes	Yes	Yes
Carry out supplier assessment	Yes	Yes	Yes
Carry out hazard analysis of handling and storage	Yes	Yes	Yes
Vet supplier compliance records	Yes	Yes	Yes
Audit supplier compliance	Yes	Yes	Yes

7. Bottling and packing - operations	Natural Mineral Water	Spring Water	Table Water
Plant hygiene - follow 'Guidelines to Good Hygiene Practice'	Yes	Yes	Yes
Carry out hazard analysis[3]	Yes	Yes	Yes
Establish CCPs and monitoring schedule[3]	Yes	Yes	Yes
Monitor CCPs[3]	Yes	Yes	Yes
Sample and test from source through all stages of production	Yes	Yes	Yes
Sample and test product at end of line	Yes	Yes	Yes
Sample finished product for shelf life testing	Yes	Yes	Yes
Create programme for and carry out shelf life testing	Yes	Yes	Yes
Create detailed product specifications	Yes	Yes	Yes
Operate positive release[4]	Yes	Yes	Yes
Maintain documentation system in force:			
- document control / issue - modifications	Yes	Yes	Yes
- records of tests / inspections	Yes	Yes	Yes

8. Post production	Natural Mineral Water	Spring Water	Table Water
Employ accredited / quality assured distribution agents / contractors, assess			
and audit outside warehousing	Yes	Yes	Yes
Operate consumer complaints system	Yes	Yes	Yes
Monitor product quality in the market place	Yes	Yes	Yes
Prepare and audit recall plan	Yes	Yes	Yes

9. Labelling	Natural Mineral Water	Spring Water	Table Water
Clearly label type of water	Yes	Yes	Yes
Include composition according to current requirements	Yes	Possibly	Possibly
Include source, location, place of bottling, brand name, best before, batch			
mark, contact details, volume, date and time of manufacture, all			
according to current labelling requirements	Yes	Yes	Yes
Product coding to identify date, time and line of bottling	Yes	Yes	Yes

3. This is a legal requirement under the Food Safety Act and Food Hygiene Regulations

4. This means having a formal procedure to clear production once all test results are available

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10. General	Natural Mineral Water	Spring Water	Table Water
Apply quality management system based on hazard analysis	Yes	Yes	Yes
Operate system of quality auditing			
- Internal	Yes	Yes	Yes
- External	Yes	Yes	Yes
- Third party	Yes	Yes	Yes

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5 BWCA procedure for cooler sanitisation

All water coolers must be fully sanitised prior to first installation and not installed from the factory box. Cooler sanitisation is required on an average of a 13-week schedule by the water cooler company. If the end-consumer is unwilling to bear the cost of sanitisation, then the BWCA supplier to the customer must furnish the customer with the appropriate BWCA leaflet "Water Cooler Sanitisation Service".

The water cooler company should furnish the end-consumer with the BWCA booklet "Essential Care of your Cooler". At all stages of delivery the water cooler must:

- be properly and effectively wrapped in cling-film or similar material to reduce or prevent the risk of contamination
- be kept clean
- be handled with care and in such a manner as to reduce or prevent any damage to the shrink wrapping

All sanitisation operatives must have received formal and appropriate hygiene training.

Off-site sanitisation must be done in an area where there is compliance with the requirements of the Food Safety Act, 1990 or any subsequent and relevant legislation. Cleaning and sanitising of the water cooler must follow the BWCA "Guidelines for Sanitising Operatives"

The date and time of the cleaning and sanitisation must be entered on a permanent record card and either kept on the water cooler or in some other place so that the sanitisation record can be inspected and certified by an independent third party. All sanitising operatives must be properly equipped with adequate non-toxic cleaning and disinfection materials and supplies.

Different water coolers may require different treatments and this must be allowed for in cleaning instructions with reference to manufacture and model type.

Supervision and spot checks on sanitisation facilities and on the standard of on-site sanitisation will be effected by the National Sanitisation Foundation or such other Inspection Service as shall be approved from time to time by the BWCA, to visit in-house sanitisation facilities and to audit water coolers on location at regular intervals.

For greater detail please refer to the BWCA Technical Manual.

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