



European
Commission



Materials coming into contact
with drinking water

At home

What to watch out for?

Environment

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More information on <http://ec.europa.eu>

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1 Introduction

1.1 Scope and field of application of this guide

When materials are in contact with drinking water, impurities can leach into the water, modifying its wholesomeness. As a result, products that involve these materials may cause a significant risk to human health or may deteriorate drinking water taste and odour. Private water systems can be affected by these risks if they are not designed, maintained or controlled in the same way than public water supplies. This guide provides advice and information for the protection of the private part of the drinking water supply network, the domestic distribution system (see figure below).

The public water network, belonging to the water supplier, usually stops at the entrance of the household or, more precisely, at the water meter or the connection's stop valve. The part of the service pipe from the connection point – usually the stop valve – to the use endpoint (tap, shower, etc.) is the responsibility of the property owner, including his kitchen or bathroom plumbing.

All the plumbing inside home till the use tap (kitchen, shower...), is the responsibility of the property owner.

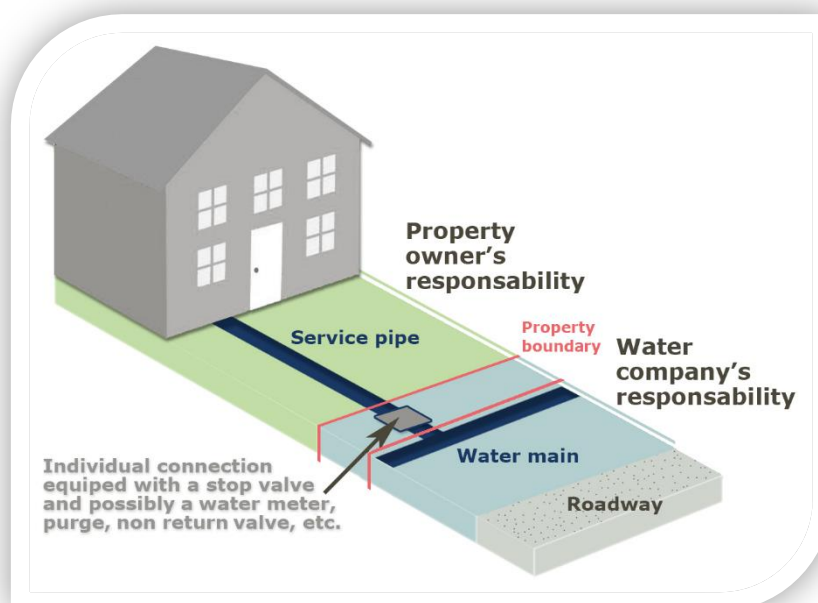


Figure 1: Public and private part of the drinking water network

Within the domestic distribution system, water is in contact with multiple materials and products, many of which are installed permanently for a long lifetime. These may impact on water quality by releasing undesirable or toxic compounds, supporting microbial contamination, or impairing taste and odour.

Manufacturers are responsible for the launch of products put on the market. Householders or installers, users of these products, are responsible for product choice and installation.

The design of good plumbing facilities must be based on an understanding of the technical requirements and relevant regulatory restrictions.

Qualified installers should be preferred to insure installation, repairs and other works on domestic drinking water systems.

This guide can be used as a tool for users for refurbishing, repairing or expanding the domestic water system, and for any suitable maintenance with the aim of assuring in the long run the hygienic suitability of the domestic drinking water distribution system.

The right terms: Substances, Materials and Products

To understand the following parts of this guide, some key concepts have to be delineated, namely what are substances, materials and products:

Substances are chemical elements and their compounds, natural or manufactured, including additives or impurities. They can be harmless but they also can modify the characteristics of water. A material can be made from one or several substances. A product is usually made of various materials, each one including several substances.

Materials are prepared from a substance (or mixture of substances) suitable for use in a manufacturing process. Materials types used for drinking water supply are, usually, metallic (iron, stainless steel, copper, etc.), organic (plastics as PVC, HDPE, rubbers, coatings, etc.) or cement based.

Products are clearly identified manufactured items, in their finished form, or component parts of a manufactured item. Products are usually made with various materials (each one including various substances) and may be composed of multiple components, such as O-rings, body, spout, aerator, seals, etc. The types of products used in drinking water supply include single material products, assembled products, multi-layered products, site applied products, etc. Products put in contact with cold or hot drinking water should be compliant with such usage, so as not to involve any risk to the water user. This means that every component in contact with water has to be safe, controlled and regulated.



EXAMPLE WITH A PRODUCT: THE TAP

Product: tap

Material: body made with brass

Substances: copper, zinc, etc.

In fact, various components are included in a single tap, each one having its own materials and substances: the tap's body, but also the valve, rubber O-rings, plastic filters or spouts, adaptors, etc.

Rather than the product itself, materials coming into contact with drinking water, even in small components as rubbers, have to be checked to confirm that the product is safe. The composition of metallic materials is easy to identify, since they contain one or more metals in certain proportions. Plastics and rubbers are considered as "organic materials". These polymers are made from a variety of substances (monomers and additives like stabilisers). Cement based materials usually contain various non-mineral substances mixed in the product or added. In addition to the intentionally added substances, different reaction products and impurities are present in the final materials. Without the knowledge of the added substances, it is difficult to identify the substances present in the final product.

If hoses, pipes, fittings, taps and valves are easy to identify, some products are less visible for non-specialists, while their interaction with water can be significant: coatings, gaskets, but also

water heaters/coolers, water meters, filters, treatment devices, domestic tanks linings, sealants, pumps, repair clamps and collars, etc.

Water systems practitioners and users may be aware that many materials having been installed in the past are still installed and used today, even if their use is discouraged or prohibited. The case of lead pipes is well known: limit of lead concentration in drinking water is set by DWD (10 µg/L), requiring, in most case, the complete replacement of lead pipes. But it can be less known that lead compounds can be used in plastics or epoxy resins, or metallic alloys and solders.

Users should check the compliance of the product for the expected use (drinking water, hot/cold water, etc.) by reading manufacturers' instructions or product factsheets.

1.2 Why a European guide on materials in contact with drinking water?

Impacts of EU legislation for products that are used in homes and premises

Drinking Water is not similar to a commercial product. Its high quality is essential for public health and human well-being, and the related trade market involves many stakeholders.

On average, a citizen needs up to 150 litres of drinking water per day for all kind of personal uses, of which nearly 2 litres are used for drinking.

To supply each consumer with safe water, public authorities have to ensure water resource protection, the water treatment and supply of water in public water systems. Drinking water has to be protected in terms of health, but also in terms of its aesthetic parameters, such

its treaties to protect human health. The European Commission Drinking Water Directive¹ (DWD) regulating the quality of water for human consumption has led to the availability of high-quality drinking water across the EU. Joint efforts from EU institutions, Member States (MS) and drinking water service providers have resulted in high compliance rates with the drinking water standards proposed by the DWD, at the user's point of connection to the public water network.

According to the DWD, the certain substances or materials used for drinking water treatment or distribution require rules to avoid possible harmful effects on human health. The potential risks for human health is not the only

What is the Drinking Water Directive?

Council Directive 98/83/EC is often referred to as the Drinking Water Directive (DWD).

The DWD applies from the source to the tap, including treatment, materials and products used in contact with water used for drinking, cooking, food preparation, and other domestic purposes.

Separate regulations and Directives are also related to materials used for drinking water, as Food or Construction Products regulations.

The DWD sets out an obligation for European Union Member States (MS) to protect human health against any deterioration of water quality, possibly related to materials in contact with drinking water. Essential quality standards are set at EU level: microbiological, chemical, physical and aesthetic parameters (taste, odour, colour, etc.).

In each MS, national or local authorities can set standards higher than those of DWD, or include additional requirements relevant within their territory. MS are nevertheless not allowed to set lower standards as the level of protection of human health should be the same within the whole European Union.

as taste, odour, appearance and colour.

At the European level, there are several regulations to reach the goals fixed in

¹ More information on Directive (98/83/CE):

<http://eur-lex.europa.eu/legal-content/FR/TXT/?uri=celex:31998L0083> or <http://eur-lex.europa.eu/legal-content/FR/TXT/?uri=URISERV%3A128079>

matter: drinking water has to be wholesome and clean. This also includes its aesthetic aspects, also named "organoleptic parameters", as taste, odour or colour.

EU Member States adapted their legislation to reach these goals. This leads to various national approaches and rules.

National legislations and regulation authorities

European Member States developed national requirements setting what is allowed or what is prohibited, for public water distribution, and for installers or householders.

National legislation is generally based on the principles that materials in contact with drinking water should not involve any risk for human health and should not significantly modify the chemical, microbiological, physical or organoleptic properties of the water.

Since 2007 a group of Member States of European Union, called the "4MS": including France, Germany, the Netherlands, United Kingdom, is working together in order to develop a

common approach and converge their requirements to facilitate mutual recognition of 'approved' substances. More recently, Portugal and Italy joined it. These countries also target to adopt similar testing methods, with the intention of reaching the DWD demand. Although the 4MS cooperate together, their approaches are not yet identical.

Right2Water initiative and public consultation

A European Citizens' Initiative (ECI) called "Right2Water" was submitted to the European Commission (EC) on December 2013, after having received the support from more than 1.6 million citizens.

It invited the EC "to propose legislation implementing the human right to water and sanitation, as recognised by the United Nations, and promoting the provision of water and sanitation as essential public services for all". The EC performed a public consultation to assess the necessity to regulate certain aspects of drinking water at the EU level. Harmonised regulation of the materials in contact with drinking water reached the highest score in the priorities expressed by the citizens.

Household

Companies in charge of the design and installation of drinking water system in households (construction companies, plumbers, etc.) should ensure they comply with relevant regulations and use good practice within European standards, to avoid improper installations and inappropriate products

and materials that would affect the quality of water. Both installers and users should be aware of errors to avoid, and regular upkeep needed for the domestic drinking water system. When choosing a new product, it is the responsibility of the user to check that the product is compatible with the drinking water provided locally.

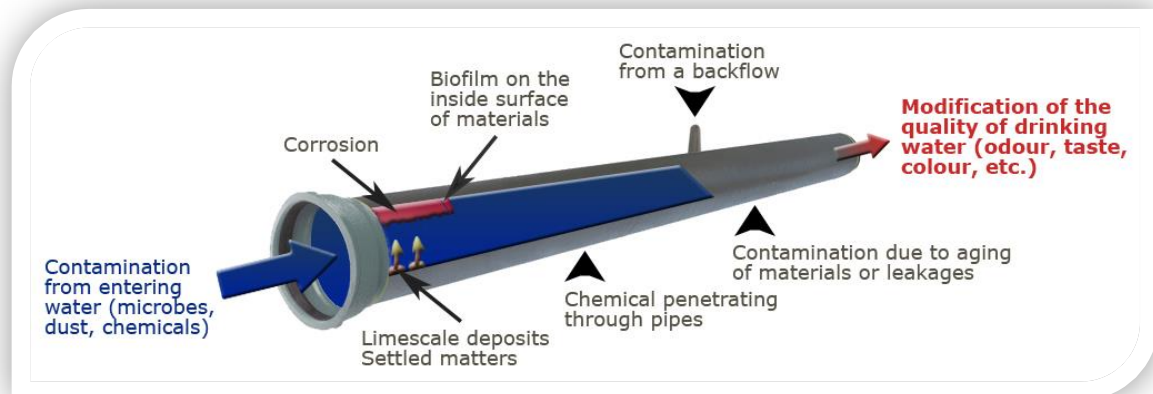


Figure 2: Drinking water network, a reactive environment
(inspired by Levi, 1995)

2 Wholesomeness of drinking water: health and aesthetic aspects

Water supply, treatment and distribution have to protect water quality from various possible contaminants, and from other possible deteriorations of water quality (taste, odour, etc.).

From the collection point – that can be groundwater, river, spring, etc. – to the private connection, where there is usually a stop valve and/or a water meter, water safety is handled by a water authority, whether it's a public or a private company. This supplier is responsible for the water quality upstream from the connection point. Downstream of this, it is the responsibility of the household owner.

Your domestic water system (plumbing) can affect your water quality, even small components, as o-rings or gaskets, can affect the quality of water. Therefore, you can find below some of the key risks set out.

There are differences between public water supply and household drinking water installations, especially in buildings, which leads to different risks.

In household installations:

- ◆ Many different products are involved such as water heater, drinking water reservoir, pipes, valves, backflow preventer, taps, shower head and so on. All these products are made of different materials;
- ◆ The surface of materials in contact with water compared to the volume of transported water is higher;
- ◆ The stagnation of water is related to the usage of the building; this can favour release of unwanted substances if water system was designed for a use greater than it actually is.

These specificity of household drinking water systems may lead to specific risks.

WHAT IS A CONTAMINANT?

A contaminant is an unwanted constituent of drinking water which, because of its concentration, amount or number, causes adverse health effects or deteriorates water quality. Contamination can be physical (as temperature), chemical (as lead) or biological (as a microbe).

TIP!

Drinking water should be maintained everywhere in your private system below 25°C for cold water and above 50°C to 55°C at the tap for hot water. Pipes insulation can help to maintain an appropriate temperature.

Beyond described contamination risks, presence of an odour or flavour should be prevented in drinking water: even if it may not necessarily involve any health effect, it affects the quality of water and, as a consequence, affects the user.

Contaminants leaching from inappropriate materials

A material put in contact with drinking water, which is not designed for this use, may release unwanted substances. Moreover, some materials may interact with other materials or with water composition. Materials can cause a risk of contamination related to unwanted substances or to microbial growth.

Even if water distributed by the local water authority is safe and compliant with national and European requirements, its quality can be adversely changed as it flows through the domestic water network.

These substances can directly affect human health or can enhance microbial growth in drinking water systems. The figure 3 on the next page illustrates an inappropriate material used in a tap, resulting in a thick biofilm on the surface.

Hazards and diseases caused by microbes

Poorly managed building water systems are prone to microbial growth within the pipes and on components such as washers, thermostatic mixing valves and outlets, stagnation and dead legs (see figure 4).

Microbial growth is enhanced by some factors:

- ◆ Lack of temperature control: mid warm water between 25°C and 50°C is favourable to bacteria, as Legionella or other bacteria that may harm human health;
- ◆ Stagnation and low water flow;
- ◆ Suspended matter (and especially organic ones) entering in the pipes, can be considered as "food", enhancing the microbial growth; moreover it will produce sludge deposits;
- ◆ Substances released from inappropriate materials;
- ◆ Lack of cleaning and maintenance of filters, aerators, or generally places where suspended matter and scale

accu-
mu-
late.

A BIOFILM IN MY PIPES?

Inside the water network - pipes or fittings - microbes can develop on surfaces. Dust entering the water system, stagnant water, rust or organic materials, like plasticizers, may encourage microorganism's growth, producing the "biofilm". Biofilm is a layer formed by bacteria adhering to solid surface in contact with water. A thin and stable biofilm is not a threat for water quality or materials. Concern arises when these biofilms become too thick and start to disseminate throughout the system.

The biofilm's growth can be reduced by preventing the sources of contamination of water - keeping water cold and limiting diffusion of organic substances from the used materials - and with a regular maintenance of your water system, as cleaning filters or tanks.

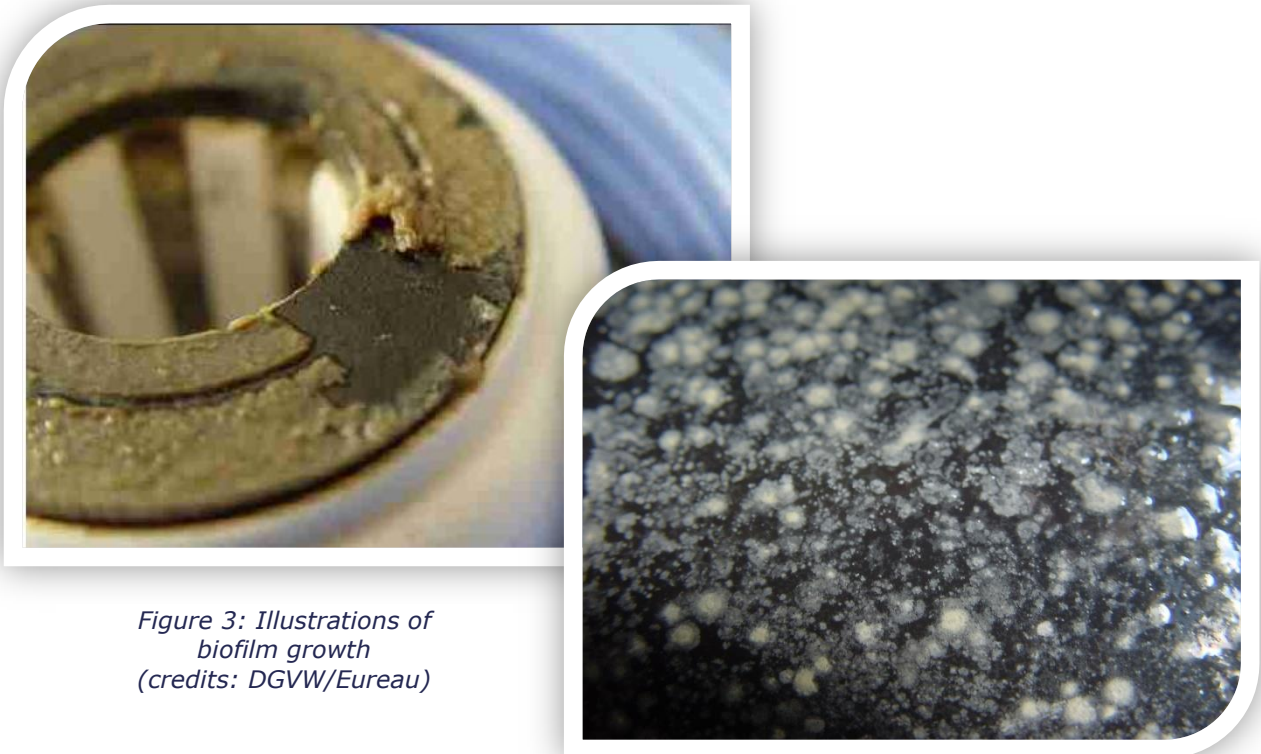


Figure 3: Illustrations of biofilm growth
(credits: DGVW/Eureau)

Risks due to an external pollution

Dust, germs, or other substances may enter the water system when it has not been cleaned after alterations or other changes to the existing system are made, or when the water has direct contact with the atmosphere, for example, if a water cistern does not have a cover.

Moreover, pollution may occur with a backflow, if contaminated water is drawn back into the drinking water system through:

- ◆ backflow from domestic devices;
- ◆ cross-connection between various water sources (rain water, well...);
- ◆ leaking fitting.

One part of the domestic drinking water system can be laid underground. With the aging and the ground motion,

pipes and junctions can be damaged. In such a case, a contamination can enter in the drinking water system from the soil.

Where there is contaminated land, barrier pipes should be used, as some materials can allow penetration of hydrocarbon through pipes, especially if they are laid in hydrocarbon polluted soils (leaking fuel tank, oil...). Penetration or leaching of hydrocarbon through pipes should be avoided.

TIP!

CLEAN WORKS

Working on the drinking water system, every material or product in contact with drinking water have to be hygienic, to prevent organic matter entering your pipes.

Disinfection of the pipes and fittings, for example with chlorinated products, may be more effective than a simple flushing. Do not forget to flush after disinfection, because this water may not be suitable for drinking and highly chlorinated products may damage materials, especially metallic ones.

Materials should in every case be fit for purpose. Thus information on the soil properties are very useful for choosing the right product.

Care should also be taken in how pipes are stored, so that soil or other contamination does not enter the pipe before installation.

Responsibility of the plumber

Depending on each country, certifications or accreditation for drinking water usage are provided by the national authorities. For example, in France, a sanitary compliance certification (Attestation de Conformité Sanitaire, ACS) is required for any products installed in contact with drinking water that have at least one organic component.

You will find, in chapter 5, a table where the main national authorities and competent bodies are identified. Users must be aware of tests and certification, to ensure these tests are adapted for drinking water usage. European or national standards have to be checked, keeping in mind the conditions of use: a product can comply with a European Norm (EN) which does not target a drinking water usage.

The combination of products and materials such as pipes, valves, and taps may cause a significant risk to human health because of various mechanisms which occur inside the system. The installer of the product might be recognised responsible for possible disorders or problems when combining these products and it is therefore necessary to make them aware of the overall situation and good practices.

Plumbers should be appropriately qualified and have the competence and knowledge to design, install and maintain plumbing systems. Plumbers play a key role in managing risks by ensuring that the product complies with applicable standards and regulation.

The design of good plumbing facilities must be based on an understanding of the technical requirements and relevant regulatory restrictions. Qualified installers should be preferred to insure installation, repairs and other works on domestic drinking water systems.



3 Advices to install, use and maintain your water system

In designing and constructing new domestic distribution systems, specific actions should be focused on minimizing sources of hazards (e.g. stagnant water, cross contamination, long branch pipes and dead legs), as well as facilitating access for monitoring and maintenance.

On the other hand, in case of existing domestic distribution system, it is important to be aware that in the past,

water systems in buildings and homes were generally designed with limited attention to prevent and control risks to public health.

The following paragraphs indicate basic criteria and practices to control risks related to materials and products in contact with drinking water in new domestic distribution systems and in existing ones.

3.1 Good installation practices

The right size: not too large, not too small

Installation of drinking water system have to be smart and based on the needs of the users: over-sizing is a common mistake. Oversizing will increase the time water spends inside the plumbing system before being used (the retention time) which will increase the risk of microbial growth or substances release.

When the water network has a limited size, celerity of water may damage the pipes and joints and cause leaks.

Pipe materials, as other devices, have to be chosen to fit with their specific performance requirements. The significance of pipes and

fittings for drinking water quality depends on flow and stagnation.

Flow and pressure have to be sufficient for taps, showers, and water domestic appliances but an excess of pressure may damage the plumbing, releasing unwanted substances.

If hydraulic calculation and system design have been correctly performed, the water network should not make neither unwanted noises - water hammer phenomenon - nor variations of flow and temperature when various taps or valves are opened.

Working on drinking water systems

If you have to repair or toughen up your drinking water installations, your work has to be clean and in proper hygienic conditions. Products have to be delivered and stored in hygienic conditions, too. To prevent pollution you should work as clean and quick as possible.

Reduce retention time and avoid stagnation

The more the water is in contact with materials, the more its quality may be affected. When water stays a long time inside the pipes, microorganisms may proliferate and substances may be released. Therefore, while designing a household water system, professionals shall take care of limiting as far as possible the pipes length and the time period water will stay in contact with materials.

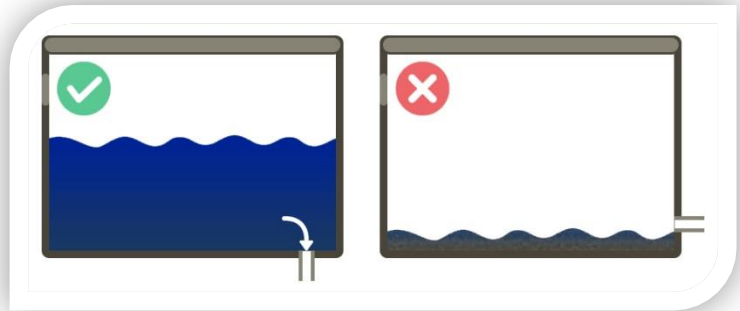


Figure 5: A drain tap may allow a complete emptying

Stagnant water, long branch pipes, and dead legs are to be avoided for all water. The over sizing of the hot water system is also to be avoided.

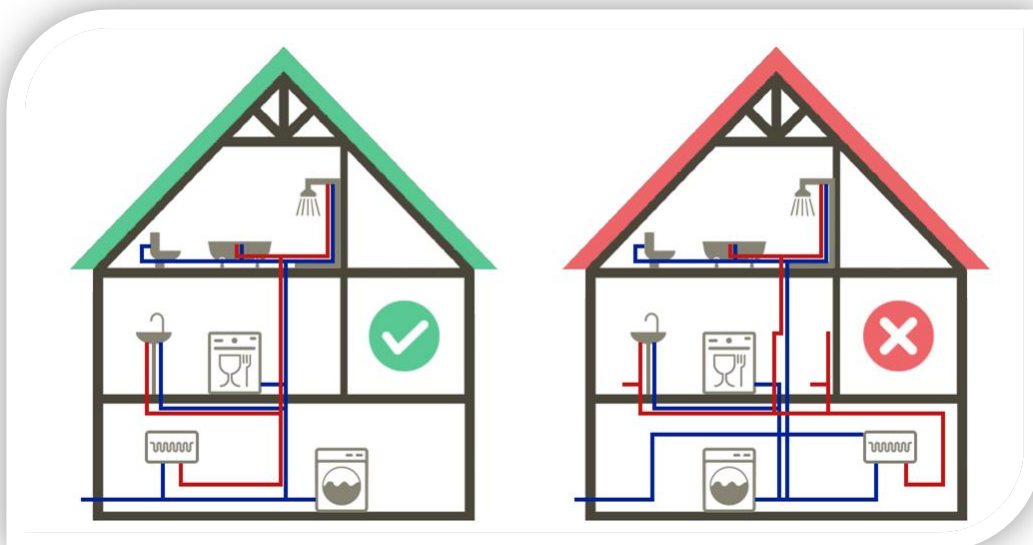


Figure 4: A good installation (left side) may limit the length of pipes

When a water system has been poorly designed and involves high retention times or dead legs, the water system has to be flushed from time to time. Therefore, a purging device should be installed at low point of the network.

Water storages, as household water tank, have to be equipped with a drain tap situated at the lowest point, to flush the deposits that may have been formed with time (see figure below).

Separate devices from the drinking water

Back-siphonage may occur with domestic devices using water (washing machine, dish washer, water heater, etc.). Those devices may include materials that are not provided for a drinking water use (flexibles hoses, rubber vessels, etc.). All domestic devices may be disconnected from the drinking water system, with a check valve for example. Suitable backflow prevention devices may be defined in national requirements.

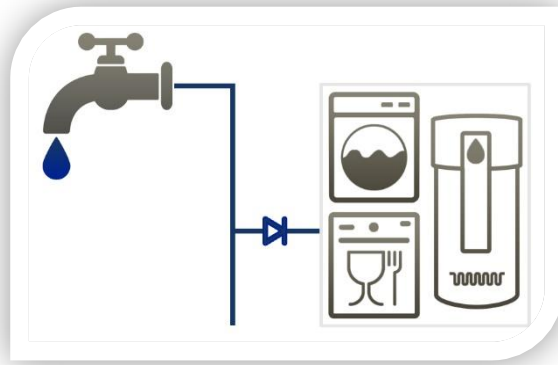


Figure 6: Domestic appliances may be separated from drinking water with a check valve or a disconnection device

TIP!

AWAY FROM HOME? DON'T FORGET YOUR WATER SYSTEM!

When you leave home for a long duration you probably close your private water connection, to protect it from a possible leakage. But when you are back home after a long duration, you may also check your water network: run the taps for a few minutes to purge the volume of water that may have stagnated in the pipes and reduce its possible stale taste.

The toilet cistern may also be properly installed, to ensure no siphoning back into the water system.

Identify and separate the various water systems

Contamination may arise from a cross connection, between various usage of water: drinking water (cold / hot), heating circuit, rain water, water from a private source (well, spring), recycled water, firefighting water circuit or even wastewater!

It is recommended that every circuit is clearly identified: colours, labels, signals for unsafe water quality, or a precise map of the circuits may avoid such mistakes. Some countries have standards which set out marking requirements.

Drinking water shall be connected strictly with wholesome water devices

(taps, showers). Any other devices or circuit have to be separated with a suitable backflow prevention device depending on the level of risk or, even better, no connection at all.

Hot water and cold water circuits may be separated. Hot water should be protected with thermal insulation to keep cold drinking water's temperature low and reduce the risk of condensation and microbiological growth. Hot water pipe should be installed at a suitable distance above cold water pipes.

TIP!

PREVENTING FROM BACKFLOW

To prevent the water from backflow out of domestic devices in the drinking water system, the use of protection devices is indispensable. The European standard EN 1717 deals with the means to be used to prevent the pollution of potable water inside premises and the general requirements of protection devices to avoid pollution by backflow.

3.2 Good practices for existing domestic distribution systems

It is important to gain any possible knowledge of the physical features of water systems including characteristics of water network and components.

Some information and data may be acquired by the previous property owner, by the manager of the building or by professional plumbers operating on the building.

The information on the system are useful to assess possible risks related to materials and products in contact with drinking water, particularly including:

- ◆ design of the system that may cause water stagnation, such as long branch pipes, and dead legs, especially for warm water;
- ◆ materials and products, including pipes, joints, tanks, appliances, home treatment devices, etc. with focus on possible prohibited materials, especially lead;
- ◆ age of system and components, as well as the characteristics of water that may increase risk of corrosion;
- ◆ characteristics of distributed water, including aesthetic features (colour of water, odour, flavour, rust, etc.) and – where necessary – chemical and microbiological quality.

LEAD: IS MY WATER AT RISK?

Lead in drinking water can be released by corroding pipes. Many regulatory authorities of European Union Member States are recommending to the consumers potentially affected by risk of lead in drinking water due to old distribution system, to assess water quality.

As an example, the Italian Institute of Lead recommends, in any case of suspected presence of lead in the domestic water system, the user to carry out a chemical analysis of water sampled after a prescribed long stagnation time (at least 4 hours); thus, the results of concentration of lead in water may define the "worst case scenario" of potential lead exposure through the consumption of drinking water.

The latter should be assessed by laboratory tests on water. In this case, suitable sampling procedures (e.g. after water stagnation or by applying controlled flushing conditions, etc.) should be applied depending on the aim of investigation (e.g. microbiological or chemical analysis). Laboratories qualified in water analyses should be contacted for specific instructions.

TIP!

EXTRAORDINARY MAINTENANCE OF WATER SYSTEM IN CASE OF PERSISTENT CONTAMINATION

In case of a serious chemical or microbiological contamination of your water system, it could be useful to scrub its internal surface by running a mixture of water-air into the pipeline while taps are kept open for drainage. The introduction of the mixture may be conveniently performed using a commercial device consisting of an air-compressor, a water inlet from a pressurized water tank or pipe, an electronically controlled mixer and an outlet to be connected to the contaminated pipeline. The flow should be continued until water becomes clear and colourless.

Before starting this operation, remember to disconnect all technological devices that may be present (e.g. washing machine, dishwasher, etc.).

3.3 Advice for good usage of your water system

Taste, smell, colour: the aesthetic aspects are indicators of the quality of water. Abnormal changes shall be a concern, to prevent from any risk for health.

TIP!

HOW TO REDUCE THE "CHLORINE" TASTE?

If you find your water has an unpleasant taste of chlorine, a good solution is to put a jug of tap water in the fridge. This will naturally reduce any chlorine smell or taste. Cover the jug and use within 24 hours to prevent microorganism growth.

example.

Is there chlorine in drinking water, and why?

Microorganisms are naturally present in raw water. Many of them are harmless for human health but some can cause diseases. Disinfection may be performed, by the water supplier, during purification treatments.

In some countries, chlorine is added in water to keep it protected against microorganisms. To protect water quality in the pipes network, a small quantity of chlorine can be present from the water treatment plant until the tap.

An excessive concentration of chlorine can modify the taste of water and interact with materials that are sensible to oxidation: metals may rust more quickly and some plastic polymers may release more substances.

The correct level of chlorine is set by the national authority and controlled by the local water authority. In some countries, disinfection is limited to some cases or even not required, as in Germany or in The Netherlands, for

TIP!

A WATER FILTER NEEDS MAINTENANCE

To reduce taste of water, many types of filters are available (on the domestic plumbing, on taps, for jugs, etc.). Do not forget to read and apply the manufacturer's instructions: cartridge have maximum duration of use. They may require regular maintenance. They may be damaged, or split, and release particles. Filters only last for a limited time: they should be replaced after their lifespan is over.

Tastes and odours associated with water

Some materials may cause an unwanted odour or taste for water. A wide range of materials are associated with tastes and odours including vegetable oils, solvents, coal tar linings, rubbers used in flexible hoses, some plastics or epoxy, adhesives and cements, lubricants and sealants, etc. This can be caused by pipes or fittings that are not designed for a drinking water use or that have not been properly stored or installed, but other appliances like dishwashers or washing machines may also generate backflows in the drinking water system.

To prevent these problems, an installer may:

- ◆ Ensure that every fitting connected to the drinking water tap is only for drinking water use;
- ◆ Ensure water from appliances cannot return in the drinking water system, by using an appropriate backflow prevention device.

Water colour

When a repair has been performed on the public water supply, or in a building outside private homes, water at home could have a brown or orange colour.

TIP!

YOUR WATER DEVICES ALSO NEEDS MAINTENANCE!

Aerators, showers, but also every filter should be cleaned regularly to avoid accumulation of materials and microorganisms growth.

If there is lime scale deposits, damping in a very weak acid, like vinegar, or coffee machine maintenance product, can dissolve the scale residue. Do not forget to rinse after treatment.

Keep the tap open for a few minutes: if water is still not clear, you may ask your neighbours if they have the same issue. In this case, you should contact the local water authority for more information and, depending on their advice, not use water for drinking: it could be contaminated and unsafe. Doing laundry may be avoided so as not to cause stains.

If the neighbourhood doesn't have this problem, the issue is probably located on your domestic water network.

If water has a cloudy or white appearance, this can be related to fine air bubbles. Keep water in a transparent jug or glass: air bubbles will escape from the bottom upwards in a few minutes. On the other hand, if the colour is caused by matters that settle down in a deposit at the bottom, you may contact the local water authority for more information.

What is the right temperature?

Microbial growth is encouraged by some conditions: warm and stable temperature, suspended matters - used as food by microbes - and rough surfaces or settlements.

Water treatment, upstream to the public water system, do include a filtration to retain suspended matters, and sometimes disinfection – usually with chlorinated products – to kill bacteria and other microorganisms.

Materials in contact with the drinking water in the public water system are regulated to control the microbial growth. All conditions are created and maintained to protect water against microbial growth. But as water stays a long time in pipes, the effect of disinfection lowers, deposits may appear on surfaces and microorganisms may grow again.

LEGIONELLA: KEEP HOT WATER HOT

Legionella is a pneumonia related to bacteria living in warm water (see figure 7). Usually, the cause of their growth can be found in the processing conditions or the design of the hot water system.

When hot water is sprinkled during a shower, Legionella may cause lungs related diseases. As for many bacteria issue, Legionella growth is enhanced by a lack of maintenance and by materials releasing of degradable substances: rubbers for example, but also poorly installed joints, poorly maintained filters or lime scale residues.

It's recommended to keep hot water temperatures high throughout the system (above 55°C at the tap, 60°C in the boiler). In case of Legionella present in the water system, especially if users are vulnerable to contamination (elderly or frail people), disinfection may be performed – chemical or thermic disinfection. Checking compliances of the chosen procedure with the water system's characteristics is necessary, as some materials may be damaged by heat or chemicals used.

Cold water (less than 15 to 20°C) and hot water (above 55°C) will limit bacteria's growth. But in warm temperatures between these values, some microorganisms can grow, causing a change in the taste of water or even causing diseases.

Faulty mixing taps which allow backflow of water between hot and cold water, or taps equipped with a hand shower where warm water stagnate, may increase the risk of bacterial growth.

To protect hot water circuit, temperature around 55°C should be reached at the point of use, but it is also necessary to ensure no injuries can be caused by hot water.



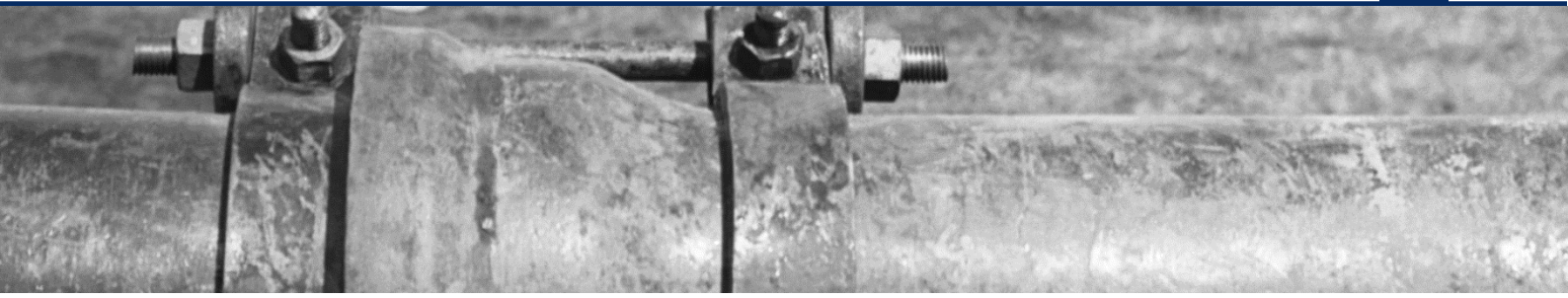
Figure 7: Legionella (credits: CDC Public Health Image Library)

Key issues of the drinking water installations usage and works:

1. Drinking water must flow (preferably no stagnation).
2. Cold drinking water has to be cold (< 25 °C).
3. Hot drinking water has to be hot (> 50 to 55°C at the tap).
4. Knowledge of your own installations and premises.
5. Protecting the drinking water quality with protection devices: no possible intrusion, no leakages, back flow prevention, no cross-connections.
6. Right sizing for drinking water installations (not too large, not too small).
7. Use of products suitable for use in drinking water.
8. Work clean and quick to reduce the risk of contamination.
9. Work on drinking water systems only if you know what you do.

How to choose a product in contact with drinking water:

1. Enquire for the distributed water's characteristics and local regulation related to drinking water.
2. Shape what you expect from the product and what will be its conditions of use.
3. Carefully read the product factsheet: conditions of use, installation, expected performance of the product, needed maintenance or consumables, etc.
4. If relevant in your country, look for the certification for a drinking water usage.
5. Stylish and innovative design is not the only criteria for a good choice: do not install a product for a use which it is not designed for.
6. Qualified installers should be preferred to insure installation, repairs and other works on domestic drinking water systems. Inadequate product or techniques can have adverse effects on the consumer's health.



4 Avoiding incompatible products

4.1 Compatibility with water characteristics

Water quality varies from place to place in Europe and - even more locally - from a region or a city to another. Water is sometimes

qualified as "hard" or "soft" water, or even aggressive, scale water ... What should be kept in mind when choosing materials for the water facilities?

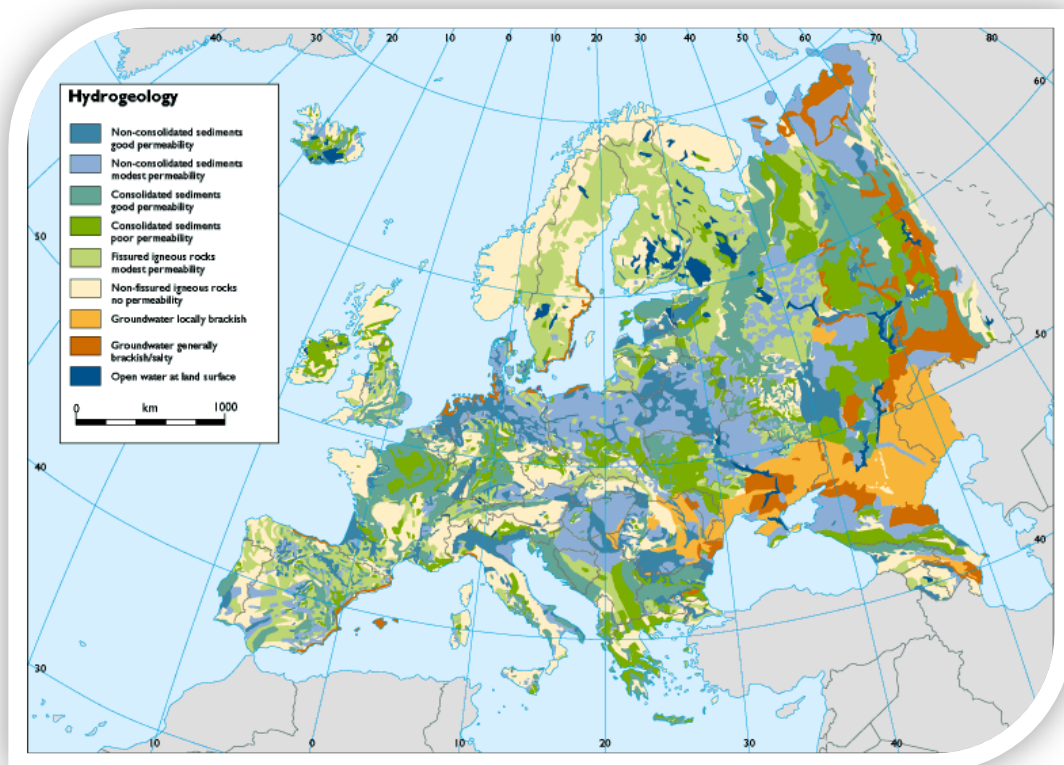


Figure 8: The hydrogeology map of Europe shows the diversity of situations of groundwater in the various areas. (source: Europe's Environment - The Dobris Assessment 1995)

When rain water falls on the ground, it's almost free of minerals. It's "pure" water. Before reaching the aquatic environment and the water collection system (a river, a pit, a lake, etc.), the water picks up minerals from the soil or the rocks. When a certain quantity of minerals is reached, water is said to be balanced. This quantity of minerals to reach the balance (mainly calcium and magnesium), is related to water pH, which measures if water is acid, alkali or neutral, and it's related to water temperature.

When you boil water, temperature rises and the water balance is changed. Less minerals can stay dissolved in the water, the "unbalanced" minerals settle: you can see white residues in spans, glasses or boilers. The more scales appear, the more your water is "hard", or limewater.

If the water has an insufficient rate of minerals, it's called "soft water". If the balance is too low and more minerals are needed to reach the balance, water can be "aggressive": it picks up some minerals along its way in soil or in pipes to reach the balance.

In fact, the aggressiveness of water is related to many parameters like pH, carbonates or organic substances. The figure hereby shows a simplified illustration: the range of situations of

TIP!

HARDNESS MEASUREMENT: WHAT TO LOOK FOR?

Test kits can be purchased to measure hardness of water, but the water analysis provided by your water company generally specify water hardness.

Various parameters can be measured to define hardness: HCO_3^- (carbonates), Ca (calcium), Mg (magnesium), alkalinity, total hardness, etc.

The hardness measurement can be expressed with many possible units that are not identical: mg/l, ppm, gpg, English, French or German degree, etc.

aggressiveness or hardness of water is in fact more complicated.

Some materials are more vulnerable to this aggressiveness and they may release substances in the water to keep the balance.

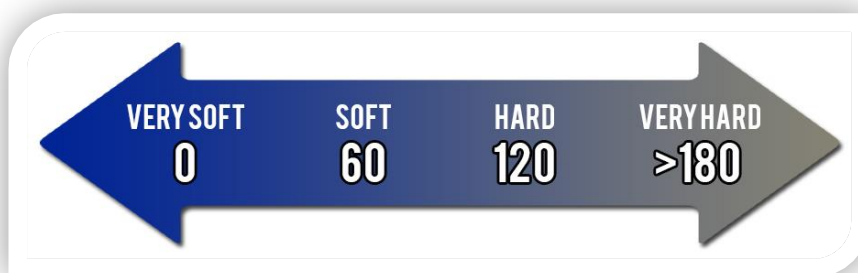


Figure 9: Hardness of water (values in calcium carbonate mg/L, many other units can be used)

What is the effect of using hard water or soft water?

- ◆ Soap, shampoo, cleaning detergents do produce less lather when used in **hard water** conditions: more product is needed for the same result ;
- ◆ Clothes that have been washed and dried are less rough if **soft water** is used ;
- ◆ Spans, glasses may have white spots and residues due to hard water ;
- ◆ **Hard water** do produce white scale residues in pipes, aerators, valves, etc. The settling is enhanced when water temperature varies: boilers, heaters, mixing tap, dish washer or washing machines may be affected. The scale sheet may reduce the energetic efficiency of these appliances;
- ◆ Regarding health, whatever the hardness, drinking water provided by the public water supplier has to comply legal requirements. It is therefore safe and do not need be treated at household level;
- ◆ **Hard water** has a different flavour than **soft water**... but the effect on human health is limited, except in cases of specific diseases related to minerals or salt. High levels of scale, hard water, can be a source of calcium or magnesium for your body, but a limited one, nutrient from food are a more important source.

How to prevent and maintain?

Hard water may increase energy costs of the water heating systems. Pipes flow may become reduced with scale. Tap, valves, aerators or showers may be affected too by these residues.

In these cases, maintenance should be performed: for appliances that can be removed (aerators, showers, filters) they can be damped in a weak acid (like vinegar) for a few hours, this will remove scale residues.

For non-removable parts like pipes, to prevent lime deposits, domestic drinking water systems can be equipped with a specific treatment system: the softener. This device should only be used when hardness do cause a real problem for the water system. It has to be chosen with care: softeners need maintenance, some are not to be recommended for users with sodium-restriction issues and, for oversized devices, retention time in the device can cause bacteria to develop. If water characteristics do not imply hardness related issues, such appliances may not be needed. When such a device is needed, it can be preferable to install a softener only on the hot water circuit, or on the water circuit involved in hardness related problems.

Choosing a new product

Before installing a new product, the plumber shall check whether the product is fit for expected use and conditions, especially fit for a drinking water usage. The conditions may include the quality of water that will be in contact with the product during its use: its temperature, aggressiveness or softness, or even presence of disinfection products, as chlorine, may be checked, to confirm its compliance with the chosen product.

When choosing a new product, it is the responsibility of the user to check that the product is compatible with the drinking water provided locally. Water utilities can give information on quality of the provided water. Additionally, water analysis can be

asked to a qualified laboratory to measure specific parameters and corrosion likelihood.

The conditions of installation of the product has to be specified in the product's factsheet. Most of the new products are provided dry and protected against contamination with, for example, a protective cap. These products may be installed in dry and clean conditions, not to permit any contamination during installation. The water system may be flushed (valves open) after installation, to clean the system for any particles due to installation or residues present on product inner, before putting it into service. Taps aerators may be removed before rinsing, to allow an efficient

cleaning.

If installation cannot be performed in dry conditions, the product can have been contaminated with organic matters. It needs to be cleaned, preferably with a disinfectant product, and rinsed before installation.

A material weakness can be increased during storage, installation or operations (low or high temperature, crushing, fire, chemical degradation, etc.), it is therefore important to specify pipes that are designed for the purpose they are being installed for. For example, some materials can be affected by disinfectants such as chlorine used in drinking water systems,

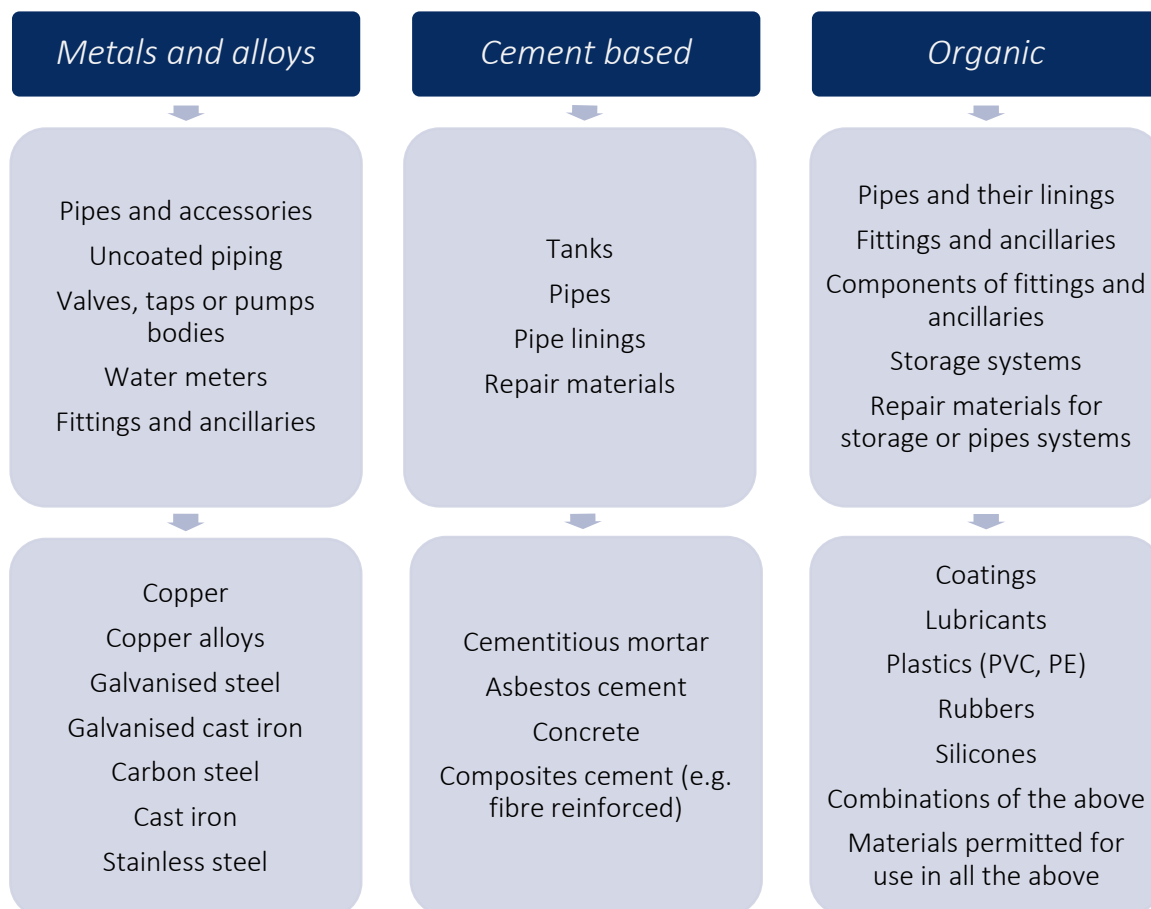


Figure 10: Diversity of products and materials that may be in contact with drinking water

METALS AND WATER QUALITY EXAMPLE IN DENMARK

In Denmark, the materials are chosen according to the water quality in the geographical area of installation. The rules given below summarise the basic applications related especially to hydrogen carbonate content:

Material	Parameter	Admitted range
Hot dip galvanised steel	HCO_3^- (mg/L)	100 to 300
Copper	HCO_3^- (mg/L)	100 to 240
Stainless steel	Cl^- (mg/L)	< 150/250

Source: *Effect of material and water quality on disinfection and risks of corrosion*, L.R. Hilbert, H.J. Albrechtsen, A. Andersen

others remain unaffected and are perfectly reliable when exposed to chemicals like chlorine.

Beware: materials for cold water are not all compliant for hot water.

Products in contact with hot water (pipes, taps for example) are more vulnerable and their components should not release unwanted substances. Plastic pipes and fittings are marked for

the end-use application, e.g. Hot & Cold drinking water or heating systems, as prescribed in relevant product standards. The European product standards specify application classes (hot water at 60 or 70°C, under floor low-temperature, and high temperature radiator heating). The marking reflects the basic characteristics of the product. For more specific explanation on hydraulic performance and heat conductivity for example, please refer to the manufacturer's technical documentation.

4.2 Poor practices to avoid

Thanks to existing regulation systems, tests are performed on materials put on the market to protect the consumer's against health hazards. For drinking water use, these tests do insure materials are adequate for a drinking water usage.

A wide range of materials can be potential sources of chemicals through corrosion, including pipes, solders and fittings. Corrosive water may



Figure 11: Development of rust and microbial growth in a cast iron pipe. Here, example on a public main pipe. (Source: KWR)

"pick up" some materials. This corrosion may enhance releases of unwanted substances (as zinc, copper or lead used in alloys or solders).

High levels of chlorine can corrode metal: rust can appear and weaken metal. These metals should be protected from direct contact with drinking water, for example with an inside coating designed for this use.

Plastics polymer pipes or fittings are used widely for distribution systems and domestic installations. Depending on the type of polymer (PVC, PR, HDPE, PEX, etc.), some of these materials are susceptible to release unwanted substances.

As some materials can be damaged by UV from sun light, they should not be placed directly in open air, and the conditions required for storage have to be applied. A technical factsheet may be provided when looking for installation of a new appliance, or product used for repair.

Hydrophobic compounds can migrate through some types of plastic piping. These materials may not be placed in soil contaminated with hydrocarbons. Storing or using hydrocarbons or solvents close to plastic piping that is porous to hydrophobic compounds can contaminate drinking-water. Storing such products in boiler rooms can lead to increased migration of organic substances due to elevated temperatures.



Figure 12: The galvanic scale

Take care when heating a material

For metals, the composition of materials that will be put in contact with drinking water, including solders, should be controlled to check their compliance with European and national requirements. For example, there may be restrictions on the percentage of lead or nickel in materials, to make them compliant.

Moreover, when soldering, it is necessary to clean extremity of tubes (with wire wool) and remove components like joints or valves which could be damaged by temperature. After installation, the system should be purged, i.e. filling of the system and letting water flow out via tap closest to the intervention for some minutes, to prevent particles and impurities from entering in the drinking water system.

Some pipes contain either cementitious or organic inner linings, usually for corrosion protection, that are the actual materials in contact with drinking water.

Solvent cementing for plastic pipes

Polymer put in contact with water, such as glue or coating, have to be compliant with drinking water use, as well as the type of water admissible if relevant. When water is stored in a tank before distribution, practitioners have to check that material put in contact directly or not with drinking water is safe: this includes all materials where condensation or freezing can occur, including for example the roof, a manhole, or the aeration system.

For some polymer plastic materials, like PVC, heating may be avoided for junctions. Some plastics can be welded with heat, but specific temperatures and duration have to be carefully controlled with a specific tool. The product factsheet has to be carefully followed.

Galvanic/electrolytic corrosion

When installing a new water system with various metallic compounds, it's recommended to keep in mind the risks of interactions between materials: the galvanic series have to be respected. When two metals are in contact with the same water, the less noble material (down the following scale) may be subject to galvanic corrosion.

When corrosion occurs, the material loses its strength. The lifespan is reduced, leakage may appear but, furthermore, corrosion may release unwanted substances, or change surface properties including creating obstacle to flow. Microorganisms may grow in the corroded parts, and hydraulic flow may be slowed down by this frictional loss.

Coal tar or bitumen coatings

In the past, coal tar was a common coating material for water pipes and tanks, used to give effective protection against corrosion.

In those pipes or tanks, after a stagnation of drinking-water or after repair work, increased levels of Polycyclic Aromatic Hydrocarbons (PAHs) were detected in the water. PAH are suspected to be related to health risks.

However, these materials are rarely installed in domestic household systems. Moreover, water samples taken during a study in the Netherlands showed that PAH concentration in drinking water systems in general is limited, even in the case of coal tar and bitumen coatings, implying a low concern for the consumer's health.

Bisphenol A (BPA)

Bisphenol A (BPA) is a chemical substance used in the creation of plastic containers for food/water, plastic pipes and epoxy lining. It is suspected to cause adverse health effects.

Epoxy linings can be used to protect water tanks, as a component of products installed or for rehabilitation of older installations. Small diameters pipes, like those used for domestic systems, are not suitable for epoxy on site linings.

BPA is authorised for drinking water under specific conditions. Migration tests on a material designed for a drinking water use, are performed to ensure that BPA does not migrate into the water and does not involve a risk for health. BPA free materials are available on the market, but it is often difficult to guarantee 100% BPA-free, as materials often entail traces that are hard to avoid.

Vinyl Chloride Monomer (VCM)

PVC pipes that have been produced in the past were susceptible to release Vinyl Chloride Monomer (VCM) in water. VCM may cause adverse health effects.

In public drinking water systems, presence of VCM is monitored and kept under safe limits by the water suppliers. Drinking Water Directive sets out the admitted value of Vinyl chloride at 0,5 µg/L².

PVC manufacturers have improved their process and pipes installed after the 1980s should not be affected.

PEX pipes

PEX or **XLPE**, is a form of polyethylene with cross-links currently used in cold water and hot water pipework. Homeowners may report a flavour in the water transport by this type of material. There are various types of PEX and methods to produce this material. To prevent any complaint from the water user, it is recommended that you check the material or product using this PEX is compliant with national regulations for the targeted usage (drinking water, cold or hot, etc.)

² The parametric value refers to the residual monomer concentration in the water as calculated according to specifications of the maximum release from the corresponding polymer in contact with the water (Source Annexe 1, DWD (98/83/EC))

**Users, Plumbers,
What do you have to do?**

New installation	Refurbishing or extension
<p><u>Plan the installation</u></p> <ol style="list-style-type: none"> 1. What are the needs and expected use (pressure, flow, hot/cold...)? 2. What is required for facilities of drinking water in the buildings (European, national, local)? 3. Have you checked good/poor practices (avoiding stagnation, reducing warm water, etc.)? 4. Have you checked compatibility between materials, products, and the water quality? 	<p><u>Check your drinking water system and act</u></p> <ol style="list-style-type: none"> 1. Check your existing water network condition (pipes, joints, tanks, appliances, including hot water, raw water, etc....)? 2. What is the lifespan of your system's components? Is there prohibited materials (lead, etc.)? 3. Check the signs of damages on your installation (colour of water, odour, flavour, rust)? 4. Does it respect the good/bad practices (avoiding stagnation, reducing warm water, etc.)? 5. Does your system comply with the needs/uses and water characteristics?



REQUIREMENTS AND INFORMATION

<p><u>Control materials, substances, products before installation:</u></p> <ol style="list-style-type: none"> 1. Check if your country has a <u>certification scheme</u> for products and materials in contact with drinking water, as for example OVGW in Austria, GDV in Denmark, ACS in France, DVGW in Germany, Swedcert in Sweden, Kiwa in The Netherland, WRAS in the UK, etc. (see table below). 2. Check international, European, national standards related to the needs:ISO, EN, NF (France), BS (UK), DIN (Germany)... 3. Read instruction and safety information for the installation of materials and products in the expected conditions. 	<p><u>Installation and maintenance</u></p> <ol style="list-style-type: none"> 1. Follow the manufacturer's requirements for installation. 2. Respect condition of use of materials. 3. Check and maintain the network in accordance with the manufacturer's instructions.
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A sustainable drinking water system in your house, in compliance with regulation, standards, and expected use conditions, will enhance your safety.





5 Where to find further information?

Plumbers and householders should check manufacturers' installation guidance and product factsheets and take them into account, to ensure any product is compliant with expected

5.1 Typology of standards

A standard³ is a **non-compulsory**, technical specification defined by a standardization body for repeated or continuous application. Several standards are described in various fields (environment, industry, security...) at various scales on the territory (national, European, international). Standards can be developed by regulatory bodies, corporations, unions or associations.

- ◆ **International standards** are developed and adopted by the International Organisation for Standardisation are marked "ISO"⁴;
- ◆ **European standards** are adopted by the European standardisation organisations. The European Committee for Standardization (CEN) develops standards, marked EN (European Norm). A European Standard (EN) automatically becomes a national standard in each member country.
- ◆ **National standards** are adopted by the recognised organisation body in

standards and regulations for how the product will be installed and used.

the country. As an example, French standards are marked NF ("Norme Française") and adopted by AFNOR ("Association Française de Normalisation")⁵.

- ◆ A national standard which complies with European standards is marked "EN" added to the national standard; as for example French national standard will be marked:
NF EN XXXX.

³ Standard is defined in Regulation (EU) No 1025/2012

⁴ Other independent international standards organizations (ASME, ASTM, IEEE, etc.) do develop and publish standards for various international uses.

⁵ BS for British Standards, DIN for Deutsches Institut für Normung, etc.

TIP!**RELEVANT STANDARDS AND TESTS**

Looking for a standard on a product, is not looking for any standard: several topics are covered with norms. For example, ISO 9001 is quality management system and ISO 14 001 is environmental management system; these standards are applied to the company, not to the product.

As a standard is voluntary and restricted to a specific use, when choosing a product or material in contact with drinking water, it's preferable to look for certifications required in your country (see table below)

When a product is said to be "Tested by a laboratory" it may be preferable to check what kind of laboratory and what tests were performed. To be sure of the quality of testing, you may look for an

5.2 CE marking

The CE marking indicates that products or materials are declared to comply with EU legislation, but not necessarily for sanitary aspects. As there is currently a lack of harmonization on EU standards directly in relation to product compliance for drinking water contact, CE marking does not mean the product is adapted to drinking water use.

Currently, there is no CE marking for products in contact with drinking water. The CE marking can be found on products for other usages than drinking water: heating circuit, waste water, etc.

The CE marking affixed⁶ on products or packaging and accompanying document have to be similar to the hereby illustration.

If CE marking is an essential information on the product, it does not absolve for observing the manufacturer's conditions of installation and use. It does not indicate that the product was produced in the EU⁷.



⁶ The definition, the format and the general principle of the CE marking are in Regulation (EU) 2017/745 on design of medical devices, and in Regulation (EU) 2017/746 on design of machinery, assessment procedures that lead to its affixing

⁷ Please note that a CE marking does not indicate that a product has been approved as safe by the EU or by another authority. It does not indicate the origin of a product neither.












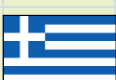




5.3 National authorities where to find more information and main quality marks













Some EU Member States established schemes for the approval of materials and products, and these may include an associated 'quality mark'. Various certification systems exist, with possibly recognition between some Member

States. Some schemes for the approval of materials are mandatory whereas others are voluntary means for a manufacturer to demonstrate compliance with national requirements. The main ones are summarized below.



Figure 14: Examples of logos of competent bodies and certification schemes. These logos are not necessarily printed on compliant products as many of them do represent a national agency, not a marking.

Member States		National legislation		Competent body & where to look for information (list is not all inclusive)	
Austria		Federal Ministry of Health	www.bmgf.gv.at	ÖVGW Österreichische Vereinigung für das Gas- und Wasserfach Accepted certification: DVGW, Kiwa	www.ovgw.at
Belgium		Public Service of Wallonia Flemish Environment Agency	www.wallonie.be https://vmm.be	BELGAQUA Belgian Federation for the Water Sector Accepted certification: DVGW	www.belgaqua.be
Bulgaria		Ministry of Health	www.mh.government.bg	DVGW accepted	
Croatia		Croatian Waters		DVGW accepted	
Cyprus		Ministry of Health	www.moh.gov.cy		
Czech Republic		National Institute of Public Health	www.szu.cz	DVGW accepted	
Denmark		Ministry in charge of Transport and Building	www.trm.dk	GDV Godkendt til Drikkevand	www.godkendttildrikkevand.dk
Estonia		Ministry of social affairs	www.sm.ee	Health Board, Environmental Health Department	www.terviseamet.ee
Finland		Ministry of Environment	www.ymparisto.fi	VTT Technical Research Centre of Finland	www.vttresearch.com
France		Ministry of Social Affairs, Health and Women Rights	http://social-sante.gouv.fr	ANSES - Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail Accepted certifications: ACS, CLP, CAS	http://bit.ly/2bLBcYu
Germany		Federal Ministry of Health	www.bmg.bund.de	UBA Umweltbundesamt DVGW Deutscher Verein des Gas- und Wasserfaches	www.umweltbundesamt.de www.dvgw.de
Greece		Ministry of Health	www.moh.gov.gr		
Hungary		Centre of National Public Health	http://oki.antsz.hu	DVGW accepted	
Ireland		Environmental Protection Agency	www.epa.ie		
Italy		Ministry of Health	www.salute.gov.it	National Institute of Health (ISS) DVGW accepted	www.iss.it
Latvia		Ministry of Agriculture	www.zm.gov.lv	DVGW accepted	

Member States		National legislation		Competent body & where to look for information (list is not all inclusive)	
Lithuania		State Food and Veterinary Service	www.vmt.lt	DVGW accepted	
Luxembourg		Administration of water management	www.eau.public.lu	DVGW accepted	
Malta		Environmental Health Directorate	http://health.gov.mt		
Poland		Sanitary Inspectorate	http://gis.gov.pl	PZH Panstwowy Zaklad Higieny	www.pzh.gov.pl
Portugal		Water and Waste Services Regulation Authority	www.ersar.pt	INSA Instituto Nacional de Saude	www.insa.pt
Romania		Ministry of Health	www.ms.ro	DVGW accepted	
Slovakia		Ministry of Health	www.health.gov.sk	Public Health Authority of the Slovak Republic	www.uvzsr.sk
Slovenia		Ministry of Health	www.mz.gov.si	National Institute of Public Health of the Republic of Slovenia	www.ivz.si
Spain		Ministry of Health, Social Services and Equality	www.msssi.gob.es	Asociación Española de Normalización y Certificación	www.aenor.es
Sweden		National Food Agency	www.livsmedelsverket.se	SWEDCERT (Kiwa) DVGW accepted	www.kiwa.se
The Netherlands		Ministry of infrastructure and the environment	www.government.nl	Kiwa Nederland	www.kiwa.nl
United Kingdom		Secretary of State for the Environment Food and Rural Affairs (England) Ministries and assemblies for Wales, North. Ireland and Scotland	www.gov.uk	Public water systems: Drinking Water Inspectorate <i>Household level:</i> WRAS Water Regulations Advisory Scheme KIWA UK	www.dwi.gov.uk www.wras.co.uk www.kiwa.co.uk

APPENDICE

Current EU legislation relating to materials and substances in contact with drinking water

Legislation	Purpose of legislation
Drinking Water Directive (DWD) Council Directive 98/83/EC	To ensure that materials and substances used in preparation or distribution of drinking water do not release dangerous substances into drinking water or substances which have an otherwise negative impact on drinking water
Construction Products Regulation (CPR) Regulation (EU) No 305/2011	To ensure that construction works do not release dangerous substances into drinking water or substances which have an otherwise negative impact on drinking water.
Biocidal Products Regulation (BPR) Council Directive 89/106/EEC	To ensure that biocidal products and residues in contact with drinking water do not have unacceptable effects on human or animal health,
Food Contact Materials (FCMs) Regulation (EC) No 1935/2004 Regulation (EC) No 2023/2006	To ensure that FCMs do not release their constituents into food at levels harmful to human health or change food composition, taste and odour in an unacceptable way. The FCM regulations specifically say these exclude drinking water. However, products that are not permanently attached to the water supply, such as water coolers, are covered by food legislation in some MS (e.g. Denmark) and not drinking water regulation.
Substances of Very High Concern (SVHC) Regulation (EC) No 1907/2006 (REACH)	Regulating the use of substances that pose hazards with serious consequences, e.g. causing cancer or are bio accumulating.
Movement of goods Regulation (EC) No 764/2008 Regulation (EC) No 765/2008	Strengthen the functioning of the internal market by improving the free movement of goods and setting out requirements for accreditation and market surveillance relating to the marketing of products.
Gas Appliance Directive (GAD) Directive 2009/142/EC	To ensure that gas appliances and fittings do not compromise the safety of persons, domestic animals and property.
Low Voltage Directive (LVD) 2014/35/EU	To ensure that electrical equipment within certain voltage limits provides a high level of protection for European citizens, and benefits fully from the Single Market. Electrical equipment under the LVD covers a wide range of consumer and professional products e.g. household appliances, cables, power supply units, laser equipment and some components such as fuses.
Ecodesign Directive 2009/125/EC	To establish a framework for the setting of ecodesign requirements for energy-related products with a significant potential for the reduction of energy. Includes taps showers and pumps.

