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Water, Drinking Water, and Water Protection

Drinking water treatment

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More than 95% of the drinking water in Germany is supplied centrally by municipal or private water companies. A small share is supplied by smaller facilities that produce less than 1,000 m³ per year, and up to 2 million Germans are estimated to be supplied by their own domestic well. Over 70% of drinking water is from groundwater or bank filtrate. Although this water usually already has very good quality, treatment is necessary in some regions in order to remove iron and manganese, or to improve its technical suitability for distribution, e.g. through softening. Furthermore, disinfection may be necessary. For surface water, technical rules require treatment as a general principle.

Treatment procedures usually begin with removal of particles, often by flocculation and filtration, sometimes enhanced by pre-oxidation, or by membrane technologies. Membrane can be used to filter very small particles. Oxidation, ion exchange, and activated carbon treatments remove dissolved substances. Bank filtration and slow sand filtration are two particularly environmentally sustainable drinking water treatment techniques that avoid the use of chemicals and combine, usually quite effectively, particle removal and pollutant breakdown (the latter by microorganisms in the sediment). Bank Filtration describes the process during which surface water is infiltrated due to a natural hydraulic gradient or due to a depression cone caused by an abstraction well. For Slow Sand Filtration surface water is used directly to load an adjusted filter.

Research performed by the Federal Environmental Agency

The focus of the Federal Environment Agency's approach to drinking water treatment is to optimise its hygienic safety while minimising environmental impacts resulting from the treatment procedure.

The focal areas of the Federal Environment Agency's current research projects on drinking water treatment procedures are:

1. riverbank filtration and slow sand filtration,
2. biological iron and manganese removal,
3. chemical disinfection.

For this research, the Federal Environment Agency (Umweltbundesamt – UBA) conducts field observations and laboratory experiments. In particular, it combines these with experiments using its own technical scale facilities which simulate treatment procedures, thus bridging the gap between unrealistically simple laboratory conditions and realistic, but poorly defined and controlled field conditions. This approach provides results and conclusions on the efficacy of treatment procedures which are as realistic as possible.

A major experimental facility is a test site for bank and slow sand filtration (*SIMULAF*), consisting of a pond with a volume of approx. 3,000 m³ in which ground water is conditioned to assume surface water characteristics and then infiltrates into a sand and gravel layer, simulating passage through the underground. In addition, it is possible to simulate both industrial scale slow sand filtration as well as artificial groundwater recharge in four infiltration ponds. The entire facility is separated from surrounding groundwater by a layer of clay, which allows experiments with hazardous substances to be carried out without the latter being discharged to the environment. The facility has been in use since 1999 for a variety of experiments, largely through externally funded projects and co-operation with external research institutes. (The latest were on the elimination of cyanotoxins and viruses and on assessing the hygienic safety of small bathing ponds.)

A basic element of the Agency's technical-scale facilities is a waterworks which extracts groundwater, uses a biological process to remove iron and manganese, and if necessary applies further treatment to provide any quality needed for the experiments. For de-central drinking water supply systems, UBA has developed and tested small-scale biological iron and manganese removal systems. Further, it has tested the efficiency of this process in removing other pollutants (arsenic and uranium). The objective of this work is to promote biological treatment processes as alternatives to chemical treatment.

Law enforcements by the Federal Environmental Agency

The [List of treatment substances and disinfection processes as per § 11 of German Drinking water Ordinance \(TrinkwV 2001\)](#) PDF / 427 KB, in German is maintained at the Federal Environment Agency on behalf of the Federal Ministry of Health.

Concerning the EU Biocidal Directive, the Federal Environment Agency evaluates the efficacy of active substances which are used for drinking water disinfection.

Disinfection procedures and the associated disinfectants may only be included in the list (see above) if they are sufficiently effective. The test to establish whether sufficient efficacy exists is performed on the Federal Environment Agency's test rig. The guidance for the test is described in [Quantitative determination of the efficacy of substances for disinfection in drinking water treatment PDF / 355 KB](#).

The test does not have to be performed at the Federal Environment Agency, but can also be carried out on corresponding test facilities at other institutes according to the above test determination.

However, Treatment substances should only be added for specific hygienic or technical reasons, limiting application to the minimum volumes that are absolutely necessary for achieving the targeted effect (principle of minimisation) and only under conditions optimizing their efficacy. The list is regularly updated and adapted in keeping with technological advances. This process is based on broad participation by public authorities, experts and stakeholder associations.

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