Mass water supply

In 2009, 9.73 million inhabitants, i.e. 92.8% of the total number of inhabitants, were supplied with water supplies in the Czech Republic. In 2009, the highest proportion of inhabitants supplied with drinking water from water supply systems was in the Capital City of Prague (100%) and in the Karlovy Vary Region (98.1%), the lowest proportion of inhabitants supplied with drinking water was in the Pilsen Region (81 .4%) and Central Bohemia (83.5%). [1]

Water by origin

- Precipitation

  Rainwater collected in various types of sumps and retention tanks;

- Superficial

  water from large valley reservoirs, river water, ...

- Underground
  - karst; fissured; infiltrated; diametrical; mineral; medicinal and mixed;
  - water with a free surface – phreatic; with a tense surface (ie under pressure) artesian;
  - water soaked from the surface – vadose; water formed directly in the deep layers of the earth - juvenile.

Water supply systems include local (individual) – 15% and central (collective) sources – 85%. "Drinking water is obtained by treating raw water. Raw water is obtained in the Czech Republic from **underground (about 45%)** or **surface (about 55%)** sources.[2] It is possible to obtain drinking water almost or completely without treatment from some sources - especially subsurface ones. Both physical and chemical methods are used to treat raw water into drinking water. All chemicals used for water treatment must meet strict legal standards. "Drinking water must meet the quality parameters set by decree 252/2004 Coll. and that in the place where it is consumed."

- **Surface waters** are waters naturally occurring on the earth's surface; they do not lose this character if they flow through temporarily covered sections, natural cavities under the earth's surface or in overhead lines
- **Groundwater** is water naturally occurring under the earth's surface in the saturation zone in direct contact with rocks; underground water is also water flowing through underground drainage systems and water in wells.

"Surface and groundwater are not subject to ownership and are not part of or appurtenant to the land on which or under which they occur."[3]

Choice of water source

In the first place, we consider **underground water** (preferably borehole or fissure water); however, the yield of the source is decisive. We can be convinced of it either by ``observing the yield of the spring over several years *or by a ``long-term pumping experiment*. Equally important is a detailed physical, chemical and microbiological analysis of the water.

If we choose **surface**water, artificial water treatment is necessary in most cases, as the quality of surface water fluctuates considerably (both from a physical, chemical and microbiological point of view). Therefore, the most suitable surface water is water from large valley reservoirs - more constant quality. Surface water also has the so-called **self-cleaning ability** - it cleans itself after a certain period of time, if it is not further polluted (dilution, dissolution, sedimentation, aeration of water, revitalization by various organisms, ...)

Surface water purity classes

- **I.a very clean water** - CATHAEROBIC zone
  - the purest water (usually mountain streams);
  - unreliable from a hygienic point of view – accidental fecal pollution can be transmitted over considerable distances; pathogenic microorganisms do not have natural antagonists here;
  - biological self-cleaning ability is very small.
- **I.b pure water** - OLIGOSAPROBNIC zone
  - zone of weak pollution without rot and with perfect mineralization;
  - total number of microorganisms is below 1000/ml;
  - plenty of oxygen, abundance of green organisms.

- **II. polluted water** - MESOSAPROBÍN zone
  - *beta-mesosarobic*
    - sulphates, nitrates appear;
    - almost complete mineralization of organic matter;
    - the number of microorganisms is below 100,000/ml;
  - *alpha-mesosarobic*
    - tumultuous putrefactive processes but there are few oxidation processes;

    - hundreds of thousands of microorganisms in ml;
- **III. heavily polluted water** - POLYSAPROBNIC zone
    - heavily polluted with high molecular weight organic substances;
    - the number of microorganisms exceeds a million/ml;
    - predominant reduction processes;
    - presence of ammonia, methane, sulfane and carbon dioxide;

- **IV. very heavily polluted water** - HYPERSAPROBNIC band
    - mainly waste water from industrial plants that contain toxic substances or other substances in concentrations that make any life impossible.

Bands of hygienic protection

All sources of drinking water have protection zones. "In these protection zones, the conditions of general protection according to the law must be observed. In the sense of this law, the establishment of protection zones is a matter of public interest. In the protection zones, activities that threaten or damage the yield, quality or health of water resources are limited or prohibited. The activities are determined by the water authority." [2]

- **1st degree protection zone**
    - is to ensure the source from immediate pollution from the surroundings;
    - for water reservoirs, which ensure the supply of drinking water, a protective zone applies over the entire surface area and a protective strip of about 100 m, for water courses the protective zone is usually 15 m wide, for groundwater sources a continuous area is usually set aside at a minimum distance of 10 m from collection points.
- **2nd degree inner protection zone**
    - forbidden, e.g. use and storage of harmful substances, application of chemical agents, construction activities - except for equipment related to water pumping and treatment, landscaping, camping, water sports, or in some cases even total entry into the zone;
    - necessary to ensure thorough sanitation of cesspools, cemeteries, ...
    - the territory must be secured against flooding and seepage of polluted water.

- **Outer zone of hygienic protection of the 3rd degree**
    - the entire hydrogeological basin of the groundwater source;
    - prohibition of landfills, discharge of waste water, faeces, radioactive water, ...
    - it is not possible to operate facilities with concentrated infection, rendering plants, slaughterhouses, waste incinerators, ...

Waterworks water treatment

The higher the quality of raw water, the easier it is to treat. Treatment is a complex process that affects the physical, chemical and microbiological properties of water.

- **Clarification** - With the help of added chemicals (aluminum sulfate, ferric chloride or shale green), a **coagulation** occurs. Colloidal micelles have a negative charge - **zeta potential**. The coagulation process can be favorably influenced by the addition of **polycoagulants** (polyvinyl alcohol, polyacrylamide, ...) which increase the adsorption of viruses.

The water is mixed after the addition of chemicals, then **microflakes** are formed, which gradually increase in size by clumping together and capturing other substances suspended in the water. The flakes then settle in the tanks (the whole process takes about 5 hours).

- **Filtration** - "Takes place on sand filters (slow or fast). It is a layer of 90-120 cm of fine clean river sand laid on 60 cm of pebbles and diatomaceous earth."[4]
    - slow flakes – a so-called **filter skin** is gradually formed at the top (from captured suspended particles) which actually filters itself. The filter must therefore be allowed to "work in" for several days after starting. **The filtration effect according to Kabrhel is 7000:1** (for every 7000 microbes, only 1 passes through). However, large areas of filters are needed and also after 2 months at the latest to "cut" the filter skin layer and to "insert" a new filter. **Slow filters can be used for their good effect, especially in the treatment of pure raw water, without prior chemical clarification.**
    - fast filters - gravity, **filter skin** is created from the **remains of coagulant flakes** and the microflakes penetrate deep into the filter bed. Therefore, the water pressure on the filter and the speed can be higher. Filters are cleaned by backwashing with pressurized water and "worked" again within a few hours. The filtering effect is not so perfect.

- **The second stage of water treatment** - only some water plants, consists in the oxidation of organic substances and odors (**ozonization**) and the capture of the remains of these substances on activated carbon.

- **Removal of other unpleasant properties of water** - removal of **iron and manganese** (by conversion to insoluble salts), aggressive **carbonic acid** (using lime), reduction of enormous **hardness water** (using lime or soda, or filtration through ionex), in case of a **lack of fluorine** - possible fluoridation, but now questionable opinions on suitability.

Water protection is carried out with **chlorine gas**. The amount of chlorine is mainly governed by the fact that the water in the distribution pipe always has at least **0.05-0.1 mg of residual chlorine**. **Ozone** or **UV-radiation** is also increasingly used. However, both methods have the disadvantage that the water can become contaminated

again in the pipeline,...

Water storage

Treated water is transported via water supply pumping stations to storage reservoirs, where withdrawal differences are balanced, reserves are created or pressure is equalized. The reservoirs belong to the 1st degree protection zone.

Water transportation

Water is transported from the water reservoirs to the final consumer via the water supply network. The main task of water supply networks is to ensure that water is delivered to the destination in the required quantity and in the appropriate quality. The water supply network ensures the transport of water either by **gravity** (selfdem), or in a **printing** way. The gravity method does not require any energy to operate the pumps, but it is conditioned by the necessary height difference between the reservoir and the consumer. Since the water source is often at the same height as the consumer, the pressure type of water supply is most often used. In this case, overpressure is created using pumps.

Pipelines must be protected from cracking and the possibility of contamination from the surrounding soil. In the course of failures in the supply of gravity water mains, a negative pressure is created in the pipeline - there is a risk of contamination being sucked in.

Water intake

Each consumer is connected to the distribution water line by a water connection. Each connection also includes a water meter shaft, in which a water meter is placed that registers the amount of water supplied. An internal water supply with the required number of outlets is connected to the water supply connection. At this moment, the consumer only needs to open the tap and drinking water is at the destination.

Links

Related Articles

- Drinking water

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