

Organisation Management for a modern water supply

Max Hammerer

Drinking water is the statutory requirements aesthetic and hygienic to provide the customers. In the pipe network, drinking water can be influenced the quality due to chemical, physical and biological processes. These influences are magnified when the water quality and the pipe materials are not coordinated. Often, the network consists of different pipe materials, the age and the condition vary greatly, which reinforced the negative impact.

Common effects are increased roughness in the pipes, water turbidity, rust water, biofilms, bacteria in the water, corrosion and leaks.

The influences of pipelines inside and outside are very different and must be considered on the basis of the local situation (underground, water parameters).

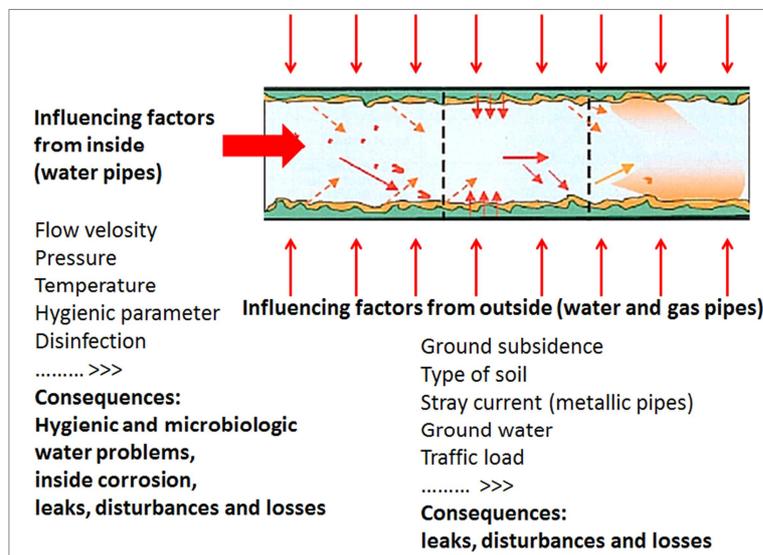


Figure 1 shows the possible influencing factors from inside and outside of the pipes.

Outside influence of pipes

The impact of outside influences are essentially mechanical influences that cause leaks by damage to the surface, or develop forces that bring the pipes to burst. The age of the pipe material or their surfaces and the quality of the assembly also affect the State. This information is found in the course of repair and damage statistics and in the water balance. This condition data are used together with the data from the GIS (dimensions, materials, age, length, etc.) for future target network planning to maintain the pipe and plant substance.

The service life of pipes is limited and laterals must be replaced to maintain the substance of the main pipes and service pipes systematically. The experience of the industry give figures, the life time of pipe systems is about 40-60 years. Actual pipes and fittings used, which can expect a life time of 80 years on average come today after optimistic assumptions. This assumption, however, requires the selection of suitable materials for the local conditions on underground, influencing parameters, water quality and quality planning with construction works to state of the art.

This results in the following procedure for the future planning of the renewal:

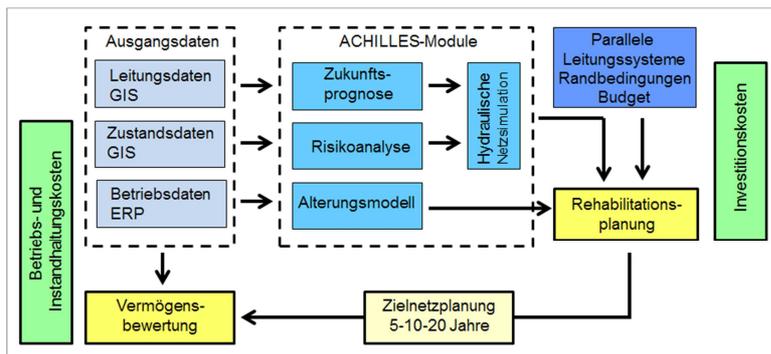


Figure 2 target network planning for replacement/renewal of pipe network systems

Influencing factors from inside of pipes

The inside influences of water pipes are varied and affect the quality of drinking water to consumers. Major influences include biofilm, corrosion, particle entry and physical parameters (pressure, flow, temperature).

Biofilm

Biofilm occurs in all pipes, regardless of the pipe material. The bulk of the biofilm mass mess on the inside wall of the pipe. Water samples give no information where and at what intensity biofilm accumulates. Consequences of biofilm are changes of pipe roughness, brown water and local bio-corrosion. Biofilm is essentially influenced by the ph-value, temperature and the water velocity.

In the long term to prevent biofilm can be achieved by a defined rest content of disinfection, which must be preserved also in end pipes. But this is the risk of premature aging in PE pipes. In unprotected pipes of metal, the corrosion effect is very high. Other risks represent the change of water quality, temperature, flow direction and the flow rate. The listed cases lead to a reinforced germ claim out of the water.

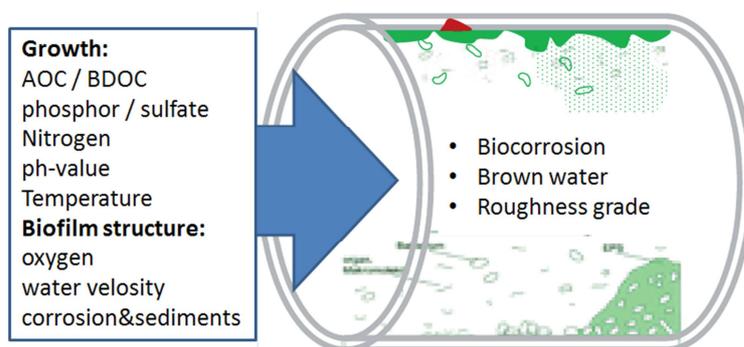


Figure 3 shows the influence factors of the formation of biofilm and impact of microbial activity

Following factors are to be followed:

- stable water quality
- uniform flow velocity
- low water temperature
- use of nutrient-poor pipe materials

Corrosion

State of the art with use of metal pipes is the inside lining using cement. The water industry however have to live for another 50 years with inside unprotected metal pipes until these pipes have reached the end of its life time.

Small problems with corrosion there are under constant operating conditions. The protective top layer of corrosion products and water content materials prevent the progression of corrosion. The reduction of the flow velocity and the residence time of the water in the pipes have particular influences. These effects lead to rust water problems, especially when after minimal water consume there comes a high sampling (night minimum and daily peak of early morning).

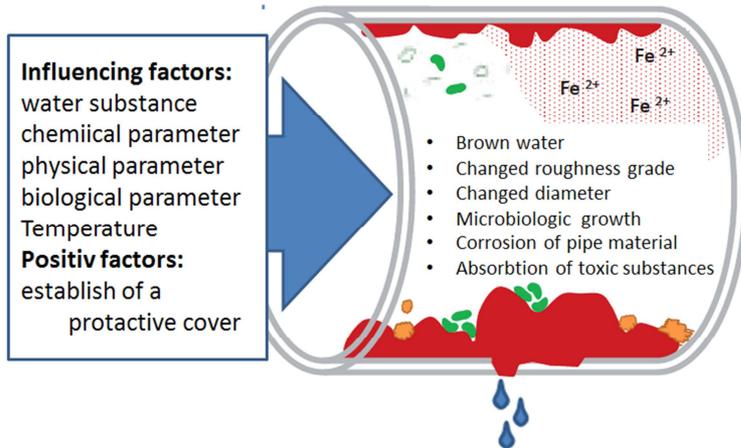


Fig. 4 shows the influences and consequences of corrosion of inside unprotected metal pipes

Attention should be paid to following factors:

- continuous flow velocity of the water
- low neutral salt content
- consistent water quality
- if necessary dosage with corrosion inhibitors

Sediments and turbidity

Particles are inserted through the treated water into the pipe system. Further impurities in construction and repair work are introduced. Even particles are formed by corrosion in metal pipes. The amount of deposits in the pipes depends on the flow rate of the water.

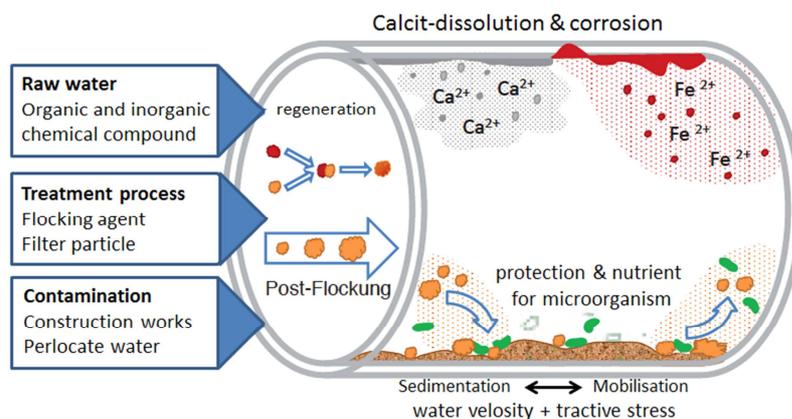


Figure 5 factors and consequences of particle entry from the outside and particle formation in the pipe

Measures are recommended by cleaning or flushing of pipes.

- Cause determination of deposits
- determine the affected pipe sections
- adjustment of the flushing intervals
- mechanical pipe cleaning

The intensity of the flushing must be matched to the quality of the particle deposits so that the protective effect of the deposit towards the pipe material is not destroyed.

A further measure is the subsequent cement mortar lining of existing pipes, as far as this is technically and economically feasible.

Using pipe materials in Germany

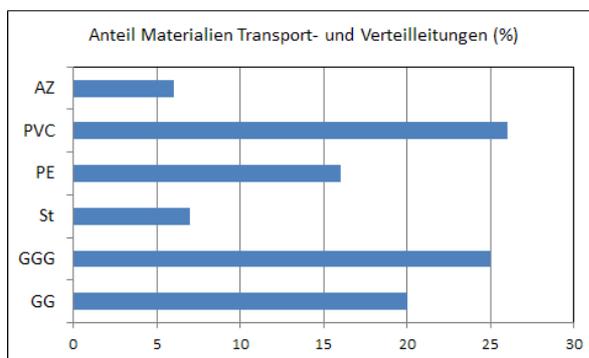


Fig. 6 pipe material supply lines

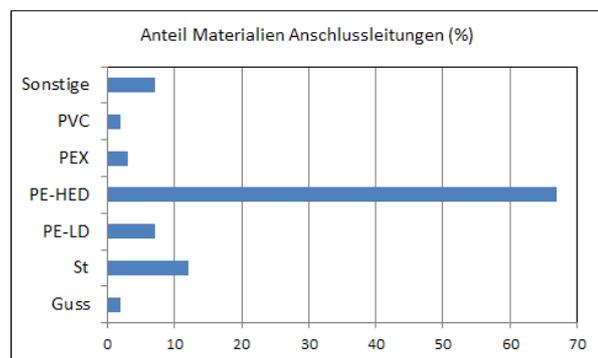


Fig. 7 pipe material house service connections

The proportion of these pipes is increasing through the development of PE pipe. Previous generations of PE materials have problems by using permanent chlorine (embrittlement).

Building installation

The selection of suitable materials is one of the important aspects in the drinking water installation. The materials and products must demands not only various technical and mechanical, but especially also hygienically safes. The industry offers various pipe materials, which must be adjusted according to the usage and on the quality of drinking water.

The following pipe materials are used in detail:

- Zinc-plated steel
- stainless steel
- copper
- plastics (PE in various qualities)

Requirements for the use of pipe materials in the building installation:

- determination of the usage range
- checking the water quality
- determination of the design for the pipe material
- determination of the design installation methods
- consideration physical parameters (temperature, pressure, hardness, disinfection, ultraviolet rays,...)

- consideration of pipe connections and fittings
- technical and hygienic certification of materials

Water tanks (reservoirs)

Reservoir systems for drinking water are mainly made of concrete. Optical and hygienic reasons, floor and walls with cement mortar be covered, tiled, or coated with an organic coating (epoxy resin). Hygienic solution is the coating with mineral mortar without organic additives. The coating with tiles that are embedded in cement mortar without organic additives is equivalent.

Problems for consideration:

- Biological growth and contamination of drinking water with surfaces that are coated with organic materials
- Delivery of components of organic coating materials, if they are not properly coated or not correctly by responding
- Biological growth and contamination of drinking water on surfaces with mineral material, which contain organic additives
- Corrosion on surfaces made of stainless steel. Causes: Use of unsuitable material quality and improper installation

Resumee: Use appropriate materials and high-quality installation.

Technical asset management in drinking water systems

In addition to the technical parameters must be taken into account also hygienic parameters. This is in the future for several reasons required and a major challenge for the future, for the following reasons:

- Energy and water savings through awareness-raising of the population
- demographic change of the population
- climatic influence of environmental by temperature rising
- limited budget situation of the "public" companies
- intensified competition with bottled water
- increased hygienic requirements by the population
- increased maintenance costs of networks and facilities (plants)

For preservation the network and plant substance, the steady maintenance in the form of inspection and maintenance of pipes and plants is required in addition to the compensation renewal, can ensure the specified parameters for quality of care to the consumer.

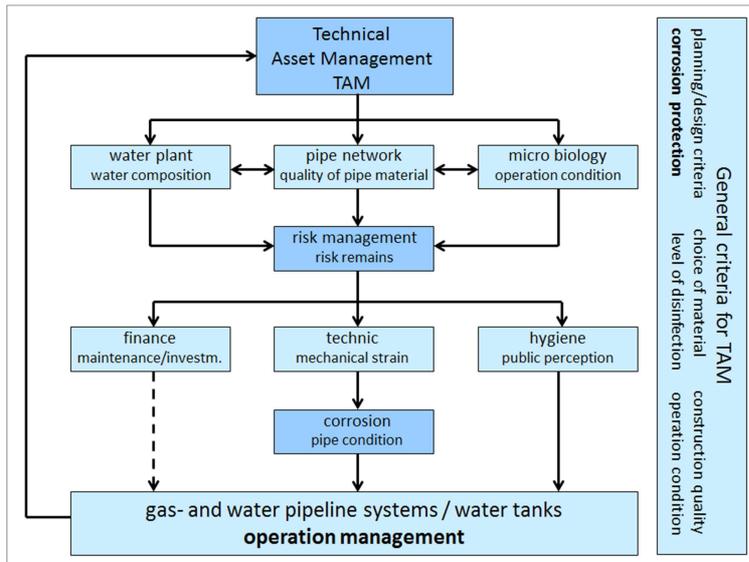


Fig. 8 technical asset management in the drinking water supply, taking into account the effects of corrosion in pipeline systems

Sources: DVGW German Association for gas and water industry, Bonn Germany
 IWW Institute for water management, Mülheim Germany
 TZW Technology Center Water, Karlsruhe Germany

Max Hammerer
 Golgathaweg 1
 9020 Klagenfurt - Austria
 max@hammerer.cc
 www.hammerer.cc

