



# MEMORANDUM

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## LEGISLATIVE REFERENCE BUREAU

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**To:** Ald. James A. Bohl, Jr.  
**From:** Tea Norfolk, Legislative Fiscal Analyst – Lead  
**Date:** August 30, 2016  
**Subject:** Disinfectants Used to Treat Public Drinking Water

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This memo is in response to your request to provide the following information:

- What disinfectants are used to treat public drinking water in major European cities, particularly the largest cities in Germany (Berlin, Hamburg, München (Munich), Frankfurt, and Köln (Cologne))? Are they using chlorine, UV radiation, or some other method?
- What are the latest or cutting-edge trends in "clean" technology for disinfecting public water supplies (not limited to Europe)?

### **Disinfectants used to treat public drinking water in major European cities**

In Germany, drinking water must comply with the Drinking Water Ordinance, which is based on the 1998 European Commission Drinking Water Directive. Germany works in collaboration with France, the Netherlands, and the United Kingdom to harmonize testing for drinking water. Drinking water may be treated only with agents approved by the Federal Ministry of Health; these agents include free chlorine and chlorine dioxide. Worldwide, chlorine is the most commonly used disinfection agent. Others include ozone, chlorine dioxide, and chloramines.

A summary of water treatment methods for the largest cities in Germany follows.

#### **Berlin**

Berlin does not add chemicals to its drinking water. According to information from Berlin's water utility, "Berlin's water is of a higher quality than stipulated by the German Drinking Water Ordinance." Berlin's water supply comes exclusively from groundwater. River water is treated by flocculation and filtration and is used for groundwater recharge or bank filtration. Drinking water chlorination was abandoned in West Berlin in 1978 and East Berlin in 1992 (following unification). However, small amounts of chlorine are used in weekly performance checks in the chlorination plants and occasional chlorination within the pipe system following pipe-burst events.

## **Hamburg**

Groundwater is treated by oxygen aeration, evaporating carbon dioxide and hydrogen sulfide. Iron and manganese are oxidized and flocculated, and the solid flakes are removed in sand filters. The residues in the filters are periodically flushed. Water is then disinfected with chlorine or chlorine dioxide if necessary.

## **Munich**

Drinking water comes from groundwater, which is not processed or purified.

## **Frankfurt**

Drinking water comes from groundwater. Soil conservation is an integral part of groundwater protection. Officials keep records on soil contamination, ensuring that it is cleaned up, and monitor the groundwater. Water from precipitation on airports and roads is collected and diverted to prevent it from seeping into groundwater or contaminating drinking water pumps. Additionally, Frankfurt has replaced most of its lead drinking water pipes.

## **Cologne**

Cologne uses groundwater, which is sprayed into large reservoirs, exposing the water to oxygen to improve the living conditions for microorganisms that help clean the water naturally. The water is then pumped into wells. The water is filtered through activated carbon.

## **Cutting-edge trends in “clean” technology for disinfecting public water supplies**

The most common steps in water treatment include:

- Coagulation and flocculation. Chemicals with a positive charge are added to the water, which neutralizes the negative charge of dirt and other dissolved particles.
- Sedimentation. Settling of dirt and dissolved particles.
- Filtration. Clear water passes through filters.
- Disinfection. Usually chlorine or chloramine.

Typically, surface water requires more treatment and filtration than ground water because lakes, rivers, and streams contain more sediment and pollutants and are more likely to be contaminated than ground water, which has filtered through layers of earth.

Another method of water treatment is the use of barrier technologies, which filter contaminants out of the water. Barrier technologies for treating water include:

- Adsorbents, such as granular activated carbon.
- Membranes, such as nanofiltration, reverse osmosis, and ultrafiltration.

- Oxidation, such as ozone and peroxide.

Other treatment processes include:

- Ultraviolet (UV) treatment.
- Anion exchange (separates substances based on their charges using ion exchange resin, which coats negatively-charged counter-ions).
- Granular activated carbon.

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