Public Health Effects of Filtration

Filters put into use—1906
Chlorination started
Carriers discovered

Number of typhoid cases per 100,000 population

1890 1895 1900 1905 1910 1915 1920 1925 1930 1935
Years
Number of waterborne disease outbreaks in U.S.
Definitions

**Filtration:** A process for separating suspended and colloidal impurities from water by passage through a porous medium, usually a bed of sand. Most particles removed in filtration are much smaller than the pore size between the sand grains, and therefore, adequate particle destabilization (coagulation) is extremely important.
Performance

- The influent turbidity ranges from 1 - 10 NTU (nephelometric turbidity units) with a typical value of 3 NTU. Effluent turbidity is about 0.3 NTU.
Media

- Medium: SG
- Sand: 2.65
- Anthracite: 1.45-1.73
- Garnet: 3.6 - 4.2
History

- Slow sand filters were introduced in 1804:
  - sand diameter: 0.2 mm
  - depth: 1 m
  - loading rate: 3 - 8 m³/d·m²
Slow Sand Filters

- **Schmutzdecke** - gelatinous matrix of bacteria, fungi, protozoa, rotifera and a range of aquatic insect larvae.

- As a Schmutzdecke ages, more algae tend to develop, and larger aquatic organisms may be present including some bryozoa, snails and annelid worms.
Rapid sand filters were introduced about 1890:
- effective size: 0.35 - 0.55 mm
- uniformity coef.: 1.3 - 1.7
- depth: 0.3 - 0.75 m
- loading rate: 120 - 240 m³/d·m²
Dual media filters introduced about 1940:

- **Depth:**
  - anthracite (coal) 0.45 m
  - sand 0.3 m

- **Loading rate:** 300 m$^3$/d·m$^2$
Fig 4-8: Flow diagram of water softening plant

- Groundwater from wells or hard surface water
- Rapid mix
- Reaction basin
- Sludge
- Settling tank
- Recarbonation
- Disinfection
- Storage
- To distribution system
- Pump
Lime slaker and feed system.
Upflow solids contact tank.
Effluent weir on right.
Settling tank with radial weirs
Rapid sand filter with exposed under drain block. Wash water troughs run from left into gullet on right.
Rapid sand filter with water level just below backwash troughs. Note iron stain at high water line.
Rapid sand filter during filtration. Reflection shows water level above gullet and backwash troughs.
Hydrofluorosilicic acid drum and pump metering system for feeding fluoride into water.
Softening sludge lagoon. Winter view shows ice (light blue) where supernatant water is standing.
Overview of water treatment plant showing sludge lagoons and building housing treatment facilities.
Figure 220. Facility layout for 10-mgd water treatment plant.
"There was 100 times less [coliform] in Lake LaVerne," Baumann said. ISU Daily February 6, 2007
If it's emblazoned on the town's water tower, is it true?
Water Towers, 1951-1970, Water District No. 54
Located on the north side of the Des Moines Field House, near the current skateboard park
Stanton, Iowa
- 96 feet tall.
- holds 2,400,000 cups of coffee (150,000 gals.)
- completed in time for Homecoming 2000.

Hollywood screen and TV personality Virginia Christine, "Mrs. Olson" of coffee commercial fame, was one of Stanton's famous daughters. At the time of our centennial in 1970, Virginia came home to be our parade marshal. During the celebration she served coffee to the public. Stanton's water tower was converted to a giant Swedish coffeepot the following year.
Helm, California
Adair, Iowa
Markle, Indiana
Ironwood, Michigan
Atlanta, Illinois