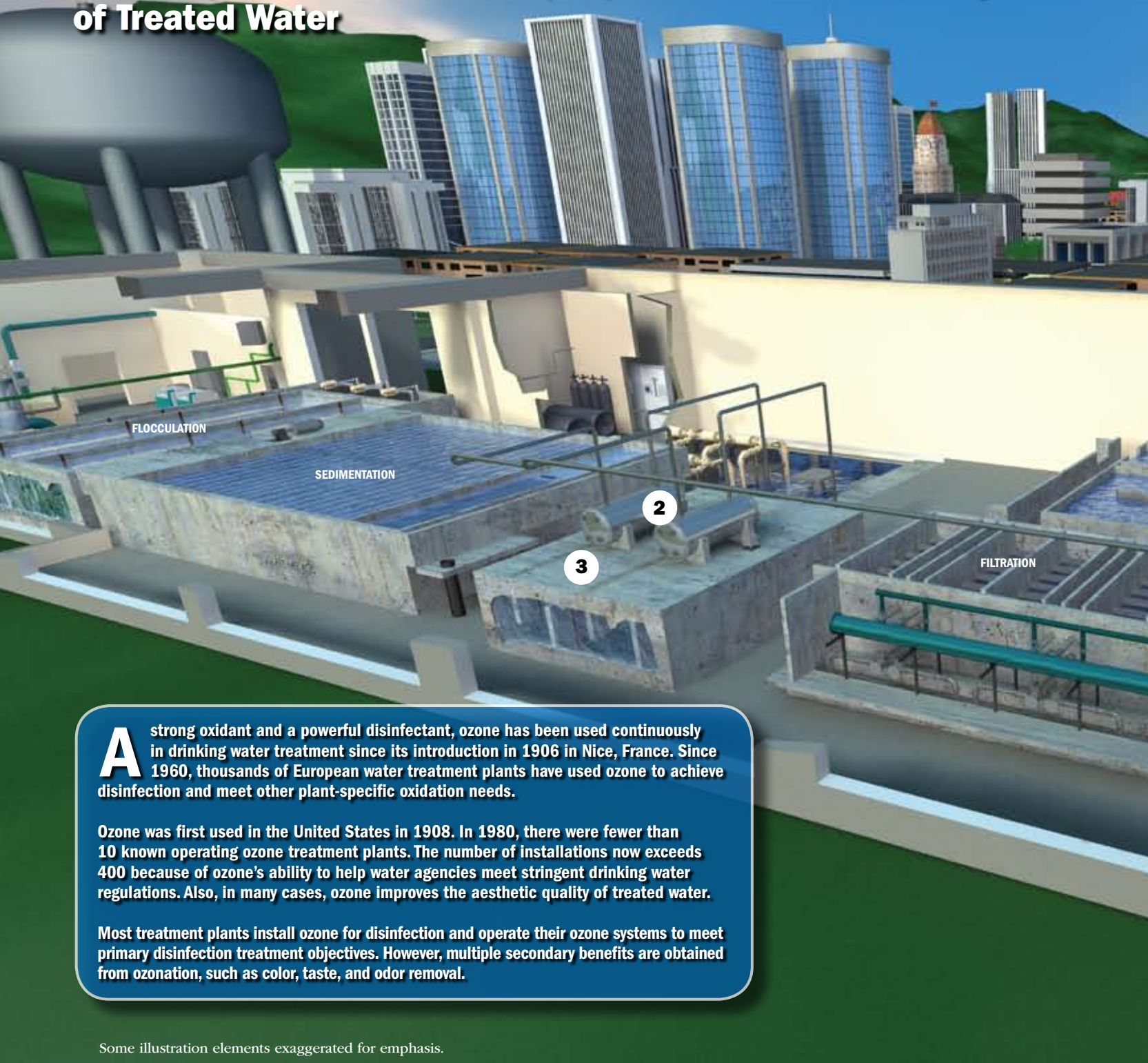


How Water Works

ILLUSTRATED PROCESSES, EQUIPMENT, AND TECHNOLOGY

Ozone Optimizes Disinfection, Improves Aesthetic Quality of Treated Water



A strong oxidant and a powerful disinfectant, ozone has been used continuously in drinking water treatment since its introduction in 1906 in Nice, France. Since 1960, thousands of European water treatment plants have used ozone to achieve disinfection and meet other plant-specific oxidation needs.

Ozone was first used in the United States in 1908. In 1980, there were fewer than 10 known operating ozone treatment plants. The number of installations now exceeds 400 because of ozone's ability to help water agencies meet stringent drinking water regulations. Also, in many cases, ozone improves the aesthetic quality of treated water.

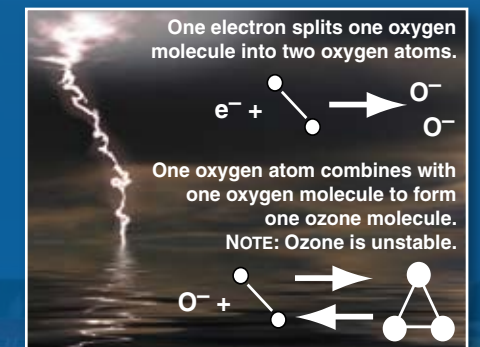
Most treatment plants install ozone for disinfection and operate their ozone systems to meet primary disinfection treatment objectives. However, multiple secondary benefits are obtained from ozonation, such as color, taste, and odor removal.

1. Liquid oxygen (LOX) feed gas (1a) is supplied to ozone generators in most ozone systems. LOX is vaporized to gaseous oxygen in a vaporizer (1b). LOX storage tanks and vaporizers may be located near buildings, but not in buildings.

2. Ozone generators create and deliver ozone on-site. Oxygen-containing gas flows through a narrow "electric-discharge gap" that's located inside the ozone generator. Electrical energy "flowing" across the gap splits oxygen molecules, allowing the formation of ozone molecules (see inset image on right). Ozone in the gas phase is only partially soluble in water and, therefore, requires special gas-liquid contacting techniques to ensure that all water is exposed to the ozone.

3. An ozone contactor is typically a sealed concrete basin. Most contactors are approximately 20 ft deep with vertical baffle walls that create an up-and-down water flow pattern. Ozone usually is dispersed into the first one or two transfer cells through fine-bubble diffusers. Recently, side-stream ozone injection and serpentine baffled contactors have become popular. Ozone contactors might be located before rapid mix, after sedimentation, or both.

Editor's Note: Thanks to Kerwin Rakness for his assistance with this image. A comprehensive look at ozone treatment is available in his book *Ozone in Drinking Water Treatment: Process Design, Operation and Optimization*, which is available in the AWWA Bookstore (www.awwa.org/bookstore).



Electrical energy "flowing" across a narrow gap containing oxygen splits the oxygen molecules into oxygen atoms (O). These atoms combine with other oxygen molecules (O₂) to form ozone (O₃). The unstable ozone gas quickly reverts to molecular oxygen, so it can't be stored in a container.

Some illustration elements exaggerated for emphasis.

ILLUSTRATION: RON KNOWLTON