Globally over the past century, the average annual temperature has increased about 1 °C; in the Arctic, it has climbed 2 to 3 °C. By 2100 the average global surface temperature is projected to increase by 1.5 to 5.8 °C

Increasing global temperatures are expected to cause a broad range of changes. Sea levels are expected to rise by about 0.5m by 2100, due to thermal expansion of the ocean, in addition to melting of land ice. Changes in temperature and precipitation patterns are likely to increase the frequency, duration, and intensity of other extreme weather events, such as floods, droughts, heat waves, and tornadoes, which will have a great effect on water quality.

This article summarizes the expected effects of global warming on water quality and the water treatment equipment to address these problems.

Effects on Water Quality

Warmer temperatures mean what would have fallen as snow will instead come down as rain. Currently, the snowpack acts a natural reservoir, storing water through the winter so it will melt and be released during the spring and summer when demand spikes. If that precipitation falls as winter rain, it will fill rivers and streams at a time of year when demand is low.

Flooding magnitudes and frequencies are expected to increase. Flooding can affect water quality, as large volumes of water can transport contaminants into water bodies and also overload storm and wastewater systems. Flooding could jeopardize water quality. In rural areas, runoff would pick up animal wastes, pesticides, and fertilizers as it traversed farms and fields. In cities, floodwaters carrying toxins and other contaminants could overwhelm sewage systems, causing untreated sewage to flow directly into waterways. The resulting contamination of drinking water by bacteria, viruses, and cysts such as cryptosporidium could trigger outbreaks of waterborne disease, while increased toxic contamination could have both acute and long-term health effects.

The combination of higher surface water temperatures and increased nutrient loading from agricultural runoff may increase the occurrence of Algae blooms in rivers and lakes, which in turn block or interfere with the performance of water treatment equipment.

Sea level rise may affect freshwater quality by increasing the salinity of coastal rivers and bays and causing saltwater intrusion into fresh ground water resources in coastal regions.

The loss of winter snowpack will greatly reduce a major source of groundwater recharge and summer runoff, resulting in a potentially significant lowering of water levels in streams, rivers, lakes, and wetlands during the growing season.

Some areas will experience decreased precipitation as a result of global warming. Drought conditions can also impair water quality, because as water supplies decline, the concentration of contaminants increases. Additionally, lack of access to clean water disrupts good hygiene and may prevent adequate hydration.

Water Treatment Solutions

Microfiltration removes particles in the range of approximately 0.1 to 1 micron. Filters that are rated as 1 micron absolute effectively remove major cysts such as Giardia Lamblia and Cryptosporidium

Ultrafiltration (UF) falls between reverse osmosis and micro filtration in terms of the size of particles removed, with UF removing particles in the 0.002-to-0.1-micron range, and typically removing organics over 1,000 ppm Molecular weight while passing ions and smaller organics. Ultrafiltration removes particulates, cyst, bacteria and substantially reduces the amount of viruses.

Nanofiltration operates in the realm between Ultrafiltration and reverse osmosis. Some dissolved salts and organic matter are rejected by the Nanofiltration membrane. Typical applications include removal of color and total organic carbon, removal of hardness or radium from well water and the separation of organic from inorganic matter in specialty food and wastewater applications.

Reverse osmosis provides finest level of filtration available. It removes dissolved solids from water by using pressure to force water molecules through a Semipermeable membrane. Rejection of dissolved minerals is typically 95%– 99%. Reverse osmosis is used for desalination of sea water and brackish water (water with high mineral content)

Chlorine is widely used to disinfect water and as an oxidizing agent for organic matter, manganese, iron, and hydrogen sulfide. It is used in the form of Free Chlorine (fast acting) and Combined Chlorine or Monochloramine (slow acting). In the presence of organic matter, is can produce disinfection by-products including Trihalomethanes, which are carcinogenic.

Ozone is a natural purifier that is 3200 times faster than chlorine. It leaves no chemical residue. It eliminates cysts, bacteria and viruses in addition to oxidizing iron, manganese and hydrogen sulfide.

Ultraviolet is a popular alternative to chemicals for disinfection of water. It is a safe technology that effectively inactivates pathogenic bacteria, viruses and protozoa. Unlike chlorine, UV does not produce any disinfection by-products.

Silver Zeolite is used to arrest the growth of algae before it contaminates water treatment. It helps eliminating odor-causing bacteria and inhibits growth of destructive mold and mildew. AgION attacks multiple targets in the microbe to prevent it from growing to a destructive population.