The techniques commonly used to eliminate Legionella include thermal eradication, hyperchlorination, ozone, and UV treatments. However, these treatments have notable disadvantages, such as the risk of scalding and recolonization that occurs in a few months, the risk of pipe corrosion, and the formation of disinfection by-products. Ionic copper and silver (Cu2+ ~ 0.3 mg/L, and Ag+ ~ 0.02 mg/L) have been shown to be an effective long-term approach for controlling Legionella in hospital hot water system. Compared to other disinfection techniques, Cu2+ and Ag+ treatments are low cost, easy to install and maintain, and the presence of the residual disinfectants throughout the system. In addition, their minimum effective concentrations are well below the maximum contaminant levels (MCLs) (1.3 mg/L for Cu and 0.05 mg/L for Ag). CuO nanoparticles were also observed to exhibit good effectiveness in treating Legionella. However, there are limited studies on the effect of Cu2+/Ag+ against Legionella. Therefore, a comprehensive systematic study is needed to optimize the treatment efficiency. This study will use single particle (SP)-ICP-MS and single cell (SC)-ICP-MS to evaluate the treatment effectiveness of copper-based nanoparticle to treat Legionella.