

# WQA WHITE PAPER ON RAINWATER CATCHMENT FOR POTABLE USE

## INTRODUCTION

The Water Quality Association (WQA) supports the harvesting of rainwater as a sustainable source of water for potable and non-potable applications. However, rainwater is at risk for picking up contaminants as it falls through the sky, to when it is collected and stored. The risk of microbiological contamination in rainwater has been well studied and documented, and a standard has been developed to address these concerns (ASPE, 2013). But research has shown that in addition to microbiological contaminants other contaminants may be present as well, such as metals, organic chemicals, and debris such as leaves, twigs, and dirt. It is the position of WQA that rainwater should be tested for microbiologicals, metals, and organic chemicals before it is used for potable applications. Disinfection is necessary at a minimum, but additional treatment may be needed as well in order for rainwater to be a safe source of water.

## REVIEW OF THE SCIENCE

Currently the U.S. EPA rules for monitoring and treatment of drinking water are based on two types of source water, groundwater and surface water. This causes confusion and can lead to onerous rules which are not necessary when rainwater is used as a source water. It can also lead to oversight of the actual risks which are associated with rainwater. WQA reviewed the scientific publications related to contaminants found in rainwater, and this position paper uses that research to provide a science-based insight into how rainwater can be used as a safe and sustainable source of drinking water. It is important to understand that local regulatory rules for rainwater catchment, and the subsequent use of rainwater as a drinking water source, must be followed despite any contrary guidance offered within this document.

Rainwater catchment has been used as a source of water for thousands of years, however in recent years there has been a renewed interest in the practice. Reasons for this include a greater awareness and concern about water quality issues, the rising costs of water from centralized treatment and private wells, and the cost efficiencies associated with rainwater harvesting (ARCSA, 2012). Rainwater harvesting can also be an economic solution for areas where drinking water is scarce. However, many research studies have investigated the quality of rainwater and found that contaminants may be present in the water.

Research has found that the contaminants which may be present in rainwater include microbiological contaminants (parasites, bacteria, viruses), metals, organic chemicals, and debris. These contaminants vary in the pathway by which they are picked up by rainwater, but the main pathways are atmospheric deposition, leaching and weathering of roof materials, fecal contamination, and leaching of materials that occurs via the storage and conveyance system. Factors impacting the presence of contaminants in rainwater include roof characteristics such as materials, design, age, and condition of the roof; weather conditions; materials used in catchment systems; and land use practices. For example, urban/industrial areas tend to have higher heavy metal

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contamination due to fossil fuel combustion and other emissions, while catchment systems in agricultural areas tend to have higher concentrations of pesticide residues, fertilizers, and other organic chemicals. Microbial and fecal contamination tend to be higher in rural catchment systems. (TCEQ, 2007; Radaideh et al., 2009; Ahmed et al., 2012; Hutson et al., 2012; Gwenzi et al., 2015).

Microbiological contaminants are the most well studied of rainwater contaminants. Microbiological contaminants can include both nonpathogenic and pathogenic organisms. Nonpathogenic organisms do not cause disease or illness, but they can reduce the aesthetic quality of water. Pathogenic organisms cause disease and can contaminate rainwater if the collection or storage of the rainwater has been contaminated by fecal material. Pathogens that have been found in harvested rainwater include *Giardia Lamblia*, *Cryptosporidium parvum*, *Toxoplasma gondii*, *Campylobacter spp.*, *Salmonella spp.*, *E. coli*, *Hantavirus spp.* (Lye, 2002; TCEQ, 2007; Gwenzi et al., 2015).

Chemical contaminants can also be found in rainwater. Rainwater can become contaminated by absorbing airborne chemicals (especially in urban areas), however most of the chemicals in rainwater are picked up during collection and storage. Volatile organic chemicals (VOCs) can be introduced to rainwater when raindrops fall through air containing gasoline or solvent vapors, or when the water encounters materials containing plastics, glues, solvents, gasoline, greases, and oils. This typically occurs when the materials used to construct the catchment and storage system were not designed for use with drinking water. Synthetic organic chemicals (SOCs) are chemicals found in pesticides, herbicides, and other man-made products. SOCs can be introduced when dust and leaves enter a catchment system, or when the rainwater is collected near an agricultural area where application of these chemicals occurs (TCEQ, 2007; Gwenzi et al., 2015).

Metals such as lead, arsenic, and copper can also be picked up by rainwater. Metals can sometimes be absorbed by rainwater in the air in industrial areas, but more commonly metals are introduced when rainwater comes into contact with lead solder, iron and copper pipe, and brass fittings. These metals can be picked up from metallic roofs, catchment systems, and storage tanks. Rainwater is slightly acidic, and as a result tends to be aggressive and corrosive toward these materials (TCEQ, 2007; WHO, 2011; Gwenzi et al., 2015).

Debris found in rainwater includes leaves, twigs, dust and dirt, bird and animal droppings, insects, and other visible material. Debris is usually picked up in rainwater as the rainwater is collected on the roof, gutters, etc. Often debris only reduces the aesthetic quality of water, but debris can leach chemical contaminants like herbicides and pesticides (leaves and dust) as well as parasites, bacteria, and viruses (bird and animal droppings) (TCEQ, 2007).

## CONCLUSION

A wide range of contaminants can be found in rainwater. Thus, considering what has been found in research and summarized in this paper, it is the conclusion of WQA that rainwater should be tested for microbiologicals, metals, and organics, and treatment implemented to remove contaminants which are present. At a minimum disinfection is needed for microbiological contaminants, however additional treatment to remove other contaminants may be necessary as well.

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