

# Comparative Life Cycle Assessment of Direct and Indirect Solar Water Disinfection Processes in Developing Countries

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## ABSTRACT

In July 2010, the UN General Assembly recognized the universal human right to sufficient water for health and sanitation (UN..., 2010). The reliable disinfection of this water plays a critical role in public health (Carter and Miller, 2005), and this study investigates the use of four ultraviolet (UV) disinfection methods for use in international development and disaster relief. The study focuses on the life cycle impacts of four direct and indirect solar ultraviolet disinfection systems. Direct solar disinfection refers to exposure of water to solar radiation, while indirect solar disinfection collects solar energy and uses this to power a UV lamp disinfection reactor. These four systems were compared to chlorine disinfection and automobile distribution as baseline methods. Existing literature was used to define a life cycle functional unit for each system, which quantified the material use, infrastructure required, and life cycle of the components of each system. The impact of each system was then defined in the Life Cycle Analysis software SimaPro. Analyses compared the use of each technology at “community, school, small group, and family” scales. Due to the significant impact that end-of-use of a system can have on rural communities, an end-of-life analysis was conducted in addition to the quantitative life cycle analysis. Life cycle analysis shows that both direct and indirect UV disinfection methods vary dramatically over several categories of impact assessment. End of life analysis and this variation highlight the extremely complicated process of designing the appropriate disinfection system for use in developing countries.

Cutler, D., Miller, G., 2005. The Role of Public Health Improvements in Health Advances: The Twentieth-Century United States\*. *Demography* 42, 1–22. doi:10.1353/dem.2005.0002

UN Office to Support the International Decade for Action, 2010. The human right to water and sanitation Reader.

## KEYWORDS

Life Cycle Analysis, Ultraviolet, Disinfection, Safe Water, International Development