INTRODUCTION

As of 1994, more than 1 billion people in the world still lacked adequate access to safe drinking water [WHO/ WSSCC/UNICEF, 1996]. Each year, people largely from this population experience 900 million episodes of the diarrhea or diseases closely associated with waterborne pathogens present in dirty drinking water [Economist, 1998]. The problem of unsafe drinking water is recognized to be not an isolated technical problem, but interrelated to the problems of adequate water supply, community education in public hygiene, access to sanitation, and effective and safe disposal of human and animal wastes [USAID, 1990]. Nevertheless, a device or technology that offers affordable, simple, robust and low-maintenance disinfection of drinking water can be an important part of the solution.

Some current technical approaches to providing drinking water to this population segment, and their drawbacks, are listed next. (1) Deep tubewells fitted with handpumps, while perhaps the simplest system to operate, require expensive drilling rigs, are immobile sources, and often produce hard water that some communities find distasteful; (2) Chlorine disinfection also treats larger organisms and offers residual disinfection, but can be expensive with its need for special operator training and a supply chain of a potentially hazardous material; (3) Boiling water over a biomass cookstove, the most well known and reliable treatment method, demands labor, and imposes high economic, environmental, and human health costs.

UV DISINFECTION OF DRINKING WATER

The use of ultraviolet (UV) light to disinfect water of water-borne pathogens capitalizes on the germicidal properties of a narrow range of the UV spectrum. Given proper dosage, UV wavelengths ranging from 240 to 280 nanometers (nm) deactivate, or effectively kill, microorganisms by damaging their DNA so as to prevent the DNA, and the organism, from replicating [Harm, 1980]. The UV dose, measured in microwatt-seconds per square centimeter, is the product of UV intensity and exposure time: dosages for a 90% kill of most bacteria and viruses range from 2,000 to 8,000 μW-s/cm^2, while dosages for Giardia, Cryptosporidium, and other large cysts and parasites are an order of magnitude greater (approximately 60,000-80,000 μW -s/cm^2) at a minimum [Wolfe, 1990].

Most current UV systems use a low-pressure or medium-pressure mercury vapor lamp and expose water to UV by pumping the water around a sleeve within which the UV lamp is supported. Typical system dosages of 25,000 to 38,000 μW -s/cm^2 reduce only bacterial and viral concentrations by 3 to 4 logs [Wolfe, 1990]. (Systems which seek certification in the U.S. under the applicable NSF standard must deliver a dose of 38,000 μW -s/cm^2.) UV systems can be coupled with a prefilter to remove those larger organisms (worms and cysts) and particulates with attached bacteria that would otherwise remain viable after passage through the UV system.