

The Precautionary Principle Under Fire:

Detractors continue to challenge chlorination as a safe water solution for developing nations

By Fred Reiff

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Despite data supporting chlorine's highly beneficial impact on clean water supplies and public health, claims persist that the potential risks of chlorination outweigh the public health value of water disinfection. To me this is comparable to watching the third sequel of a grade Z science fiction movie about a monster that won't die. A case in point is a Greenpeace report currently posted on the organization's website asserting that DBP concerns had no bearing on the spread of disease during the 1991 cholera epidemic that began in Peru and was propagated to almost all countries of Latin America. From personal experience I can confirm that these claims are utter nonsense. I am concerned that such disinformation and half truths might be accepted as fact, resulting in otherwise avoidable disease, suffering, death, and economic impact on the poor people of developing countries.

Why am I qualified to respond? From 1981 through most of 1995, I was an official in the Pan American Health Organization/World Health Organization (PAHO) in a position that offered a very unique vantage point. During this period I was responsible for disseminating the WHO drinking water quality guidelines and fomenting the adoption or updating of national drinking water quality standards. I also was responsible for managing the United Nations Global Environmental Monitoring Programs for Water (for the Americas), the development and promulgation of environmental interventions in disaster preparedness and relief, and the development of appropriate technology for treatment of both potable and waste water. I also served on PAHO's management task force that was formed for the prevention and control of cholera. This level of involvement provided many opportunities for both overall and close-up monitoring of the status of water supply disinfection and its effectiveness as a public health measure in prevention and control of waterborne diseases in all Latin American and the Caribbean countries before, during, and after the introduction of cholera in Peru in 1991.

For many years prior to the cholera outbreak, PAHO had been promoting the disinfection of community water distribution systems and other delivery systems for water for human

consumption. Primarily through its Center for Sanitary Engineering and Environmental Science (CEPIS) in Lima, Peru, PAHO collaborated in pilot and demonstration projects for virtually all disinfection methodologies in various countries to ascertain their relative disinfection efficiency, cost effectiveness, and practicality for various cultural and economic situations. Some of them worked well and others were failures. Everything considered, chlorination was almost always found to be the most reliable and cost effective.

Until the cholera outbreak erupted in Peru in January-February of 1991, the acute and deadly diarrheal disease had not been prevalent in the Americas since the early 1900's. Immediately upon verification of its presence, PAHO began organizing workshops to inform the appropriate officials of the countries of Latin America (and later Caribbean countries) of the seriousness of this disease and its potential to become an epidemic. We shared the most effective and advanced technologies to detect the pathogen, how to diagnose and treat the disease, the tried and proven methodologies that have been used to prevent cholera, public education strategies, and the epidemiological efforts and methodologies to track and understand the propagation of the disease.

Simultaneously, PAHO headquarters directed each of the PAHO Country Offices to advise health and water agencies to take measures to continuously chlorinate all water distribution and delivery systems. For the population not connected to public water systems, special programs were developed to promote the disinfection of water at the household level. In addition, treatment of the waste products of cholera victims with lime was recommended before its discharge to the sewer systems or the environment, and a list of all preventive measures to be taken by officials and individuals were provided to all appropriate officials. Chlorination was recommended, not only because all of the countries were familiar with this technology, but also because chlorine products were readily available and chlorination was the least costly of the disinfection methodologies. And, most importantly, chlorine is very effective in killing or inactivating *Vibrio cholerae*, the pathogen of this disease as well as pathogens associated with almost all other waterborne diseases.

Shortly after this directive was issued, I was surprised to learn that some local PAHO officials were encountering pockets of resistance to chlorination from a number of health officials, both in Peru and in other countries. I was specifically told that the reason was their concern for chlorination by-products, especially trihalomethanes. This concern had its origin in press releases and published scientific studies widely disseminated by environmental agencies in the developed countries. I traveled to Peru and other countries and personally met with the health officials and even heads of water agencies who expressed their concern directly to me; some even believed that they might be subjected to a lawsuit if they chlorinated or raised the level of chlorine in their water supplies. I also met other concerned health officials in various cholera workshops and symposiums sponsored by PAHO. Most surprising of all was the

discovery that even officials in small towns were aware of disinfection by-products and their alleged negative health effects. It was pointed out to all that when the cholera pathogen is present in a water supply, the risk of contracting the disease is immediate, and that a resulting epidemic could cause thousands of deaths. In contrast, the hypothetical health risk posed by trihalomethanes in levels in excess of those recommended by WHO (and EPA) was one extra death per 100,000 persons exposed for a period of 70 years. Unfortunately, some of these well-meaning, but ill-informed officials had to experience the immense proportional difference in risk before accepting this reality.

Debates over the relative significance of the drinking water pathway for cholera in comparison to other pathways also impeded the rapid implementation of drinking water chlorination. Routes that can be taken by cholera include food, beverage, and ice that have been processed or prepared with contaminated water, unhygienic food handlers, produce that is eaten raw but which has been irrigated with cholera contaminated water, filter feeding shellfish harvested in sewage contaminated water, and casual person-to-person contact. Both practical experience and studies have proven that even if cholera is initially introduced through a pathway other than drinking water, the waterborne pathway will soon be activated unless drinking water is disinfected continuously with an adequate level of disinfectant and measures are taken to prevent recontamination before its consumption. A cholera contaminated distribution system is without doubt the most efficient way to transmit this disease.

It should be noted that throughout the first four years of this epidemic the countries with the highest percentage of continuously and adequately chlorinated water systems had no secondary transmission of cholera, even though the disease was introduced into these countries. Also countries that quickly implemented chlorination were able to bring the epidemic under control. There was also an obvious inverse correlation between the percentage of the population receiving chlorinated water and the incidence of new cases of cholera. In one country with excellent long-term epidemiological surveillance in place, it was found that after implementation of measures to prevent cholera, there was also a significant reduction in typhoid fever and infectious hepatitis.

Conversely, those countries that were not able (for whatever reason) to implement chlorination of water supplies on a timely basis, suffered recurring annual epidemics until a sufficient percentage of the population had developed immunity, preventing further epidemic propagation of the disease. Typically there were a number of reasons for delay in implementing widespread chlorination of drinking water supplies. However, no obstacle was harder to overcome than the incorrect perception of risks posed by disinfection by-products relative to the very real and deadly threat of cholera.

To reduce the spread of cholera in areas of abject poverty where household were not connected to water distribution systems PAHO worked in concert with the U.S. Centers for Disease Control and Prevention (CDC) and the University of North Carolina to develop, test, and microbiologically and epidemiologically monitor the results of a methodology to purify the available water at the household level. The end result was chlorination of the household water in containers that were specifically designed to preclude subsequent contamination during storage and use. The annual cost of this intervention was found to be less than \$2.00 per family, the major cost being the container. The annual cost of the calcium hypochlorite was less than fifty cents per family. Not only did this prove effective for Latin America but it also led to global health organizations adopting this or similar programs as a viable interim health measure for developing countries in Africa and Asia.

Since the cholera outbreak of 1991, many nations have embraced what is known as the “Precautionary Principle”, a protocol acknowledging that uncertainty is inherent in managing emerging risks. The thrust of public health management in the principle is to take steps to reduce potential harm, even when uncertainties remain. Yet a true precautionary approach also means that you do not do away with a proven health intervention. This concept was clearly stated by Dr. Carlyle Macedo, Director of PAHO in his address to the 1992 International Conference on the Safety of Water Disinfection, Balancing the Chemical & Microbiological Risks sponsored by the International Life Sciences Institute.

“In developing countries, the primary public health concern for water supplies should remain preventing them from becoming an efficient vehicle for the widespread transmission of enteric diseases. This concern should not be overshadowed in any way in our efforts to also address the tertiary concern of minimizing the relatively small risk stemming from disinfection by-products...”

The high incidence of diseases that are related to water supply and sanitation are primarily a reflection of the social and economic inequities and marginalization that unfortunately still exist in our hemisphere. Basically the people that suffer the most from these diseases have so few economic resources that all but the simplest and least expensive of interventions to reduce their risk of exposure to the many waterborne pathogens are beyond their means. Under such circumstances the disinfection of drinking water with chlorine at the household level, is usually the most viable and cost-effective public health intervention available. To cause these people to abandon chlorination is not only unwise, but cruel, if the alternative is beyond their economic and technical means. Unless there is a simple alternative at an affordable cost, these people should not be frightened away from chlorinating their water. This will only increase their suffering and decrease their life expectancy.”

To protect public health, particularly in developing regions, applying the precautionary principle requires use of practical, affordable technologies and a realistic balancing of known and uncertain risks.

Fred M. Reiff, an engineer, is a former official of the Pan American Health Organization/ World Health Organization. He retired from that organization in 1995 but continues to serve as an independent international consultant.

To read the Greenpeace report “Cholera and Chlorine” please refer to the following link:
<http://archive.greenpeace.org/toxics/reports/cholerachlorine.pdf>