

## Preface

Over the past decade, the issue of water crisis has become increasingly popular. In early April 2016, if one put ‘water crisis’ in Google, there were some 30 million references. Irrespective of where in the world one is located, very seldom does a week pass without a major story in the media on the so-called water crisis.

Any serious objective and comprehensive analysis of the overall water crisis issue will indicate that the world is not facing a crisis because of actual physical scarcities of water. This is true even for the most arid inhabited regions of the world. However, the world is indeed facing a crisis, because of continued mismanagement of water over decades, if not centuries. If the management process can be improved, there will be enough water in the world for all types of water uses, not only for the present but also for 2050. By 2050, the world population is projected to reach 9.7 billion, that is, 2.3 billion more than at present. Furthermore, human activities are expected to increase very significantly during this period. But even by 2050, by using good management practices, knowledge and technology available at present (in contrast to what may be available in the coming decades), and formulation and implementation of rational water policies, water crisis can be avoided. Thus, as Shakespeare said many centuries ago, the fault is with us and “not in our stars”.

A major problem for the water sector has been the lack of realization that water is a renewable resource. It is not like oil or coal, which once used breaks down into various components and cannot be used again. Water is a renewable resource. It can be used, treated and then reused. This cycle can be repeated numerous times with good management.

For the domestic water use sector, there is currently enough knowledge and technology which can be successfully used to treat wastewater to a level that it can be of even better quality than the water supplied by the utilities. Singapore at present treats its wastewater so well that it is of better quality than the drinking water that its citizens receive. The treatment process is cost-effective. Monitoring and supervision of the treatment processes are very rigorous and strict so that water quality requirements are met consistently. There are no health risks, real or perceived. This means that in terms of technology and economics, there is absolutely no reason why all wastewater generated is not being treated extensively at present so that it can be reused time and again.

While the future is mostly difficult or even impossible to foresee, one prediction can be made with complete certainty. Scientific and technological advances in the coming decades will make wastewater treatment processes continually more and more efficient and cost-effective. In future, it would be a crime not to treat wastewater properly and then reuse it as many times as possible.

The legitimate question thus is, if wastewater can be cost-effectively treated to the level of drinking water, or even better, at present, why is this practice not being used extensively all over the world?

The reasons are many. However, the two most important ones are the following. First, historically, with the exception of very few countries like Singapore, most unfortunately, water has not been high on the national political agendas. Politicians and media are interested in water only when there are catastrophes like heavy floods, prolonged droughts or other serious national disasters like earthquakes. Once these catastrophes are over, political and media interests in water simply evaporate. Unfortunately, water problems can be solved only on a long-term basis, which requires sustained political interest. This is missing at present.

In addition, to the extent there is interest, this is almost exclusively with respect to water quantity; quality issues are seldom seriously considered. There is lot of rhetoric on the importance of water quality from national governments and international organizations. Sadly, sustained and well-thought-out actions are conspicuous by their absence. Thus, not surprisingly, almost all water bodies in and around centres of population and industrial developments in developing countries are heavily polluted with known and unknown contaminants. Furthermore, in most cases, water quality is steadily deteriorating, in both surface water bodies and aquifers.

Second, the fundamental problem with the use of properly treated wastewater is neither technological nor economical, but public acceptance of its use. No matter how well wastewater is treated, people remember its history, and are strongly opposed to its use even though its quality could be higher than provided by a utility. Even the discussions of the issue are often framed in pejorative terms. Thus, in California, the discussions were framed on the concept of “toilets to taps”, and in Australia, it became “citizens against drinking sewage”.

Generally people are uncomfortable with or averse to the idea of drinking treated wastewater, irrespective of all the scientific and technical evidence that categorically indicates that it is perfectly safe to drink. One study in the United States found that one in four people believe that wastewater cannot be treated to a high enough quality so that it can be actually drunk. In other words, no matter what is done, no matter what its quality is, its history ensures that its use is unacceptable. There appears to be a universal belief that once water has been in contact with a disgusting object like human excreta, it will always remain in contact, irrespective of the treatment processes.

There are other anomalies in human perception as well. One American study indicated that people are more willing to drink treated wastewater if it has been stored in an aquifer for 10 years, compared to only 1 year. Some 40% of the people are willing to try it if it has travelled in a river for a hundred miles, as opposed to only one mile. Somehow, it seems, the longer it is stored, or the further it travels, more acceptable it becomes.

In other words, irrespective of all the scientific and technical evidence which indicates that treated wastewater is safe to drink, the gut feeling of most citizens is that it is not so, primarily because of the ‘yuck factor’.

This leads to another issue. Historically, the water profession is dominated by engineers and technologists. There is no question that in the coming years they will make the treatment processes continually more efficient and progressively more cost-effective. However, this development alone is unlikely to change the opinions of the vast majority of the people in terms of drinking properly treated wastewater. The breakthroughs are likely to come only if behavioural psychologists and economists play a major role in convincing the society that their attitudes to and perceptions of use of treated wastewater are irrational. This behaviour needs to undergo a sea change, which will be difficult to achieve without the help of behavioural scientists.

The good news is that behavioural psychologists and economists are starting to take an interest in this issue. While this is a good beginning, we need a critical mass of such experts working all over the world to convince the people that current practices of wastewater treatment can ensure that the resulting water is perfectly safe to drink. This has to be complemented with proper long-term monitoring and safeguard practices.

If water is not reused extensively, the world’s water problems cannot be solved. It is thus very heartening to see that National University of Singapore and PUB (Singapore’s national water agency) have brought together some of the world’s leading experts to discuss this complex topic from multidisciplinary, multi-sectoral and multi-issue perspectives. This special issue of

the *International Journal of Water Resources Development* is a direct result of this meeting. I am confident that this issue will indeed contribute to finding implementable and socially acceptable solutions to a complex and difficult problem.

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