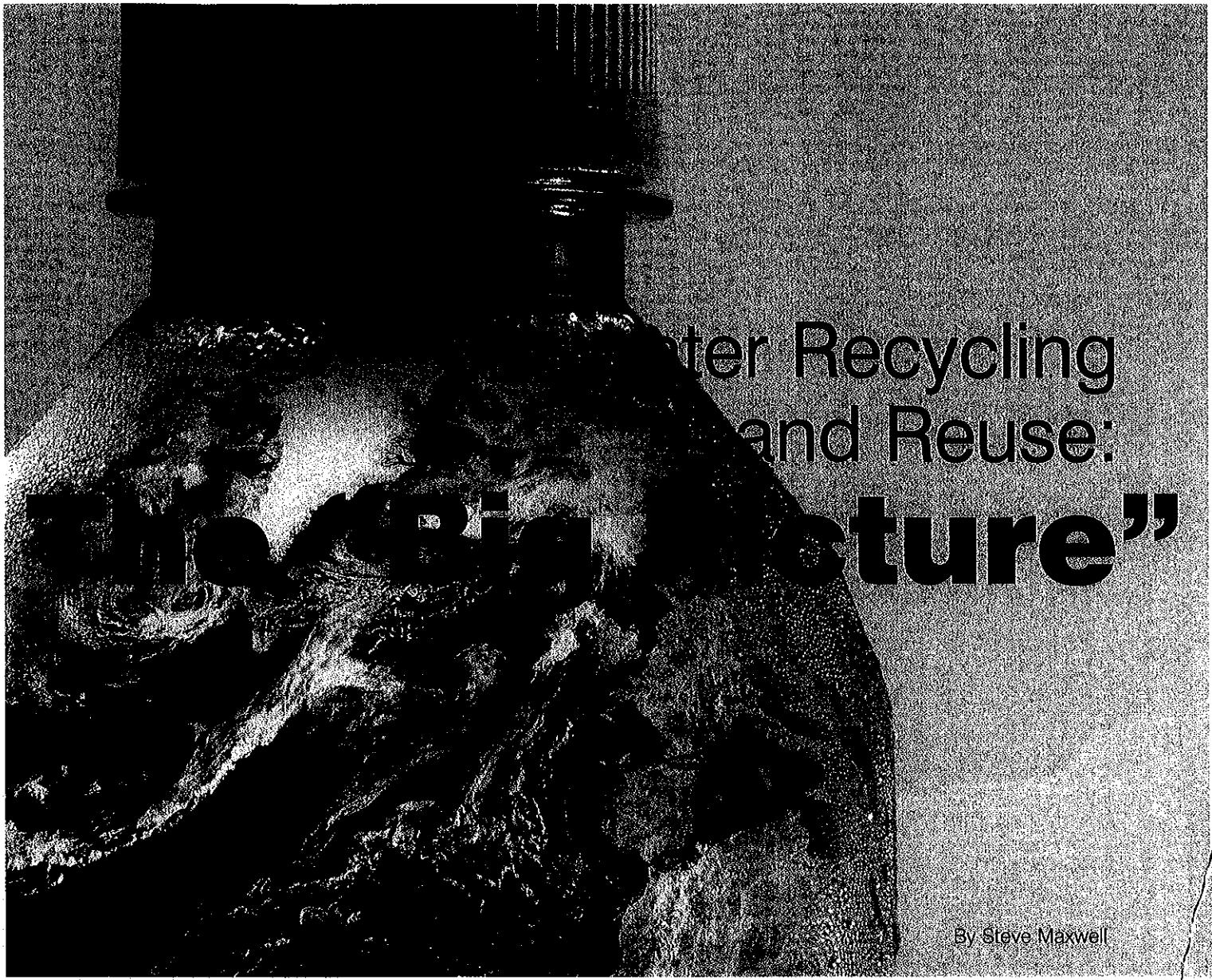

ter Recycling and Reuse: ture"

By Steve Maxwell

Water recycling and reuse — in all of its varied forms — is one of the most robust sectors of the overall water market today. The recent rush into this industry by many major international corporations such as General Electric and Siemens have been partially driven by perceived opportunities for rapid future growth in water recycling and the desalination of seawater.

Growing public interest in drinking water issues and water resource availability is increasingly focused on the need for improved water conservation and recycling programs across the planet. Water reuse initiatives — all the way from the individual residence to the large municipality or major industrial installation — are beginning to gather steam. Since these terms are often used rather vaguely or interchangeably, it may be useful to start out with some definitions and clarifications. However, no matter what you call it — water recycling, water reuse or water reclamation — this sector of the business is definitely "hot."

Most municipal and industrial wastewater can easily be recycled and cleaned to levels where it can be reused for either 1) so-called beneficial reuse applications such as agricultural irrigation, industrial cooling purposes, toilet flushing and the like or 2) primary drinking water purposes. These recycling and reuse applications can occur in both a more direct manner and in an indirect manner. There are important differences between these two conceptual approaches to reusing water — differences that are particularly important from the perspective of public understanding and acceptance.

Indirect Reuse

Indirect reuse of wastewater for primary drinking purposes is — by necessity — widely practiced everywhere around the world today. Indirect reuse occurs, for example, when treated wastewater is discharged into a river that serves as a raw water intake source for a primary treatment plant downstream. Or, it can occur when treated wastewater is used to recharge an underground aquifer; the contents of which are later to be withdrawn and run through a primary treatment process. It has been estimated that on some of the major river systems in the United States, water is used and reused up to 20 times as it travels to the sea – the treated discharge

from one wastewater treatment plant essentially comprising a part of the raw water intake at a primary drinking water plant a few miles downstream. In fact, as a result of 30 years of steady progress in cleaning up natural waterways under the guidelines of the Clean Water Act, the heavily treated discharge from wastewater treatment plants is sometimes cleaner than the supposedly "natural" rivers and streams into which it flows.

From a broader holistic perspective, the indirect reuse of wastewater, via the natural hydrologic cycle, has been going on since the dawn of civilization and will continue to go on forever. Whether it be the ancient civilizations who essentially used the rivers and oceans to carry away their wastes or modern day industrial economies employing advanced wastewater treatment plants — used wastewaters eventually must merge back into the natural hydrologic cycle to be reused, over and over again in the future.

In essence, water can neither be created nor destroyed. The activities of mankind may taint the quality of the water in the cycle — as in the case of long-term chemical contamination of groundwater aquifers. Or, we may affect the rate at which some of these natural processes occur — for example, by withdrawing water from underground sources like the high-plains Ogallala aquifer at a far greater pace than they are replenished naturally. It is now increasingly believed that gradual global climate change may also affect the location or intensity of various parts of the hydrologic cycle — where precipitation occurs, or the rate at which it falls. However, from a long-term perspective, mankind can do very little to stop the workings of the natural hydrologic cycle.

Direct Reuse

What is often meant by the term "water reuse," today, is a more specific and direct type of reuse — a more immediate or onsite recycling of wastewater for primary use purposes without the intervening or diluting impacts of "nature" via the natural hydrologic cycle.

Direct reuse of wastewater for drinking or other household uses has been generally feasible for many years, utilizing an array of widely employed technologies. But, for non-technology related reasons, any widespread utilization of such approaches still seems to be a long ways in the future. Putting a "black box" treatment system (often based on some form of activated carbon treatment with membrane filtration) on the outside of a factory or an individual home to treat sewage and recycle it directly back to the kitchen tap is clearly "suspicious" or unpalatable from a social point of view to most people. Scare stories in the press tend to reinforce this reticence or concern. The popular media has often referred to this process as "toilet to tap" and has whipped up a frenzy against such an approach in most of the cities where it has even been mildly considered.

Negative perceptions and public resistance to broader direct use of recycled wastewater is, at the base level, simply a result of poor understanding of the potential of the industrial recycling processes – and it ignores the fact that almost all of the primary drinking water in this country has indeed already been recycled hundreds of times. Wider public acceptance of direct wastewater reuse for drinking will be a major public education challenge in the future, but eventually more and more direct reuse seems certain to happen.

Today, such direct reuse for drinking water purposes is only commercially practiced in a few very arid locations around the world. The example most often cited for direct wastewater reuse for potable purposes is in the southwest African desert city of Windhoek, Namibia. However, despite the social concerns, more and more cities around the world are beginning to seriously look at recycling wastewater to reuse for drinking. This is especially true for cities in arid regions – where the natural conditions simply force a greater willingness to explore and accept new or alternative water sources. The inland town of Toowoomba, Australia, for example, recently announced plans this year to evaluate this kind of reuse system to supplement its scarce water resources. Arid but coastal cities, like many of the major metropolitan centers springing up in the Middle Eastern states, are among the world leaders in large-scale desalination as a source of drinking water. However, it seems clear that carefully planned and efficient reuse systems are incrementally a far cheaper source of additional water than are huge desalination plants or developing totally new source waters.

There is one additional and critical statistic to consider when evaluating the overall potential impact of reuse as a means of extending our water resources – a factor that should eventually make direct reuse much more feasible on a wide scale. Only a tiny percentage of our primary drinking water supply is actually used for drinking. Compared to the roughly 130 gallons of water per capita per day that we currently treat to drinking water standards, most individuals drink less than a gallon a day. Even if we also consider the proportion of our water that we use to cook and clean with – which most people also wish to be treated to high-level drinking water regulatory standards – this is still a small percentage of our total water consumption. In other words, the vast majority of the 130 gallons per person per day of primary water that we currently use could be recovered and reused for a variety of other applications without anyone ever having to drink directly recycled wastewater. We are starting to see more and more of this, with lightly treated wastewater being used for the irrigation of golf courses or the flushing of toilets, for example. Even if only small incremental gains could be made in terms of non-potable water reuse, overall water availability concerns could be substantially impacted in the United States and around the world.

One thing seems certain — water prices will continue to rise — and as they do there will be ever-increasing incentives for more careful recycling, reclamation and reuse and more conservation in the first place. When it begins to hit us in the pocket book, individuals and households will begin to use water more carefully. When purely financial incentives begin to be more critical, industrial companies will rethink their approaches and retool their manufacturing systems to utilize less water and to better reuse and recycle their wastewater streams. As public awareness and understanding about dwindling natural water resources increases, more innovative approaches to reusing and recycling water will become more common and more acceptable. There is still a great deal of "low-hanging fruit" in the areas of smarter and more efficient water use and reuse and society will increasingly grab hold of this opportunity in the future.

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