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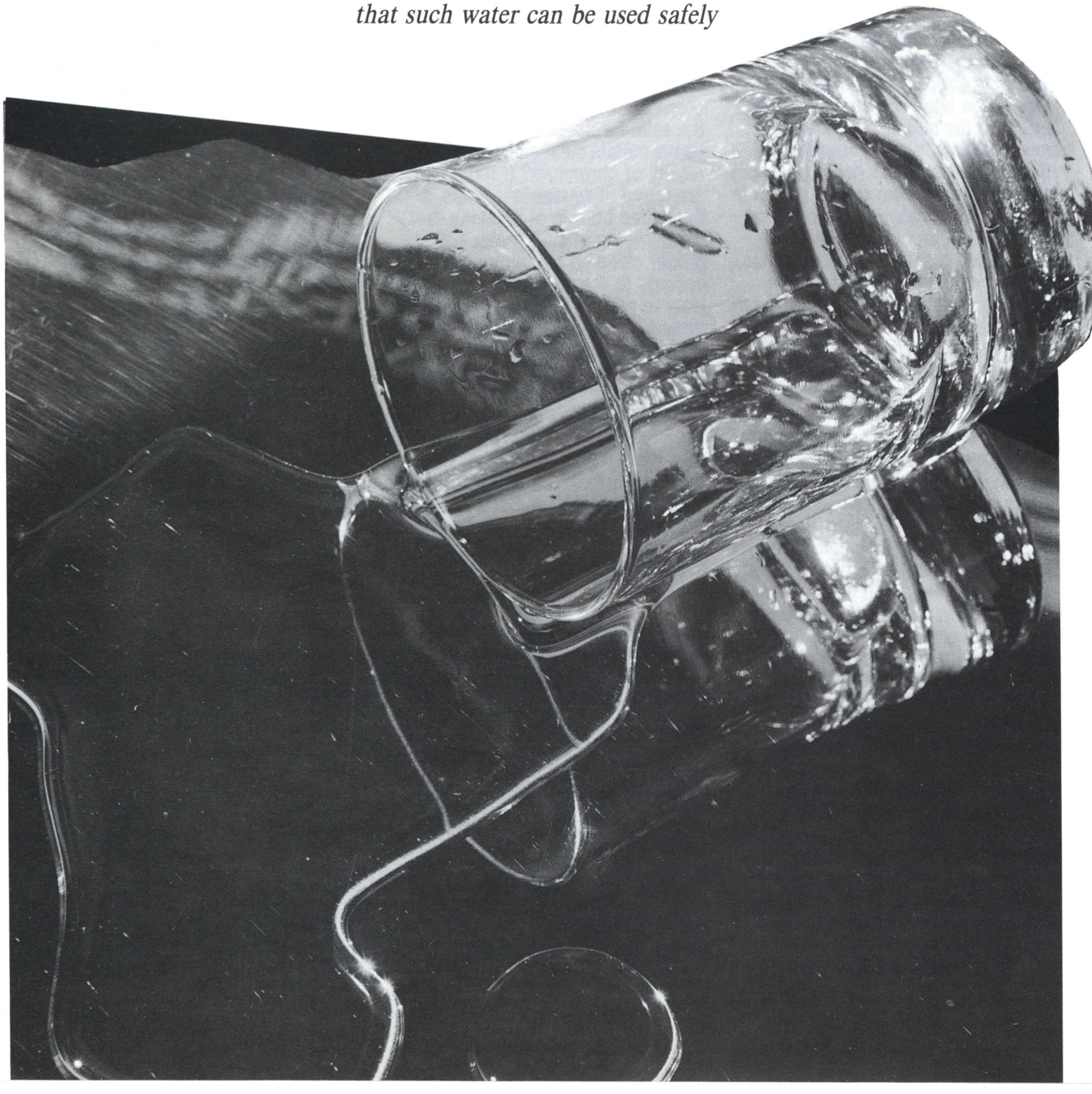
WASTE NOT WANT NOT

Another voice calling for more extensive recycling of wastewater for agriculture is that of Prof. Yona Chen of the Faculty of Agriculture, who has demonstrated that such water can be used safely



WHEN A COMMODITY THAT we use for daily living becomes scarce we look for an alternative. When coal was becoming difficult to mine or scarce in some localities, we turned to oil. As the oil supply dwindles, we have nuclear or solar power available. What happens when water starts to become scarce? Do we drink oil instead, wash in alcohol, or water crops with sewage? Well actually yes, at least to the question of watering crops. Some remarkable things have been done in Israel in reclaiming wastewater for further human use. Here we will take a look at some of the things that have been done, their potential and also their limitations.

Wastewater is all water that remains after its original use in homes or industry. All water of this type has the potential to be recycled and reused, with a number of pretreatments and precautions. But not all wastewater is created equal. Some industrial wastewater, because of the amount and type of contaminants it contains, is for all practical purposes unrecyclable and unreusable. It would be highly uneconomical to try to recycle such water. An example of such water would be wastewater contaminated by hazardous waste and heavy metals such as cadmium, lead, nickel, or chromium. This type of waste is produced by common industries such as electronics (batteries) and paint manufacturing. The solution is not to stop industry; after all, who wants to give up batteries for his Walkman, or a fresh coat of paint in her home? Rather we must constantly research methods to try and recycle such wastewater economically.

If we are careful not to mix this type of wastewater with the general type of wastewater, then the goal of recycling and reuse is more attainable. The recommended method of handling such wastewater is to treat it at the plant that generated it to remove the heavy metals before mixing it with the general waste. We now understand the damage unscrupulous industrialists can do if they take such waste and dump it into the waste system without proper treatment. Because most treatment centers work on the assumption that such metals do not exist in the wastewater, they do not treat for it. As a consequence of such dumping the heavy metals can end up in the environment, or worse, on our table.

However, only a small fraction of wastewater contains the heavy metals, and the remainder is more easily reclaimable. It should be pointed out that treatment of wastewater is not really a matter of choice. No matter how much water a country has it must treat its wastewater to some degree before dumping it into the environment. Without proper treatment, the dumping of wastewater high in organic matter and other pollutants into our rivers or seas can severely damage the environment. After some type of primary treatment to make sure the wastewater is "reasonably cleaner", we can then release the water into the environment and let nature's natural cleaning procedure do the rest. We must not give nature a clean up job she was never meant to handle.

"Reasonably cleaner" for release into the environment is still a long way from usability for agricultural or other purposes. Besides cleaning wastewater to protect the environment, countries like Israel whose shortage of water is so severe must recycle wastewater to meet their various water needs. Needless to say, there are numerous problems to overcome before such water can be used again. The problem of hazardous waste, as we mentioned above, can be dealt with at the site. Another problem is the education of society and the high cost of clean-up. These two are put together for good reason. Unless there is a tremendous drive in society to treat and clean up its waste and not dump it directly into rivers or oceans, people will not be willing to pay the financial cost of clean-up. This drive must be an internal one, not one imposed by laws nobody is willing to obey. Society must be educated to realize that dumping is no longer an alternative.

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Lastly there are the technical problems of clean-up. Surprisingly, compared to the previously mentioned problems, these are the easiest. We have solutions to most of the technical problems, and know how to treat wastewater quite well to achieve the purposes we want. The techniques are there, and it is mostly a matter of the will of the people to want to pay the cost of the complex engineering of clean-up.

Not only are the complex techniques extant, but they are in place and working in various locations in Israel. Generally, there are three levels of treatment of wastewater. The purpose of a primary treatment is to reduce the amount of solid matter in the water. This is done mainly through sieving and precipitation. The purpose of a secondary treatment is to remove as much organic matter from the waste matter as possible after the first treatment has been effected. The last, or tertiary treatment, is aimed at removing specific contaminants the previous two treatments might have left behind. One of these contaminants might be the nitrate ions, which in the last decade or so we have come to realize are dangerous for human consumption.

Almost all wastewater in Israel originating from cities undergoes a primary treatment. There are a few places, especially in Judea and Samaria, were wastewater is dumped directly into the environment. The reason - not enough money for treatment centers. A large part of the wastewater in Israel undergoes a secondary treatment. This secondary treatment is so good that with proper management, it can be and is used extensively for agriculture. The key words are proper management.

re-cy-cle vt: 1: to pass again through a series of changes or treatments: as **a:** to process (as liquid body waste, glass, or cans) in order to regain material for human use (*Webster*)

This is where Prof. Yona Chen and his colleagues at the University's Seagram Center for Soil and Water Sciences come in. Using secondarily treated water for agriculture offers a tremendous saving in fresh water use, but its limitations must be recognized. Presently, secondarily treated wastewater is being used to grow cotton, and under very controlled conditions, certain orchard fruit such as oranges. It is illegal, however, to use such water to grow vegetables. Through extensive research, and considering factors such as depth of groundwater, time required for such water to filter through the soil, and the allowable amount of water to be used per acre, researchers in Israel including Prof. Chen and his team have demonstrated that such water can be used successfully and safely.

Tertiarily treated wastewater is an even bigger success story. Because of its need of such water, Israel has made significant contributions at this level. This water is so good that if all the parameters by which we measure

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drinking water were applied to this water, it would pass. Because of the unknowns that might be present, such as certain viruses which might be difficult to identify, or very low level concentrations of certain organic chemicals whose impact, if used, we are unaware of, this water is not used directly for drinking. It is pumped into the ground and it spends, at a minimum, ten to twenty years in groundwater aquifers, being treated by nature, before it is used for drinking water. Tertiarily treated water is also used for agriculture. One plant in the Tel Aviv area that treats up to the tertiary level pipes approximately 80 to 90 million cubic meters of water a year to the northern Negev for irrigation. The goal is to increase tertiary production in this plant so that 140 million cubic meters per year can be piped. The question can be asked, if tertiary treatment is so good, why not treat all wastewater at this level? As usual, the answer is an economic one. To go from secondary treatment

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to tertiary treatment increases the cost to up to 15 to 20 cents per cubic meter, an increase of 25-30 percent compared to the secondary treatment.

Despite these successes, Prof. Chen quickly admits that much research still needs to be performed in the areas of recycled wastewater and its use. All the potential health hazards in using recycled water, despite the many precautions taken, still have to be more fully investigated. Also, the long term effects of recycled water on soil quality have to be more throughly looked into. The many unanswered questions of how using recycled water affects soil salinity, dispersion of soil particles, and the loss of permeability of the soil due to the organic material contained in such water, must be answered. At the technical end, a perpetual goal is to bring the cost of cleaning wastewater down as low as possible.

Presently, about 110 million cubic meters of recycled water is being used throughout Israel each year. Prof. Chen would like to see that usage tripled to about 300 million cubic meters a year. Another goal of his is to have all wastewater in the entire country undergo at least a secondary treatment before it is released into agriculture or into the environment. Then there is the problem of the sludge, the material that remains after the various treatments. Its present methods of handling and disposal, Prof. Chen admits, still leave vast room for improvement. But despite the problems that remain, the future, because of waste, looks wetter. ■