

WATER NEEDS OF TOMORROW

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Someone has said "a thirsty person cares not for reason, listens not to justice, nor are his knees bent by any prayers." In other words, he recognizes that water is an absolute essential to life. It regulates where you live; what you do; and the growth of any community.

The problem of many areas of the world is not only food and how to get enough to eat, but water. For water is essential in the production of that food.

The importance of water in our everyday life cannot be overestimated. Our very activities in what we do are completely dependent on our ability to get a potable supply of water. The Office of Saline Water is in the business of trying to find a cheaper way of getting fresh water from the oceans and the brackish waters that underlie many areas of the United States. The oceans represent potentially inexhaustible supplies of good water. The success and well-being of every citizen, whether he be in the livestock business, a teacher, a preacher, a businessman, or plain citizen Joe, is fully dependent on an adequate supply of sweet water.

President Eisenhower in his Message to Congress in 1953 recognized that the Government had a real responsibility in managing the Nation's natural resources for the benefit of ourselves and future generations. A Special Committee in the Senate is studying what has gradually come to be recognized as our most vital natural resource, water. After long and exhaustive hearings in many States, they will soon make an important report to the Nation. The President's Water Commission made a report which points up the urgency of our water situation. Presidents Roosevelt and Truman recognized the importance and seriousness of the water problem. They, along with President Eisenhower, appointed committees to study and furnish information on our future water needs.

We must realize that all of the world's people live on less than one-quarter of the globe's surface. They are dependent for life entirely on the fresh water upon and beneath the inhabitable land. Man's epic struggle to survive on this planet could be written in terms of his constant concern and need for water.

Through the ages, natural supplies of water, fluctuating in an unpredictable manner, have governed the rise and fall of civilizations. Some of the most creative and cooperative ventures in the annals of human advancement were applied to the development of water resources. When these developments were successful the Nation prospered. When they failed, the Nation perished.

The lessons of history are clear and the predicted use of water in the United States is a matter that should deeply concern every citizen. Today, we are using nearly 300 billion gallons of fresh water daily. By 1980 we

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expect the demand to reach nearly 600 billion gallons of water a day. This immense increase is equal to the daily flow of 20 Colorado Rivers, exceeding by 85 billion gallons our total available daily supply. If we ponder for a moment the serious water shortages that periodically plague various areas of the Nation at today's rate of demand, what will be the situation in just twenty years when the demand will more than double?

Can you picture a city without ample water to operate its sanitary sewer system? Without enough water to fight a serious fire? Unable to supply the water demands of its industry?

Without water a city or a Nation will die. Without water man faces the same fate.

While it is difficult to glamorize a glass of water, it is impossible to get along without it. Nationally we have been blessed with such ample and readily available supplies of water that we have been able to turn a faucet any time, almost anywhere, and obtain good, pure, hot or cold water, at an average price of less than 10 cents a ton--delivered.

There are already many soft spots, however, in our water supply picture, especially in the more arid areas here in the Southwest where an adequate supply of water has been quite difficult to provide and, in turn considerably more expensive than the national average.

Our population is increasing at the rate of 8,000 a day, or at the rate of a city approximately the size of El Paso, Texas, every month. I think we can safely say our population is growing at a chain-reaction speed, and at the same time our industrial complex is expanding at an unprecedented rate placing new demands on our existing reserves of fresh water. Some of the industrial water requirements may surprise you. It takes as much as 240 thousand gallons of water to manufacture a ton of acetate; 660 thousand gallons are needed to produce a ton of synthetic rubber, and as much as 65,000 gallons to produce a ton of finished steel and a like amount to produce a ton of newsprint. To refine a gallon of gasoline from crude oil requires seven gallons of water for each gallon produced.

Agricultural interests are constantly pressing for more and more water. When we speak of the water required to maintain agricultural production, we really get into volume water requirements. Grains take over 650 thousand gallons per acre to produce a crop. An acre of alfalfa needs over a million gallons per acre per season.

WATER USE AND DISTRIBUTION

Flush a toilet	3 gallons
Tub bath	30 to 40 gallons
Shower bath	20 to 30 gallons
Wash dishes	10 gallons
Run a washing machine	20 to 30 gallons
Alfalfa requires about	35 inches of water
Sugar beets	30 inches
Cotton	25 inches
Potatoes	20 inches

To produce a single pound of beef for the dining room table requires an estimated 3,750 gallons of water.

Examined within the framework of these figures it is not difficult to see that the task of providing ample supplies of fresh water for the America of tomorrow may indeed be our No. 1 domestic problem.

You folks living in Texas, New Mexico, and the West, live in what is generally known as the arid part of the West. The West is in the business of growing meat. Irrigation has helped to diversify your crops. This fits in with the business of producing meat. Meat has made a tremendous contribution to the American diet. American people have always been big meat eaters. Meat was a planned diet for human beings from the very beginning of time.

I know, as a doctor, that the human body is and has been adapted to the consumption of the meat produced. I have said before that there is no food which nature has so largely and lavishly endowed with the necessary proteins, vitamins, minerals and fats, as it has meat. Meat is the masterpiece of nature's laboratory. It contains 22 amino acids; 10 of which are absolutely necessary to keep our bodies healthy. Yet meat is mostly water, and there must be water to produce the meat that the nation consumes.

The people of the world that are big meat eaters are generally large in stature and have great energy. The Hindus, Chinese, Japanese, and the inhabitants of Okinawa, who eat little meat are small in stature.

Why did I mention meat and its importance in the diet when I am talking about water? I did so because no meat, no vitamins, amino acids, or food crops could be produced without the proper amount of water.

We are quite sure that in the coming years many areas of our Nation and the world will have to rely on water from the sea for a substantial percentage of their supply. In the Office of Saline Water we are racing the clock, hoping to be able to develop processes that will make this water available to cities and industries when they need it, and at an economically competitive price.

There is a false philosophy that the water in some parts of the world should be essentially free to the consumer, just like air. The philosophy is self-defeated because water projects cost taxpayer dollars.

It is estimated that capital expenditure for public water facilities was more than a half-billion dollars in 1959. Sewage disposal projects took another quarter of a billion dollars. The water treatment plants for just the chemicals alone required more than a billion dollars. It is estimated that more than 60% of all water today has to be treated and that about 80 per cent of the water is "hard" water. The annual treatment of water bills including chlorination may reach 3 billion dollars by 1980. About 75% of our American cities derive their water from wells.

In the Office of Saline Water, we carried on in 1960, 54 separate contracts involving saline water problems with Universities, technical institutions, or private industry. Private industry engaged in about half of these 54 projects and generally put in a part of the actual cost or supplied tech-

nical equipment and experienced personnel.

There is no limit to where scientific minds may go or what they may do if they are given the green light and the minimum amount of Government interference. They are making tremendous progress in the saline water field.

It is my humble opinion that the plants we build today will be "horse-and-buggy" type ten years from now.

We are now engaged with the Army Engineers in running a small pilot plant at Roswell, New Mexico, in an effort to determine how these particular well waters will react to a vapor compression process. The well waters are around 22,000 parts per million dissolved salts. We are also experimenting with some drop-wise condensation equipment supplied by the Struther Wells Company. This salt content is higher than we generally consider for brackish water.

The Office has received more than 600 ideas on how to desalt water. Some of these were good and quite feasible; some, of course, bordered on the crackpot ideas. The Office has a large group of scientific men and women that we may call upon to help evaluate the different processes.

I have always told my engineers when a new suggestion comes to the Office that they must never say it will not work. I want men and women around me who will say they will find a way to do the job. It is quite possible that some obscure approach may in the end be the method that will solve the difficult problem of making drinking water from the ocean. You and I know that many of the great inventors of the past were thought to be "crazy" because they advanced certain ideas that today are commonplace.

There are about 17,000 towns and cities in the United States that have a public water supply system. They serve about 115 million people. Can you imagine what might happen if the citizens in a large town would turn on the faucet and be without water? Indeed, that has happened. Some cities during the 10-year drought were buying water, paying as much as 50¢ a gallon. Recently I read an article where the breweries in Miami had closed down and were bottling water in order to sell it to the people at Key West who had their supply of fresh water interrupted by hurricane Donna. The violent storm wiped out over a mile of their 130-mile pipeline and caused at least six other serious breaks in the line. Key West was without water and faced the serious problem of possible bacterial invasion.

The 150,000 residents of Tijuana, Mexico, are depending on trucked-in-water to meet an emergency water shortage.

The British Crown Colony of Hong Kong can supply its teeming population with fresh water only two or three hours each day. The Virgin Islands have for years used barges to bring in part of their fresh water. They will soon have a distillation plant in operation.

These are examples, and I could cite many more, where they may soon solve their water problems by converting sea water to fresh.

The Office of Saline Water has been consulted by the Navy about the problem of supplying water to our base at Guantanamo Bay in Cuba. The renegade

Castro's next move may be to shut off the slender thread and vital life-line of water supply to the base. He can easily do this because the water used at the Guantanamo Base arises in the Cuban inland. This Office has made some suggestions to the Navy on using some distillation units now in old "Liberty Ships" to meet the emergency needs of the base. We have one company under contract, Struther Wells of Warren Pennsylvania, that has offered to build a 250,000 gallon per day freezing plant for \$1.00 profit to supply the base. In my opinion, the emergency at Guantanamo Bay will be accentuated as soon as Castro decides to move in and attempt to push our troops off this vital point. Water could well be the determining factor, but, thank goodness, we now have several methods of getting fresh water from the ocean that can meet the needs of the base.

Cities are having a real problem on how to handle detergents. While it is possible to sterilize water and treat sewage water and make it potable again, the detergents from mother's washing machine and her dishwasher have caused the water to foam in city water supplies 20 miles away. There is going to be a real problem for the scientists and chemists to handle this new problem of detergents'. I have seen the Potomac River in Washington boiling like soapsuds a few hours after washday was concluded. In modern treatment, plants are quite capable of cleaning sewage wastes out of water and making it perfectly safe to drink. People don't like to think they are drinking that kind of water, but some of them are doing just that now. There is a problem, however, of screening out the detergents. People like a head on their beer but not their drink of water.

The Office of Saline Water was established by Congress in 1952 with an entirely new concept in mind. To develop processes for an abundant supply of fresh water for human, industrial, and agricultural uses--at low cost.

As late as 1952 the cost of converting a thousand gallons of sea water to fresh ranged upward from \$4 to \$5, which is far too expensive for general use; but as the cost comes down more and more areas will find converted sea water to be the most reliable and economical source of supply.

In 1958, President Eisenhower approved legislation that set the stage for a new pioneering effort. The legislation directed the Secretary of the Interior to select from the most promising of the presently known processes five different methods for use in plants designed to demonstrate their reliability, engineering, operating, and economic potentials. These five processes and sites have been selected.

Their very selection gives a measure of the rapid progress that has been achieved during the eight short years the Office of Saline Water has been in existence. Three of these methods did not exist as a saline water conversion process in 1952, and the two that were known at that time have been vastly improved. The fruits of our labors are made available to the world through publications.

Recently I had the rewarding experience of participating in the ground-breaking ceremony for our first demonstration plant which is now under construction at Freeport, Texas. Using a process developed wholly under Office of Saline Water sponsorship, this plant will produce fresh water from the sea at the rate of 1 million gallons per day at an anticipated cost of

about \$1 per thousand gallons.

A process that could be classified as no more than a laboratory phenomena in 1952 will be utilized in a 250,000 gallon per day plant at Webster, South Dakota, to demineralize the brackish well water of that City. Construction bids for this plant were opened on October 4. The successful bidder will be announced shortly.

On October 18th we opened bids for a second one million gallons per day plant to be located at San Diego, California. This plant is also expected to produce fresh water from the sea for about \$1 per thousand gallons. As exciting as this prospect may be, we stand on the threshold of fresh water from the sea at a price considerably below that figure. As in many operations, savings can accrue from quantity production. Our studies indicate that when these processes are incorporated in plants of 25 to 50 million gallons per day, we can expect fresh water for less than 50 cents per thousand gallons.

In 1957, a year of moderate drought, over 1,000 cities and communities in the United States were forced to restrict the use of water. Some cities are close enough to sea or brackish water sources so they can get relief by installing proper equipment.

While I am not posing as a prophet, it is my firm belief that before 1980 there will be more than a thousand alert and progressive cities that will have averted a water crisis by using conversion units--units that are being developed today--to provide tomorrow's water.

This Nation has always had new frontiers to conquer. And each era has produced its own hardy band of pioneers to accomplish the task.

We must place greater emphasis on basic research for new scientific knowledge--the most challenging and exciting frontier we have ever tried to conquer. Our ability to compete in world markets in the coming decades will be determined by the research and development we are willing to support today in order to penetrate the ever-expanding frontiers of science.

The trails today's pioneers are blazing in the laboratory are vastly more important than any traveled by earlier pioneers. I am convinced that there is no limit to what science can accomplish when free men and women make up their minds to reach their goals. Chemical engineers are performing and will continue to perform a vital role in the development of low-cost conversion processes that will assure ample supplies of fresh water to meet needs of the future.

The development of our West has largely been due to the fact that we have made use of our western resources, including the conservation of water. The development of our country has come about because of wise political, economical and spiritual leadership. It makes little difference which party is in power as long as they carry out the ingredients of that prescription. We may doubt and question what wise political, economical and spiritual leadership may be, but we can never doubt the wisdom of developing our water resources.

Our forefathers when they went into a new country first looked to the

water supply. They dug their own wells by hand. It was necessary to have water if they were to live on the new frontiers. They did this with a minimum amount of government interference. They carved out their own destiny and determined their own future by planning, courage and action. They had to have some iron in their blood and granite in their backbone. They conquered the inhospitable prairies; they carved out their homes and towns; built their churches and their schools and raised their families, which are the communities of today. They had no guaranteed prices for their crops; no social security; no unemployment compensation insurance. They fought hard winters and long droughts but with confidence in the land and through their own strength and determination, they carved an empire that became America. This heritage was handed down to us and made a strong America, whether you were raised in Kimball, Nebraska, my hometown, or in Roswell, Pecos or Santa Fe, New Mexico.

In all of this development, water has been the one thing that is needed. It is just as essential to the lone shepherd on the range as to the teeming millions in the city.

I think the efforts of the Office of Saline Water are well expressed in the words of Daniel Webster that are carved on stone over the Speaker's chair in the House of Representatives: "Let us develop the resources of our land, call forth its power and build its institutions, promote all its great interests and see whether we also in our day and generation may not perform something worthy to be remembered."