THE INDUSTRIAL USE OF WATER

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The industrial use of water in New Mexico is more than 1% of the some 2,125,000 acre ft./yr. presently being used. A rather insignificant volume, and most of this 39 million gallons per day is being used by the potash and oil industries. We are all familiar with the role New Mexico's mineral resources has on our economy. It is not only of local importance, but of national significance. To date our minerals industry has been primarily of an extractive nature with little processing or manufacturing taking place locally. Why? Perhaps water is one factor!

The opportunity exists for the expansion of our mineral industry; however, one of the first requirements for the development and (may I emphasize)---processing---is an adequate supply of water. What water does industry need? Of course this question is difficult to answer; however, based on certain known and many estimated figures, some of the information that is to follow may be of assistance to those of you that are charged with the responsibility to see that water requirements are met, and that the water we have is put to a beneficial use.

The population of our state has been increasing steadily at a rate above the national average, and our per capita income has increased, but is still below the national average. To make any substantial expansion in our economy it must come through increased processing of our mineral products within the state. Certainly we welcome the abnormal concentration of government activities within our state--most assuredly myself, since I happen to be part of that activity---but we cannot rely on this for a solid foundation. When the "cold war" is "hot" we are growing, but what will happen in years to come? We are not an industrial state as indicated by many statistics, including:

1. Our use of industrial water is the lowest of any state in the Union.

2. Our personal income of almost 1½ billion dollars last year was concentrated in government salaries, 32% to be exact, the highest of any state in the Union.

We are not an agriculture state, for only 9% of personal income was derived from this source -- the lowest state in the Union! We are prosperous now, but we want to remain so and grow a little with time.

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Certainly one limiting factor is our water. One authority estimates that the water necessary to support one low salaried agriculture employee (and 56% of our farmers make less than $2500/yr.) could support 60 industrial workers. Definitely our future does not depend on industry or the dictatorial use of water, but we can work toward improving our use of water and increasing industry. Being close to the oil industry, I have had the opportunity to observe what the wise use of this resource has meant, and I hasten to add-to the economy of New Mexico.

I mentioned earlier that the importance of the mineral industry was not only of local significance, but also national, and since the mineral industries use most of our industrial water, I wish to indicate to you the magnitude it plays.

New Mexico is one of the greatest sources of energy in the United States and rich in basic minerals. In 1957 New Mexico produced 95 million barrels of oil, placing our state as the 7th largest producer, and our production of 731 billion cubic feet of gas placed us as 3rd in gas production. If we convert gas to a common yardstick with oil by the means of BTU's we find that the energy of gas was equivalent to 122 million barrels of oil. This plus 1957's oil production gives a total of some 217 million barrels of oil. Without adding some 15¼ million barrels of raw gasoline and LPG products stripped from our gas, we were the 6th largest state in hydrocarbon energy and just short of replacing Kansas as Number 5. Upon adding our anticipated production in 1960 of 3½ million tons of uranium ore, which according to experts is equivalent to 70 million barrels of crude oil, we may have a total of 287 million barrels of oil, placing New Mexico in 5th place and close to replacing Oklahoma as Number 4.

With this energy and our 80 known commercial minerals we have the raw materials for a large industrial development. Not only do we have energy and commercial minerals in our favor, but our position, geographical and population-wise when compared to the United States as a whole, places us in a very favorable position to be more than an export state. In 1955 New Mexico had an annual refinery capacity for about 140 million gallons of gasoline; however, we consumed 336 million gallons. Refineries located in New Mexico have a capacity for 10% of our production. The remaining 90% is exported. Therefore, a large volume of petroleum products is imported after having been processed in another state. Basic hydrocarbons used by the petro-chemical plants are raw gasoline and LPG products. In 1957 15¼ million barrels of these products were exported for use and processing. It is estimated that a petro-chemical plant processing local products will yield $12 for every $1 obtained by export of crude. True, these plants use a lot of water, but let us assume that all crude oil we produced last year could have been processed. This would have been a figure in excess of 3 billion dollars.

From these examples I have indicated somewhat the loss New Mexico is suffering due to our lack of petroleum processing plants. No doubt exists in my mind that water has been a contributing factor. However, water is available, and economically so, for many plants in several areas. A little more about this later.

WATER USED BY INDUSTRY

Most basic water data was furnished by Mr. Don Akins of the State Engineer's office and obtained from a 1955 survey. Production statistics for 1955 by the various industries was obtained from recognized source material.

PRODUCT	Mgd.	GALS. WATER/UNIT OF PRODUCT
Crude Oil Refineries	1.426	60 gals/bbl crude processed
Potash	12.386	2,425 gals/ton K_2O
Electricity	6.581	1 gal/kilowatt-hour
Oil Well Drilling	1.500	50 gals/foot hole drilled
Gasoline Plants	4.875	3,703 gals/MMCFG processed
Uranium	1.432	410 gals/ton ore processed
Copper	6.000	34,000 gals/ton recoverable Cu.
Carbon Black	.400	4,000 gals/ton
	34.600	

FUTURE WATER NEEDS OF INDUSTRY

OIL WELL DRILLING

Water needs in drilling for oil and gas are expensive due to transportation problems, but not particularly significant in volume. Estimating an average of 250,000 gallons of water per well, and this a conservative figure, we used 550 million gallons of water in 1957. Assuming that drilling activity will remain at about our present rate for the next 10 years, the total water needed for drilling will be some 16,800 acre feet.

POTASH INDUSTRY

This is a major New Mexico industry which is presently using the largest volume of water. Some 12,386,000 gallons of water per day were used to recover 1955's total production of 1,864,000 tons of K_2O equivalent. Based on published reserves of 80 million tons of K_2O, and at the continued present rate of use, it will take 595,509 acre feet of water to refine known reserves. At $37/ton the value of the potash will be $2,960,000,000.

URANIUM

Our new uranium industry, with 1.432 Mgd. used in 1955 to process 3,500 tons of ore, will need 62,884 acre feet to process 50 million tons of proven reserves. With new mills under construction and those completed since 1955 it is anticipated that the 50 million tons of proven reserves will be depleted in 15 years.

GASOLINE PLANTS

With proven reserves of over 21 trillion cubic feet of natural gas it will take 29 years to deplete at our present rate of export. With gasoline plants processing all gas and using 3,703 gallons of water per one million cubic feet of gas processed it will take 239,000 acre feet of water.

OIL REFINERIES

It is more difficult to project the future needs of refineries due to obvious factors, however at our present capacity within the next 20 years, or 200 million barrels of processed crude, we will need 28,000 acre feet. This is based on the present use of 60 gallons of water per 1 barrel of oil.

GENERATION OF ELECTRICITY

Estimated present consumption of water in generating electricity is 1 gallon per kilowatt hour. In 1955 2,402 million kilowatt hours were produced in New Mexico. Projecting this same rate and water consumption 20 years hence indicates that we will need 147,440 acre feet of water. Please note that no growth is indicated.

CARBON BLACK

At the rate of 4,000 gallons of water per ton of carbon black and assuming present production of some 1 million pounds per year for the next 20 years, this processor will need 12,276 acre feet of water.

SECONDARY RECOVERY

The oil industry of New Mexico will need in the near future enough water to produce by water-flooding 500 million barrels of oil. According to estimates made by the Bureau of Mines in 1954 approximately 2.2 billion barrels of water was injected into oil-bearing strata in the secondary recovery of 110 million barrels of oil, or about 20 barrels of water per one barrel of oil. Secondary recovery experts inform me that with increased capital outlay a minimum of 10 barrels of water per barrel of oil recovered can be reached. Basing

my following calculation on the minimum figure, this will take 5 billion barrels of water, or 644,579 acre feet. At the present rate of pumpage this is equivalent to more than 2 years of water used in the Lea County Water Basin for irrigation. Another comparison: Based on 50,000 acre feet per year presently being consumed by the city of Albuquerque, it is a volume large enough to last the city 10 years.

What will be the financial return for the use of such large volumes of water? Based on present day value of oil at $3.00 per barrel, the gross income will be $1,500,000,000 -- or about what the personal income of the entire state was during 1957. Again -- another comparison would be the total expected income that will be derived from all of our known uranium reserves.

To recapitulate the above information and arrive at an estimation of water needs by these major industrial water users I have projected each industry to twenty years in the future. Obviously numerous factors will affect these estimates -- to point out a few:

Increase in known reserves, increase in processing, or conversely the decrease.

INDUSTRY	ACRE FEET WATER NEEDED IN NEXT 20 YEARS	AVG. NO. ACRE FEET NEEDED ANNUALLY*	REMARKS
Oil Well Drilling	33,760	1,688	This is based on a continuation of 1957's rate. Doubtful this can be maintained.
Gasoline Plants	158,666	7,933.3	Reserves sufficient for 29 years @ present rate.
Oil Refineries	40,000	2,000	Based on continuation of present rate for 20 years, or 200 million barrels of oil.
Potash	297,754	14,887.7	Reserves sufficient for 30 to 40 years at present rate.
Uranium	75,461	3,773.05	Present proven reserves only sufficient for 15 years @ present rate of milling, but undoubtedly new discoveries will be made.

* Computed by the editor.

Carbon Black	12,277	613.85	Doubtful if present methods of processing can survive this full 20 years.
Generation Electricity	147,440	7,372	1955 rate extended to 20 years, no accounting for increase in capacity.
Secondary Recovery	644,579	32,228.95	Doubtful, but very probable that secondary recovery will be this far along.
	1,409,937	70,496.85	

Certainly this sum of 1,409,937 acre feet of water is not small, and the geographical area of use is rather limited.

As of April 30, 1958 the Lea County Water Basin had 84,450 acre feet of water unappropriated. Since the largest portion of the 1,409,937 acre feet of industrial water will come from Lea County, it is obvious that industry must begin making plans now to develop a water source.

What Source?

Fortunately in southeastern New Mexico relatively large volumes of water are available at certain points from oil field disposal projects. It is estimated that from the Hobbs Pool .500 Mgd. of 15,600 PPM total solid water will be available within 6 months. I venture to estimate that the cumulative water gathered by this system will reach 500 million barrels or 64,458 acre feet by the end of 1978. Other major disposal systems such as the Monument area will be collecting and disposing of some 31,000 barrels/day within the next 2 years and by 1978 will have a cumulative production of some 500 million barrels (64,458 acre feet). Other major sources for this saline to brackish water will be Denton, Caprock Devonian, and many others.

A survey made by this speaker in 1956 indicates that from 8,914 oil wells, many in widely scattered areas, that 145,772 barrels of water per day was produced. The methods of measuring oil field waters are inaccurate and at best this figure is 25% short of the actual amount produced. However, using this figure, some 6,859 acre feet of water/year is presently available. To make a guess as to the ultimate water is dangerous, but I will venture to estimate that 5 billion barrels will be produced within the next 20 years, or 644,580 acre feet. The cost to lift this 644,580 acre feet from depths of 3,000 to 12,500 feet will have already been met, as will the gathering. But, if you please, I would like to relate what this same volume of water would cost to lift from the Lea County Water Basin at a depth of 70 feet. Based on lifting cost as published by Mr. W. P. Stephens, under certain conditions water could be lifted for as low as $3.16

per acre foot. Therefore, the cost for lifting 644,580 acre feet of water would be slightly over 2 million dollars.

Certainly many industrial plants can utilize this mineralized water, and it is desirable for use in secondary recovery. However, we are presently reinjecting water that was lifted from great depths at considerable cost back into formations from 4,000 to 12,000 feet deep. Certainly no forseeable factors will enable us to relift this water. Definitely the contamination of what water we have is to be prevented, but perhaps there are other approaches to this problem. The most apparent are:

1. Demineralization and reinjection into shallow ground water. Expenseive? Yes, but perhaps not for industrial purposes.

2. Storage of brackish water in reservoirs at shallow depths. Detailed mapping outside of the Lea County Water Basin will undoubtedly reveal that such reservoirs exist.

3. A third avenue for investigation might be termed "Controlled Contamination". That is, the injection of highly mineralized water into aquifers containing relatively fresh water, but not contaminated beyond the point that makes the fresh water nonpotable.

Other sources for industrial water in Lea County include the Santa Rosa formation at depths of 800 to 1,000 feet. Limited information indicates that this is a major aquifer.

Perhaps some of the ideas presented might sound as if this author was for sin and against motherhood, but certainly suggestions such as the above rate consideration equal to the magnitude given to the recycling of sewage.

To sum up I would like to point out:

1. That our present industries need more water than is generally realized.

2. The time for obtaining a relatively cheap source of water is rapidly drawing to a close, if not already past in most areas.

3. That the time for planning the development of future industrial water resources is here.