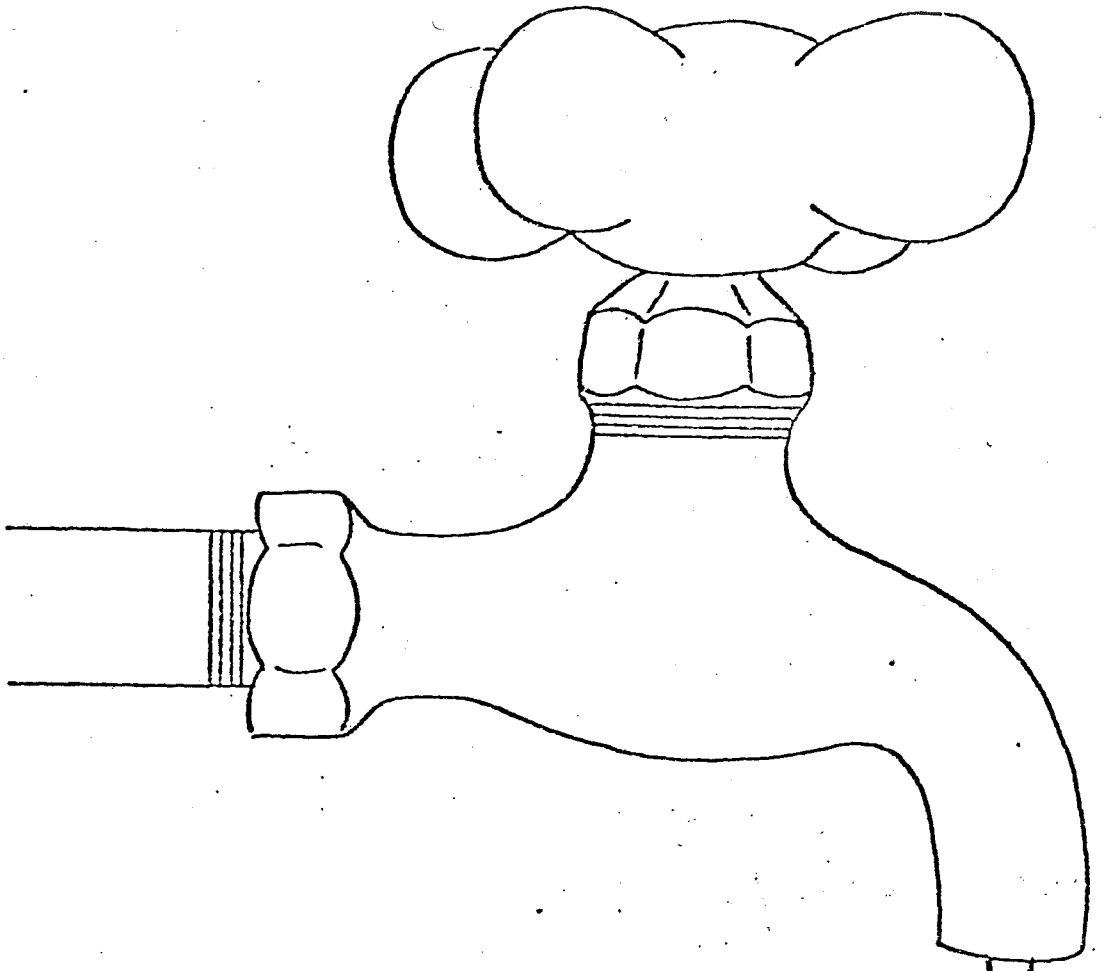

ALGAE: THE ANSWER

Pure, pristine-like water, purified by one of nature's oldest, yet most effective biological systems, ALGAE, began flowing into Lumberton, New Mexico, early this year. Lumberton, a small town located high in the North Central Mountains of New Mexico, has been without potable (drinking) water since it was founded as a lumbering and coal mining community over 50 years ago.

FIRST TIME
IN 50 YEARS
CITY HAS CLEAN
WATER TO DRINK

ALGAE: THE ANSWER

by

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SWEET WATERS FLOW IN LUMBERTON

It tastes like a rotten egg in a stale glass of 7-Up; potatoes and beans turn black when boiled in it; as for coffee, well-it's not recognizable as coffee when made with it; one can actually ignite and burn the gasses coming from it although that doesn't improve its taste. What is it? It's the water supply for Lumberton, a Northern New Mexico town. But all this has changed thanks to an innovative water treatment system--the first of its kind in the world--that uses green and blue-green microalgae to purify the town's water. The algae are used in place of other expensive water purifying methods such as ion exchange and reverse osmosis which have high initial and recurring costs.

Lumberton sprang up as a main switching point for the area's lumbering activities when the Denver and Rio Grande Railroad layed narrow gauge rail there in the last century. Since its beginning, Lumberton was a town without potable water. The railroad hauled a tank car of water to Lumberton once a week for the town's water supply. But in 1949, the railroad began pulling up its rails to the west from Durango, Colorado, and by 1960, all rail links disappeared from Lumberton. With that link went the last tank car of fresh water.

A well was dug in the center of town near St. Francis Church, but the sweet waters of life turned out to be sour, sulfide-smelling, malodorous water. Another well was dug east of town in 1964 (presently the site of the new water treatment plant), and it, too, was foul, the reason being that deep under the ground the water passed through soft coal and shale beds.

The town looked for alternatives to the nonpotable drinking supply. Nearby towns--Dulce, New Mexico and Chama, New Mexico--didn't have enough fresh water for themselves. So Lumberton's 30 families were forced to haul raw water from the Navajo River, five miles from the community.

Over the years, the town has qualified for several federal grants to help clean up its water supply, but the techniques tried failed to remove the noxious odor and taste. Then, in early 1977, the Office of the Governor, State of New Mexico, contacted Victor Kollman who was experimenting with algae for water treatment. A biological treatment system was designed and the wheels in the Governor's Office began turning as funds were made available for construction of the first "algae-powered" biological water pretreatment system of its kind anywhere.

The algae-treatment process, which takes place naturally wherever algae are found growing, is relatively simple. But only recently has man found it possible to duplicate nature's processes. Water which is pumped from the 360-ft well contains dissolved chemicals and gasses. As it comes from the well, it has a black color due to the suspended particles of coal. The larger chunks of coal are filtered from the well water as it is pumped into a 20,000-gallon degassification pond. In the degas pond, compressed air is bubbled through the water to remove dissolved methane, ethane, hydrogen sulfide, carbon disulfide, and carbon dioxide gasses. The degassed water is pumped, by demand, to a 20,000-gallon algae culture chamber where algae grow rapidly and remove sodium bicarbonate and other dissolved chemicals which also make it unsuitable for drinking.

The algae are then filtered from the water as it passes into a 5000-gallon clearwell. In this tank, the process water is treated with ozone gas and ultra violet light to sterilize the water and lower its pH. The process water, now suitable for drinking, is transferred to a second 5000-gallon tank where the pH of the water is further reduced by the automatic addition of acid. The water then passes through a microfilter, is chlorinated to prevent bacterial contamination, and is pumped to the town's 20,000-gallon storage tank a mile away.

The algae which are grown can be used as a food supplement for secondary (animal) consumption or for a fertilizer.

The chemical analysis of the well water and algae-treated water is shown in the following table. The column showing percent of change between the untreated and algae-treated water shows that arsenic, barium, calcium, copper, iron, lead, magnesium, silver, sodium, zinc, chloride, and the carbonates are substantially reduced by the algae treatment. The total dissolved solids are reduced from 1606 ppm to 645 ppm; the pH of the treated water is maintained at 7.8. The treated water meets or exceeds Environmental Protection Agency (EPA) and New Mexico Environmental Improvement Division (NMEID) health standards for domestic water supply.

Each day this unique biological water purification system provides 60,000 gallons of high quality potable water for Lumberton's residents at a cost of only $4.00 per day.

As would be expected, the community's interest in their new water system is high. Tourists now stay overnight in this scenic area. Best of all, the 120 school children have a choice of sugar-containing beverages or high quality water to quench their thirst.

It is a cliché, but one easily forgotten, that algae comprise an extremely important group of organisms. They constitute the primary source of food in the sea upon which all life ultimately depends. It has been estimated that marine and fresh-water algae fix about 10-billion tons of carbon each year, more than that fixed by all terrestrial (land) plants. In fresh-water habitats, the significance of algae to the continuance of life is profound as even detergent, and pesticide and herbicide manufacturers have recently been obliged to acknowledge. The environmental improving mechanisms of algae

LUMBERTON WATER ANALYSIS

Constituent	Well Water (ppm)	Treated Water (ppm)	% Change
Arsenic	0.022	<0.001	96
Barium	0.260	<0.010	96
Cadmium	0.005	0.005	0
Calcium	2.000	0.930	53
Chromium	<0.004	<0.004	0
Copper	0.242	0.012	95
Fluoride	0.460	0.460	0
Iron	3.890	0.111	97
Lead	0.054	0.010	81
Magnesium	0.629	0.54	14
Manganese	<0.001	<0.001	0
Mercury	<0.001	<0.001	0
Selinium	0.008	0.008	0
Silver	0.022	<0.001	96
Sodium	520.0	200.0	62
Uranium (U_3O_8)	$<1 \times 10^{-4}$ ppb	$<1 \times 10^{-4}$ ppb	0
Zinc	0.112	<0.001	99
Chloride	50.0	4.0	92
CO_3	10	8	20
HCO_3	1020	430	58
Total Dissolved Solids	1606	645	60
pH	8.9	7.8	-

have been operative since they first appeared in abundance on earth. Only one algae water purification system has been described here; others are planned and one is presently under construction in Chama, New Mexico, less than 20 miles east of Lumberton. Chama's wastewater treatment plant, when complete, will treat 75,000 gallons of raw sewage water daily. The nitrogen and phosphorous cycles will be interrupted, the recycle water will be raised to drinkable quality, and the algae produced will provide a suitable secondary food supplement. Yes, algae <u>is</u> the answer!