

**Sent:** Tuesday, February 05, 2008 11:48 AM

**Subject:** FORUM Q & A UPDATE: BUT I THOUGHT I NEEDED MY MINERALS ?

Dear Aquathin Dealer OnLine;

**FORUM Q & A UPDATE: BUT I THOUGHT I NEEDED MY MINERALS...**

Well, it's been almost four years as you can see since we sent this Forum Q & A...and it's great to see that many of you utilize the BANKS SECTION of the Aquathin Website as **YOUR PERSONAL RESOURCE CENTER**.

Recently a SalesTeam Member at an Aquathin Distributor stated that some of his Customers are very knowledgeable and know that minerals in water are good. I asked why. He said, they know because they are wealthy and successful. Clearly the SalesTeam Member believed that because his Customer had more money, larger home, expensive car, they also had better information...which is not true in this case. The SalesTeam Member should KNOW HIS CRAFT and be able to present strong literature to help his Customer's positive decision making process. Here is the additional information that I provided to the SalesRep:

SalesRep: "My Customer understands that minerals in water are important to metabolism and water is a nutrient".

Alfie: "That is not true...minerals in water are not important...only chelated minerals which have amino acids attached resulting from plant absorption or animals that eat those plants become nutrients. Water is not a nutrient by definition...a nutrient has to change during metabolism...water does not change."

SalesRep: "My Customer says minerals in water are important and water is indeed a nutrient".

Alfie slightly frustrated: "That's BS...now let's re-educate. Here is the basic formula of metabolism:

**FOOD (nutrient) + COMBUSTION (digestion) + H<sub>2</sub>O = ENERGY + WASTE + H<sub>2</sub>O. On both sides of the equation water does not change, and therefor is not a nutrient. In fact, water never changes even as a gas, solid or liquid...it remains H<sub>2</sub>O. Now let's take food out of the equation:**

**H<sub>2</sub>O MINUS FOOD CAN'T PRODUCE COMBUSTION BECAUSE LACK OF FUEL = NO ENERGY + H<sub>2</sub>O...FOR APPROXIMATELY 56 DAYS RESULTING IN DEATH. PROOF AGAIN THAT WATER IS NOT A NUTRIENT. THE 56 DAYS ARE COMPLIMENTS OF YOUR FAT CELLS. WHY DOES A PERSON WHO INTENTIONALLY STARVES THEMSELF AND ONLY DRINKS WATER, BECOME EMACIATED? Please re-review '5th Function of Water, 'Pure H<sub>2</sub>O', 'Forum Q&As'.**

*Further, ask your Customer to try to find valid studies using sound science proving exact concentrations of each mineral to be taken through water...and if you don't have these minerals in your local municipal water, why isn't your municipal water facilities providing these minerals!? If the municipal facilities did, the result would be identical Total Dissolved Solids in every city around the world...but Lisbon is 400ppm, Ft. Lauderdale is 150ppm, New York City is 55ppm, Midland Texas is 1800ppm.*

*Now, having said all that, if your Customer remains fixated on watery minerals, advise that you will add the Aquathin CAL 10 Mineralizer Filter. They will then get Aquathin water with calcium carbonate. Note: we probably ship less than 50 CAL 10 per year and so often, the Customer never reorders the CAL 10 when they have scheduled annual service.*

*KNOW YOUR CRAFT"*

*I LOVE MY AQUATHIN ! AND REMEMBER, THE NEXT BEST THING TO OWNING AN AQUATHIN IS RECOMMENDING ONE TO A FRIEND !!*

*Let me know what you AquathinK !*

*Warmest regards to all...as well, your comments are always welcome and very much appreciated.*

**FOR THE BEST TASTE IN LIFE &**

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**...and another Quarter Century re-inventing the water industry !**

**Think Aquathin...AquathinK !**

**( visit the allnew [www.aquathin.com](http://www.aquathin.com) )**

**\*\* AN ISO9001:2000 QMS REGISTERED / CERTIFIED COMPANY - (IMS 0192) \*\***

*"Alfie"*

*Alfred J. Lipshultz, President*

**P.S. "Splash NewsBulletins", "Forum Q & A", "Allergic Reaction", Biz Bank, Tech Bank and Quote Bank... ARE ALL FREE services to all Authorized Aquathin Dealers and their clients to keep you abreast of technology updates and industry news.**

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**From:** AQUATHIN TECH SUPPORT [mailto:techsupport@aquathin.com]

**Sent:** Monday, May 10, 2004 4:31 PM

**To:** info@Aquathin.Com

**Subject:** FORUM Q & A: BUT I THOUGHT I NEEDED MY MINERALS ?

*Dear Aquathin Dealer OnLine;*

*This Forum Q & A is mostly for your newer Salespeople who will be asked these two questions from people who will become your very, very best Customers; "I certainly don't want to be exposed to bacteria, solvents, nitrates, heavy metals, chemicals and pesticides, but how do I get my minerals if your system takes everything out?"....and "if your water is tooooooooo pure, won't it leach minerals out of my body?"*

*Attached herewith are several articles and a paper loaded with powerful and educational responses...and why we do what we do (incidentally, this is the type of information you will be able to research on your own in **TECH BANK** in the new Aquathin website coming soon). Your Customers will appreciate receiving*

*this superior level of information and handed copies of these reprints...and you'll receive their appreciation along with their confirmed understanding that you know your "stuff"...and NO ONE DOES IT BETTER THAN YOU !*

*Warmest regards to all...as well, your comments are always welcome and very much appreciated.*

*FOR THE BEST TASTE IN LIFE &*

***25 Years Pure Excellence***

*Think Aquathin...AquathinK !!*

*( visit the allnew [www.aquathin.com](http://www.aquathin.com) )*

*"Alfie"*

*Alfred J. Lipshultz, President*

***P.S. "Splash NewsBulletins", "Forum Q & A", "Allergic Reaction" , Biz Bank, Tech Bank and Quote Bank... ARE ALL FREE services to all Authorized Aquathin Dealers and their clients to keep you abreast of technology updates and industry news.***

# The Fifth Function of Water

by Alfred J. Lipschultz

In the April '85 issue of *The American Chiropractor*, there appeared a discussion concerning the five functions of water entitled **Pure H<sub>2</sub>O**. This paper will focus attention on the fifth function of water as a dispersant. It is necessary to understand the concept of the following terms, as they shall be used in this paper.

**Chiropractor:** As a group, the world's foremost authoritative nutritionists. The limitations of their licensing has forced them to practice a new type of preventive medicine that has hurled them decades ahead of many other practitioners.

**Preventive Medicine:** A practice from the belief that degenerative diseases and cancers are not "diseases of chronicity," a thought still maintained by the traditionalists in medicine.

**Pure Water:** Water that is free of inorganic pollutants as well as organic.

**Reverse Osmosis:** The greatest contribution to preventive medicine in the past five years. It is a process to achieve pure water.

Through years of water research regarding the role that water plays within our bodies, it was thought that water had four functions: a solvent, transportant, lubricant, and coolant. It was not until after numerous discussions with physicians that the possibility of a fifth function of water was recognized. Subsequent studies found their roots in understanding the difficulties in manipulation of obese patients who complained of back pains, tension,

headaches, all caused from the protrusion in front of the overweight patient . . . and his constant battle to maintain a center of gravity (of course, many of these patients additionally suffered from hypertension and various degrees of diabetes, both of which were attributable to their obesity.) If that patient could begin to lose weight, the job of health maintenance would be easier for both the patient and doctor.

In talking with obese patients, it was found that most of them had tried as many as five different methods of weight loss. The main problem they encountered was that no program remained consistent for them; they would reach plateaus, suffer anxiety, and release themselves from the "hardship of dieting." When researching each weightloss program individually for its merits and benefits, it was found that the basic concept indigenous to them all was incorrect because it dealt with the problem of obesity as a physiologic problem: "If you eat too much you will gain . . . if you count calories and limit them you will lose . . . eat less fats and live longer, etc." It is important for the patient to understand his own body, because the victim of obesity who does not understand what is causal in obesity does not know enough about the situation to make a reasonable and valid choice to bring about a change. The laws of learning are precise —before we can bring about a change of an individual, we must **show him why he is in trouble**.

In the study of obesity, one must view all the characters of the adipose cell. Frank Lloyd Wright said "function determines design." It is the function of the fat cell to store that which the body cannot use and/or get rid of. The fat cell is spherical in shape to maximize storage capacity and when it grows, because it is a sphere, storage area increases geometrically. When asked what type of weight one wishes to lose, most persons reply "fat." In looking at the constituents of a fat cell, understanding that "fat" is a wrong answer creates a unidirectional concept, and the realization as to why so many fail at "dieting." An adipose cell contains for the most part salts, sugars, other inorganic and organic pollutants, tiny amount of lipid, *all bathed in an ocean of water*. These salts and heavy metal inorganics have an affinity for others, a magnetic attraction so to speak. It is in fact an osmotic attraction. A woman about to begin her menstrual cycle understands a portion of this because if she consumes a pizza and soft drink during this time, she will "retain" fluids. So she takes a diuretic (an electronegative enhancer) to avoid water retention by dispersing the salts into solution. Fat cells are good, not bad. They store toxic material and keep it from being deposited in vital areas. However, when the fat cell has reached its limit of storage, it will allow the deposition of metabolites and wastes in other areas, such as blood vessels.

To further understand the act of deposition, it is im-

CONTINUED ON PAGE 23

portant to comprehend a few laws of colloid stability. A colloid is a particle that stays suspended in a solution. When that colloid is ten microns in size or less, it assumes a negative charge automatically. Milk is not a white liquid. It is clear with many white colloids all charged the same (electronegative) and repelling one another. When adding a positive charged particle (cation) to the milk, an agglomeration or flocculation, or coagulation is caused. That is how cottage cheese is made. Milk with a brine solution passed through it causes it to form curds, a coagulant. The electronegativity of the system has been reduced. Red blood cells are less than ten microns in size and follow the laws of colloid stability; that is, they are electronegatively charged along with the lining of the lumen of the blood vessels. Red blood cells pass single file, never touching one another. The distance between the cells can be measured and a norm be defined.

**N**ormal specific conductivity (a numerical electrical measurement of a fluid's ability to resist an electric current) of blood is 12,500 micromhos. When kidneys work properly they maintain an even blood waste level, which is directly correlated to specific conductivity value of 12,500 micromhos. When urine levels exceed 12,500 micromhos, the kidneys are either working overtime to avoid deposition in vital areas and/or taking the stain off the adipose tissue to store more wastes. But when the kidneys can only do this for a period of time, wastes are permitted to remain, causing the red blood cells to lose their electronegativity and draw closer together. A greater loss of electronegativity causes the red cells to lose all space between each other and form "clots." Doctors treat this acutely by prescribing coumadin and heparin (electronegative inducers.) However, the above two scripts lose part of their effectiveness when taken with tap water that contains many cations, contradicting the potential effect. Another method to avoid clots through maintained electronegativity is the consumption of citric foods, garlic, and onions, all of which are naturally electronegative inducers. Further, the ingestion of copious quantities of pure water enhances electronegativity because, when the volume of a colloid system is increased, the electronegative potential is increased. Also, through osmosis the fat cell will try to take in more of this pure water, due to the cell's "education" to attract salts. Because there are no inorganics, or a reduced amount, in the solution that baths the fat cell, the cell will disperse its contents into the solution due to a law of equilibrium, and those ingredients will be removed through the kidneys more readily because of the volume and ability a pure water has to carry wastes. A measurement of the specific conductivity of urine demonstrates the existence of this phenomenon. The result is that not only does one lose weight, but circulation is improved. Also, flow through blocked capillaries can be improved with chelation therapy and oral chelators, both of which are electronegative inducers. Positive results are proven with the use of thermograms. The chelators work in the same manner as when oil companies add tripyrophosphates (the most powerful electronegative inducer known today) to millions of years old, thick, sludgy oil in Alaska. The tripyrophosphates allow the oil to become "thinner" and flow easily through the thousands of miles of pipeline.

Studies of the role that "salt-free water" plays as a dispersant in hemodialysis patients provide important information for all of us. Whatever would happen to a normal, healthy human being within a lifetime, with regard

to accumulation of wastes and the associated symptoms thereof, happens to a dialysis patient in a period of days. A study performed at the Mercer College of Pharmacy in Atlanta, Georgia reached the merits and benefits of consuming inorganic and organic free water by hemodialysis patients. In all cases in this double crossover study, all patients had decreased two and three day weight gain between dialysis sessions when consuming this type of pure water, and claimed to have a better general feeling of well being.

The process of reverse osmosis forces water of a high dissolved solid concentration through a semipermeable membrane, leaving the solid dissolved content on the one side and a slight amount of content (usually monovalent) on the product side.

A calorie is only a unit of measurement to measure the combustibility of a food. Those "foods" such as saccharins, preservatives, leavening agents, smoothing agents aren't foods at all and do not have a caloric value which most dieters mark as an attribute. By consuming them along with tap water or bottled mineral water, we do not consume calories, but we will decrease our electronegative atmosphere and readily store them, hence attracting other wastes and toxins and ultimately creating a home for a multitude of degenerative diseases to begin to take shape and form. It is important to become knowledgeable and invoke a change in our lifestyle and practice this type of preventive medicine. The greatest gift the chiropractor has to give in his practice is his knowledge.

Alfred J. Lipschultz has devoted many hours of research to the functions of water in the body and the processes and technology by which water can be purified. Mr. Lipschultz is the Vice President of Aquathin Corp. and can be contacted for more information in Fort Lauderdale, Florida.

# TAC SPECIAL

by Alfred J. Lipshultz

# PURE

*The inorganic minerals that line a thirty-year-old plumbing pipe will eventually line ours.*

# H<sub>2</sub>O

A gentleman said to me in the middle of a recent business meeting, one that seemed to be going nowhere, "O.K., Alf, what's the bottom line?" My response was so off-the-wall that he didn't know whether to laugh, act insulted, or just leave my office: "The bottom line is to improve my quality of life." He sat back, collected his thoughts to search for an alternative to circumlocute my statement, and then said, "You're absolutely right." Well, to make a long story short, I bought his line of goods and he bought an Aquathin.

What it all comes down to for all of us is quality of life. If you don't have your health, everything else loses its value. So, I began to research what makes us healthy. Hardly any research has been devoted to the most important thing we put inside us . . . WATER. We're approximately 85% water, yet water is taken for granted!

Water has five functions in our bodies: it is a lubricant, solvent, transportant, coolant and dispersant (electronegative enhancer). If water carries a load (salts, heavy metals, and pollutants dissolved into itself) then the water cannot be efficient in these functions. If your car has rusty water in the radiator, it overheats. If we have an above normal waste level in our blood, we overheat and develop fever. In sports medicine, physicians advise athletes to drink water. Research shows water consumption during activity increases endurance, and muscles remain relaxed rather than tense when the activity is over.

Our kidneys have to filter 400 gallons of fluid a day. If there is enough water present, kidneys operate easily. If not, kidneys are forced to recycle too much and deposits may be left behind in the form of stones. Many of a kidney stone's mineral constituents are the same as in tap

water or bottled spring water. These minerals are plant food, inorganics from rocks, and not people food. It is not until a plant absorbs that mineral, making it organic, that we can use it. A doctor could look at you and say, "You appear a little anemic. Here are some nails and iron supplements. The choice is yours." You would not choose the nails, that's for sure; yet the iron found in nails is the same as that in our tap water and bottled waters. Once when I was speaking to a medical convention in Ohio I showed the doctors a picture of a blocked vessel. The color photo showed deposits completely closing the vessel. I asked the doctors to tell me what this picture was. The unanimous decision was a blocked artery from a person needing multiple aorta bypass surgery. I said, "Doctors, your diagnosis is correct. This is a blocked artery; however, it is the one that feeds my house." It was a water pipe. They were amazed. The inorganic minerals that line a thirty-year-old plumbing pipe will eventually line ours. Also, the inorganic materials (preservatives) that give our foods an extended shelf life, take shelf life from us. We should not eat processed meats, yet we'll drink processed water (electronegative reducers).

Many physicians and dieticians are calling for low- and no-salt diets because of the propensity towards higher blood pressure. But consider other minerals to; i.e., aluminum. Aluminum is the most powerful coagulator known to man. When a boxer gets cut, his corner man puts alum in the cut to stop the bleeding. Syptic saves the lives of careless shavers. Aluminum chlorhydrate shrinks the pores of our underarms to avoid the embarrassment of perspiration. Further, municipalities add ferrous aluminum sulfate to murky reservoir or river drinking

water to coagulate and precipitate the particles to provide clear water. The brain of the prematurely senile Alzheimer's victim is overdosed with abnormally high aluminum levels. We consume aluminum leavening agents in bread, dissolved in canned foods, leached from the surface of cooking utensils, and most recently in the air we breath from space shuttle launches. One launching deposits 150 tons of aluminum oxide into the air. Water that is void of inorganic materials is the type of water we need to consume. Drinking two litres of this water daily will improve the roles that water plays within our bodies through its ability to move nutrients deeply into tissues, pick up wastes, keep us cool, and maintain joints without leaving deposits.

Hence, Aquathin . . . a water purification system designed to remove wastes found in tap water using the same principle that kidney dialysis machines use to remove waste from blood. Aquathin utilizes reverse osmosis and deionization for maximum rejection and removal of waste contaminants. Carbon filters, which is what most people have, cannot remove salts, heavy metals, and only reduce a few of the pollutants in the spectrum of pesticides and industrial wastes.

Aquathin removes 98-plus% of the inorganics and 100% of the organics. Getting rid of these contaminants, the causes of degenerative disease, can only improve the quality of our lives. And after all, our great grandparents knew this. They collected their drinking water in rain barrels—we cannot. Water is the key to life . . . and a pure water is the key to a healthful qualitative life. If you would like to know more, direct your questions to: Alfred J. Lipshultz, Aquathin Corp., 6303 NW 9th Avenue in Ft. Lauderdale, FL 33309. ♦

## Pure Water and Medication

Untreated water can interfere with pharmaceuticals.

By Dr. Harvi Lipshultz and Alfred J. Lipshultz

**A**ny water treatment professional is familiar with the many health risks related to consuming unpurified water. What many people, even in the water industry, do not yet know is that tap water can interfere with the medications doctors prescribe.

Many prescription vials carry small, brightly colored stickers that say "Take on an empty stomach" or "Do not take with dairy products or antacids." The pharmacist places these stickers on the vial because the components of food, milk or antacids will inhibit the absorption of the medicine and render it partially or totally inactive. These same components are found in tap water and can render some medication inactive. Antibiotics, specifically tetracyclines, norflaxin and ciprofloxacin, can be affected in this way.

Also, certain medications depend upon an acidic (low pH) environment to be absorbed. The stomach provides an acidic site of absorption, but if tap water is basic (high pH), it might render the environment neutral and inhibit the absorption and activity of certain medications.

### Fluoride Considerations

Another pharmacological reason not to use untreated tap water to swallow medications is related to the fluoride content of the water. Many post-menopausal women suffer from osteoporosis, which is a breakdown or thinning of the

bones. The treatment for this condition is hormonal and calcium supplements. However, if calcium is consumed with tapwater, the fluoride in the water will render the calcium insoluble. Therefore, the calcium might not be absorbed, and it will have no effect on bone formation.

If tap water contains an excessive amount of fluorides, it may cause a condition known as endemic dental fluorosis, which appears as a dark brown spotting of the teeth. In certain cases, the teeth become chalky in appearance.

American Medical Association (AMA) has issued several printed statements about drinking water and human health. AMA states, "Since drinking water frequently contributes significantly to the human intake of a number of chemicals, the physician should be aware of the consumption of water in relation to the patient's condition. For example, the sodium content of drinking water in public systems is reported to health authorities so that physicians can prescribe alternative water sources for hypertensives and others who must restrict sodium intake." All patients with any type of cardiovascular disease should benefit from sodium-free water.

Another pharmacological interaction occurs between sodium and the medication lithium. Consuming excessive amounts of sodium will increase the excretion of lithium resulting in a decrease

in the activity of lithium and an increase in the symptoms of bipolar affective disorders, or manic-depressive illnesses.

As people get older, their renal (kidney) function decreases. Drinking chemical-laden water puts an additional stress on an already stressed renal system. Evidence of this is seen in people who are maintained on hemodialysis because of kidney failure. They are advised not to consume tap water with excessive ammonia levels, since ammonia causes toxic uremic effects in this patient population.

AMA also attributes outbreaks of disease to the quality of water. Microorganisms such as protozoa,

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The physician should be aware of the consumption of water in relation to the patient's condition.

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fungi and coliform bacteria have been found in tap water, usually resulting in an advisory to boil the water. These microorganisms are potentially dangerous to anyone who consumes them, and they pose a particular danger to people with weakened immune systems, as in cases of chemotherapy, radiation and AIDS.

These are just some of the pharmacological reasons not to drink unpurified tap water, including the possible inactivation of medications, aggravation of existing health problems or even the creation of new ones. Mounting evidence of serious health risks such as these provide ample motivation for increasing numbers of people to investigate the water treatment option. □

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*Dr. Harvi A. Lipshultz is clinical coordinator of the North Broward Hospital District, Broward County, FL. Alfred J. Lipshultz is president and CEO of Aquathin Corp., Pompano Beach, FL.*



Untreated water can affect the efficiency of various medications.

# **CONSUMPTION OF LOW TDS WATER**

**A COMMITTEE REPORT**

**BY**

**WATER QUALITY ASSOCIATION  
SCIENCE ADVISORY COMMITTEE  
1992-1993**

**With  
Review By**

**Dr. Lee T. Rozelle**

**and**

**Dr. Ronald L. Wathen, M.D.**

**MARCH 1993**



**WQA  
Technical  
Services**



## INTRODUCTION

Since the beginning of time, water has been both praised for good health and blamed for human ills. We now know the real functions of water in the human body are to serve as a solvent and medium for the transport of nutrients and wastes to and from cells throughout the body, a regulator of temperature, a lubricator of joints and other tissues, and a participant in our body's biochemical reactions. It is the  $H_2O$  in water and not the dissolved and suspended minerals and other constituents that carry out these functions.

Low TDS water is defined in this paper as that containing between one and 100 milligrams per liter (mg/L) of total dissolved solids (TDS). This is typical of the water quality obtained from distillation, reverse osmosis, and deionization point-of-use water treatment of public or private water supplies that are generally available to consumers in the world.

Highly purified (distilled) water is believed by some to help "cure" arthritis by "washing out" excess calcium and other minerals from deposits in joints. Along with this reasoning, some people speculate that drinking highly purified water, treated by distillation, reverse osmosis, or deionization, "leaches" minerals from the body and thus causes mineral deficiencies with subsequent ill health effects.

An isolated report, a summary of Russian studies available through the World Health Organization, has recommended that fluid and electrolytes are better replaced with water containing a minimum of 100 mg/L of TDS. However, this may pertain more to situations in the human body during heavy exertion and sweating. It is the market for sports drinks which are formulated to help replace the sugar compounds, glucose in the blood and glycogen in the muscles that are burned in prolonged exercise. Sports drinks are formulated to help replace the sugar compounds - glucose in the blood, glycogen in the muscles - and electrolytes - salt, calcium, and potassium that keep cells in proper electrical balance - that may be burned and depleted after an hour or more of hard exercise. This situation does not have anything to do with low TDS or demineralized water for normal drinking and cooking purposes. Even in warm weather exercise, the greatest danger is that of dehydration, and the proper advice to ward it off is to drink lots of plain water.

The scope of this paper is limited to answering whether low TDS water contributes to the loss of minerals from body tissues, producing associated harmful side effects. The types of minerals -- e.g., calcium versus sodium, or hard water versus soft water -- and the toxicity of minerals - - e.g., lead, cadmium, brackish, or saline waters -- are not an issue in this report. Information on the body's homeostasis mechanisms, community water supplies with natural TDS less than 50 mg/L, historic use of distilled water with less than three mg/L TDS on board Navy ships, the U.S. Environmental Protection Agency's response to this issue, and other evidence are presented to demonstrate that the consumption of water with low levels of minerals is safe.

## ESTABLISHED DRINKING WATER STANDARDS

A review was conducted of the United States, Canadian, World Health Organization (WHO) and European Community (EC) drinking water standards. None of them has minimum limits or optimum levels of total dissolved solids. The U.S. recommended maximum level is 500 mg/L, the Canadian guideline suggests less than 1,000 mg/L, and the EC maximum admissible concentration (MAC) is 1,500 mg/L (for "dry residues").

The EC standards also list numbers for calcium (guide level of 100 mg/L) and magnesium (guide level of 30 mg/L, and MAC of 50 mg/L), and a minimum for hardness (minimum required concentration for softened water of 60 mg/L as Ca), and alkalinity (minimum required concentration for softened water of 30 mg/L  $\text{HCO}_3^-$ ). However, there is no health criteria documentation for these advisories. These levels are listed as aids to operation for water supply systems, i.e., suggested parameters for laying down a passivating film of scale in municipal distribution mains. Calcium, magnesium, hardness, and alkalinity conditions are not necessary for judging the safety of drinking water. It is understood that the association of European water suppliers, Eureau, is moving to exclude these parameters from the European legally enforceable limits.

## THE NATURAL CONTROL OF MINERAL CONCENTRATION IN THE HUMAN BODY

A better understanding of the effect of low TDS water on the human body requires a basic understanding of the body's mechanism in this respect. Following is a description of the relevant mechanism.

Homeostasis is the maintenance of static or constant conditions in the internal body environment. This natural process controls the mineral (ion) and the water concentrations in the body fluids within narrow limits inside and outside all the cells in all the organs and tissues of the body. The kidneys are most important in maintaining constant ion concentrations (including sodium, potassium, calcium, etc.) through elimination and reabsorption.

In homeostasis, three body fluids are involved: plasma (approximately 3/5 of the blood volume); interstitial fluid (the fluid between cells); and intracellular (fluid inside the cells). The concentration of sodium ions is highest outside the cell and that of potassium ions is highest inside the cell. When the osmotic pressure is high on one side of the cell membrane (high concentration of ions) and low on the other side, water moves across the cell membrane from the dilute side toward the other side to equalize the osmotic pressure. This phenomenon is known as osmosis. [This is unlike reverse osmosis which occurs when outside pressure is applied to the concentrated side, pushing the water back to the dilute side.] The normal osmolality (concentration of ions) of all these fluids is about 300 milliosmoles per liter (mOsm/L) (~ 9,000 ppm).

Any changes from normal in ion concentration across the cell membrane is corrected in one minute or less because water moves quickly through cell membranes. Thus, small changes in osmolality from drinking purified water (0 to 100 mg/L TDS) are quickly brought to equilibrium.

The kidneys control the overall concentration of the constituents of body fluids. It filters about 180 liters (165 quarts) of water per day, but over 99% is reabsorbed and only 1.0 to 1.5 liters are eliminated as urine. If the osmolality of the fluid to be filtered by the kidney is lower than normal (low solute concentration - such as low TDS water) nervous and hormonal feedback mechanisms cause the kidney to excrete more water than normal and thus maintain the ion concentration in the body fluid to normal values. The opposite is true if the ion concentration of the fluid to be filtered is higher than normal. This kidney homeostatic mechanism keeps the body fluid osmolality normal. The osmolality of the fluid to be filtered by the kidney is controlled to  $\pm 3\%$  to maintain it at the normal level of 300 mOsm/L. The three basic hormonal and nervous control systems triggered by abnormal ion concentration in the body fluids to be filtered by the kidney are antidiuretic hormone (ADH) from the pituitary gland, aldosterone from the adrenal glands, and thirst (as osmolality rise of about 1% causes thirst).

Because of these kidney control mechanisms, drinking one liter of water would cause the urine output to increase about nine times after about 45 minutes (due to absorption of water in the gut) and continue for about two hours. Thus, the concentrations of solutes in the blood and other body fluids are quickly maintained by the kidney through homeostasis. These control

mechanisms keep the sodium concentration at  $\pm 7\%$ . Calcium secretion is controlled by parathyroid hormone to  $\pm$  a few percent in the extracellular body fluid.

Also, saliva increases the ion concentrations during water intake. The concentration of sodium chloride in saliva is typically 15 milliequivalents per liter (mEq/L) or 877 mg/L; that of potassium ion is about 30 mEq/L (1170 mg/L). As low TDS water is consumed, it is combined with saliva which increases the TDS before it reaches the gut to be absorbed, (e.g., each one milliliter of saliva can increase the TDS level in eight ounces of water consumed by about 10 mg/L).

Thus, based on the above highly credible and up-to-date textbook knowledge\* it is evident that consumption by a healthy person of low TDS water alone cannot cause unhealthy systems. ['Healthy person' means free of disease, hormonal problems, etc., and not necessarily a healthy diet.] Of course, homeostasis is maintained by diet as are other body functions. If homeostasis is not maintained because of major diet deficiencies, disease, or hormonal dysfunction, consuming low TDS water would be a minor (if any) factor in any observed symptoms. It is apparent that disease, physiological dysfunction, or major nutritional deficiencies may cause a "leaching" problem, but not consuming one to two liters of low TDS water on a daily basis.

\*Guyton, Arthur L., M.D. *Textbook of Medical Psychology* Eighth Edition, W.B. Saunders Company, Philadelphia (1991).

## LITERATURE SEARCH AND REVIEW

During the last 12 months, several literature searches have been undertaken to bring out studies, reports, reviews, and related information that may be of value to reach conclusions that would be scientifically supportable. These searches can be outlined as follows:

- Request of expert review by U.S. EPA, Dr. Lee T. Rozelle, and Dr. Ronald L. Wathen of an annex (Appendix) attached to a report submitted to WHO prepared in 1980 by two Russians, G.I. Sidorenko and Y.A. Rachmanin, on the general subject of desalination.
- Letters sent out to various experts and informed parties, including inquiries sent to the World Health Organization (WHO), U.S. EPA, and U.S. Department of the Navy.
- A comprehensive search of the Medline medical literature database for articles related to low TDS water and homeostasis.
- A search of AWWA's WATERNET database for articles with key words describing low TDS waters and salt "leaching," etc. (No articles were found.)
- Review of published information regarding the levels of TDS in many public water supplies.

A review of the literature has shown that there is very little information published in western scientific literature that relates the consumption of low TDS water to physiological effects on the human body. A report "Guidelines on Health Aspects of Water Desalination" prepared by G.I. Sidorenko and Y.A. Rachmanin of Russia in 1980 and submitted to the World Health Organization contains an annex (Appendix), 6½ pages long, reviewing work that has been reported in the Russian literature. The present literature search did not unearth any official translation of any of the articles cited in that annex. The annex concludes that consumption of water with less than 100 mg/L disturbs the body's water/salt balance, promoting the release of sodium, potassium, chloride, and calcium ions from the body of animals or humans, imposing a stress on the mechanism of homeostasis, promoting changes in the gastrointestinal muscles and mucosa, and reducing the thirst quenching capacity of the water.

This annex has been intensively reviewed by many scientifically oriented individuals, including Dr. Lee Rozelle and Dr. Ronald L. Wathen.

Dr. Rozelle summarized his review:

The data for their conclusions, summarized in Annex 8 of the WHO unofficial guidelines, are not very convincing from a scientific viewpoint. The volume of water consumed per day was not indicated and the length of time of the experiment for the human "volunteers" was not indicated (one year for rats). The physiological changes reported apparently were based on rat and dog studies. For dogs, the same physiological changes were observed for water containing 50 mg/L and 1,000 mg/L.

The conclusion of a minimum TDS of 100 mg/L is confusing and thus not very convincing.

In the human studies, diuresis was observed particularly on the second day of the study (the increase in urine output reported to be 18%). The volume of water in the body from the "distillate" was reported to be 50 to 100% higher than the "other groups." The Russians also reported increased elimination of sodium, potassium, chloride, calcium, and magnesium in the urine, and the specific gravity was reduced. In the blood serum, the sodium was increased and the potassium decreased. Then it was reported that the "tendency" for similar changes were observed after consumption of 100 mg/L TDS and 1,000 mg/L TDS. The water intake (based on thirst) of various TDS waters was not clearly reported. In some cases it was difficult to determine if the data were from animals or humans.

In summary, the Russian studies, as reported in Annex 8 of the WHO document appeared not to be rigorously scientific.

Dr. Wathen reviewed it from a medical point of view and wrote the following:

The Annex VIII of the report is an alleged "review" of water and salt balance under the influence of a variety of water and salt intakes, in a variety of animals, including humans, exposed to a variety of conditions. The review is long on deductions, but very short on (re) presentation of solid data. Moreover, probably only a handful of references cited in this review (assuming they are cited correctly) may be from creditable scientific journals, that is, journals which demand proper scientific methodology and peer review of all work, prior to publication. Many of the cited articles may be from journals of "personal opinion": being versed only in English, it is impossible for me to establish the credibility of the cited work.

This review cited observations on the organoleptic features of water (i.e., consumer appreciation of taste, odor, and color qualities) to underscore precise, physiologic thirst slaking with specific levels of TDS -- containing water in response to volume depletion. To begin with, the quoted electroencephalographic studies probably indicate only that a maximum number of receptor sites (taste buds) have to be recruited through stimulation to provide a maximum brain (alpha) wave response and that the TDS level in water providing the maximum response was between 200-600 mg/L of salt.

One would expect such a response; one might also imagine that receptor response (sensitivity) is considerably tempered by prior salt and mineral exposure for the individual. Organoleptic features are very, very unlikely to define whether a given water source is healthful or non-healthful or that the amount imbibed is appropriate to need. Moreover, taste receptor electrical activity, being unlikely to reveal preference by the consumer, means the consumer must be asked whether he or she prefers a given type of water. More often than not, preference reflects prior experience (learned behavior).

The review refers to exposure to desert and exercise conditions for humans and how water lost in sweating should be replaced, not with purified water but with salt water. Who would disagree with this conclusion? With Gatorade<sup>®</sup>, for example, selling to extremely large U.S. and world markets, one hardly needs to be reminded in this day and age that volume and salt losses encumbered with the sweating of heavy exercise are best replaced with a fluid whose constituents are more aligned with extracellular fluid in the human. Gatorade<sup>®</sup>, though billed as being "low sodium" on its label, is in fact rather high in salt content (both sodium and potassium) and it provides a rapid, convenient, and safe way to promptly reconstitute vascular volume after heavy exercise. Dizziness, even syncope (passing out), from volume depletion are thereby avoided and strength of the individual is better sustained, due both to volume replacement and the glucose contained within Gatorade.

Gatorade<sup>®</sup> is a water source to be taken only to replace severe fluid losses accompanying sweating; it generally averts the need for supplemental salt tablets. Gatorade<sup>®</sup>, in an opinion which may not be shared by the Gatorade Company (Chicago, IL), is not a source which should be used to replace normal fluid and electrolyte losses any more so than pure water should be used to accommodate severe volume losses. In the presence of salt accompanying usual dietary food intake (4-8 gm/day of sodium in U.S.), Gatorade<sup>®</sup> might conceivably lead to volume excess. A 64 oz. serving of Gatorade<sup>®</sup> contains: 880 mg of sodium; 200 mg of potassium; and about 400 calories, as carbohydrate (112 grams). There is no magical solution; one should drink what's appropriate to the circumstance.

Replacement of the large fluid losses accompanying heavy exercise or thermal exposure, therefore, has nothing to do with using purified water for normal drinking and cooking purposes, the latter being paired with normal food intake to meet salt and mineral needs. In normal day-to-day activity not associated with extremes in sweatloss, the salt and minerals accompanying normal food intake more than meet daily dietary needs of such elements, whether consuming potable water (e.g., TDS of up to 500 mg/L) or purified water (e.g., TDS 100 mg/L) or pure water (e.g., 0.111 mg/L TDS).

Salts and minerals are not "leached" from the human body; they are preferentially retained or excreted, either of these events occurring relative to whether or not one is surfeit in water or salt or both. In short, the human body is not a lead or copper pipe which "leaches" in the presence of purified water. The Annex VIII review is very misleading in this regard.

I also think it is incredible to suggest that, in the absence of abnormal water loading experiments, consumption of demineralized water will cause distortion of the mucosal cells lining the GI tract. Besides, in the normal human setting, such water is often combined with other elements (e.g., coffee, tea, fruit juices, soft drinks, etc.) which raises its TDS prior to consumption.

But, even if the TDS is not raised by some external means, through the additions of saliva, gastric secretions, and small intestine secretions beyond the stomach,

there is an internal elevation in TDS of any dilute fluid one might drink. It would be my opinion that the adsorptive portion of the GI tract, that is, the small intestine, in the absence of extreme water loading, never sees a hypotonic solution sufficient to cause the mucosal cells to swell or to appear damaged. There is a tendency in this review to draw conclusions from observations in anhidrotic (non-sweating) laboratory animals (dogs, rats, and rabbits) and apply them to the very hydrotic (sweating) human. That is, the review often draws conclusions from fluid, electrolyte, and acid-base studies in "non-sweaters" and seems to transfer these conclusions to the "sweaters." It is imprudent physiologically, if not scientifically erroneous, to do so. I found the reported physiological data to be very confusing, often at right-angles to prior knowledge. One wonders if the responses to various levels of salt in water were confused when citing data from the actual papers used in the review.

I personally have never heard of osmoreceptors being present in the gut which might serve to regulate fluid adsorption. And certainly, I have never heard of the liver being a repository of salt to be released to reconstitute salt levels in the vascular compartment. This statement, I think, is borderline preposterous. The literature cited here has been misconstrued or is comprised of essentially factitious observations. Salt in all body fluid compartments redistributes bidirectionally in attempts to off-set excesses or insufficiencies in extracellular fluid constituents, particularly in the vascular (blood volume) compartment.

The following responses have been received from different experts in many different fields:

WHO's Dr. Galal-Gorchev states that WHO has "no information that such (low TDS) water would have and adverse effect on mineral balance".

U.S. EPA's Dr. Edward V. Ohanian, Chief of Human Risk Assessment Branch wrote,

Drinking water supplies a number of minerals that are important to human health. However, drinking water is normally a minor source of these minerals. Typically, the diet is the major source of these beneficial minerals. I am not aware of any data adequate to support the conclusion that water with low levels of minerals is unsafe.

The U.S. Navy has used distilled water with less than three ppm TDS aboard ship for more than 40 years. Surface ships while on shore take on water from shore sources, but it is common for submarines to provide nothing but purified water for months at a time, all with no reported ill effects. This was confirmed with separate sources at the David Taylor Research Center in Annapolis, the Naval Sea Systems Command, the Bureau of Medicine and Surgery, and the Navy Environmental Health Center. Finally, the Surgeon General directed the Navy to address the subject formally in 1972. The conclusion was that drinking distilled water is not harmful.

The University of Illinois Health Sciences Library's ONLINE SERVICES department was contracted to search the MEDLINE database for the several key word groups back to 1980. That search produced 18 articles, but only two relevant ones, both supporting the proposition



that the physiologic mechanisms of homeostasis are more than adequate to permit routine drinking of purified water.

Article 1 described experiments in which dogs were given large amounts of distilled water to lower the blood osmotic pressure while monitoring very closely the pH and CO<sub>2</sub> of arterial blood and the breathing rate. They found that the blood osmolality has a direct effect on breathing in addition to the known effects on kidney function. Thus, homeostasis appears to be controlled while intentionally consuming low TDS water.

Article 2 described experiments with rats which had had their pituitary glands removed ("hypophysectomized rats"), and which therefore should show some damage to the hormonal control system. They found that the renin-angiotensin-aldosterone system worked well even without a pituitary, suggesting an additional control system leading to the maintenance of homeostasis.

None of the 18 articles, including these two, showed any direct information about the subject matter of interest, but only that the homeostasis mechanism in living beings has significant abilities to adapt to different situations and inputs.

## DISCUSSION OF FIELD EXPERIENCES

There are no known scientific data which clearly demonstrate that the consumption of low TDS water by humans will or will not lead to harmful effects on the human body. However, a number of field experiences can be cited which support the premise that the consumption of such water by humans does not cause such harmful effects. There are no known documented experiences which show that consuming low TDS water will create any long-term health effects.

The U.S. Navy has used distilled sea water for human consumption for approximately 40 years. TDS levels below 3 mg/L have been reported and consumption of this water for months at a time is common on submarines. No health problems have been reported by the Navy and they feel low TDS water is safe to drink.

The U.S. Army uses reverse osmosis units to provide drinking water for soldiers in the field. They do not consider low TDS water to be a problem and have no minimum standard.

The U.S. EPA conducted a project in San Ysidro, New Mexico in which the TDS was dropped from 800 mg/L to a range of 40 to 70 milligrams per liter. No health effects were observed during the one year test.

Possibly the largest field study of human consumption of low TDS water is within the United States where municipal systems are delivering water in this category. Millions of people currently consume such water, and this practice has gone on for decades. Exact data are difficult to obtain due to seasonal changes, use of blended water from multiple sources, and changes of sources. However, the following levels have been reported:

Boston, MA	64 mg/L
Portland, OR	23 mg/L
Baltimore, MD	89 mg/L
Lake Tahoe, CA	50-64 mg/L
San Francisco, CA	27-154 mg/L
Seattle, WA	34-47 mg/L
Denver, CO	39-216 mg/L
New York City, NY	41-283 mg/L

In addition to these areas, thousands of private wells, as well as numerous small municipal systems in the U.S., produce low TDS water. No known health effects or problems have been reported as a result of this widespread practice.

Thousands of TDS reduction devices have been sold residentially in the United States for decades. No reports of mineral depletion or health effects are known as a result of the consumption of this water.

In Plains, Texas, where the drinking water was brackish at 1500-2000 mg/L TDS, a change was made to desalinated water and the residents experienced temporary diarrhea. Because of the high initial TDS and because of blending, the treated water exceeded 100 mg/L TDS, which is above the definition of low TDS water established for this report.

In Montreal, a study compared the gastrointestinal disorders of two groups; one consumed tap water, while the other consumed reverse osmosis water. The group consuming the tap water had a higher incidence of GI infections. While neither of these experiences can be considered conclusive, no evidence of mineral leaching, the topic of this report, was reported in either case.

NASA has reported no ill effects from the consumption of approximately .05 mg/L TDS water on board space craft. It appears that the possibility that this could have been a problem was never seriously considered by NASA.

In a field test in Boulder, Colorado with about 50 families, an experimental, zero discharge water system provided drinking water containing about .05 ppm TDS. No ill health effects were caused as a result of drinking this water.

In conclusion, the field experiences cited suggest that there are no long-term ill health effects, specifically the mineral leaching from human tissue, due to the consumption of low TDS water.

## **CONCLUSION**

**It has been concluded that the consumption of low TDS water, naturally occurring or received from a treatment process, does not result in harmful effects to the human body. This is based upon the following points:**

- **No public health organization with authority over the drinking water quality anywhere in the world has enacted or even proposed a minimum requirement for total dissolved minerals in drinking water.**
- **The human body's own control mechanism (homeostasis) regulates the mineral content of the body fluids and the discharge of different types of ions from the body of normal health individuals drinking water with low or high mineral content.**
- **Several types of scientific literature searches have found no harmful effects to the human body attributable to the consumption of low TDS water.**
- **Review of the Soviet report has shown that the scientific methods used are questionable and the conclusions are either vague or unsupported by the data.**
- **Many examples of real-world situations in which large populations have been and continue to be provided exclusively with low TDS water without any reported unusual or ill health effects, establishes the safety of consuming such waters by human beings.**