TAP SAFE WATER SOLUTIONS, Inc.

A Delaware Company in the Water Space

WHITE PAPER

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WHITE PAPER

I. The PROBLEM

"A Reliable, sustainable supply of clean water is a worldwide need and a worldwide crisis in the making, everyone needs to participate in the solution" – Mark Shannon, Director – Center of Advanced Materials, for Purification of Water, University of Illinois. Funded by the National Science foundation.

More than 1 billion people, 1 in 7 on the planet, lack access to clean water. More than two million die every year from water contaminated food or drinking water. Three babies die each minute from contaminated water usually through diarrhea. In the USA, EPA estimates are that 270 million Americans are exposed to DBPs (Disinfection ByProducts) in the USA every year and this number is growing. This is nearly 82% of the country. The 54,000 residential water treatment facilities in the USA are required to check only a handful of toxic or carcinogenic compounds leaving thousands of compounds unchecked as water passes along to the tap. EPA changed "safe level" to "acceptable risk" in 2007 when the accelerating rise of carcinogenic compounds passed along to the tap exceeded anything water districts could control. This was despite amendments to the Clean Water Act (1996 et al.) and the stronger Stage II rules enacted in 2007. For instance Colorectal cancers in men, followed rigorously by EPA/NIH and CDC, have allowed baseline studies to now be reported. One such study can be found here: while emerging studies documenting reduced sperm count (males) from tap water are consistent with the overall decline in male fertility: .

EPA concentration standards for THMs (trihalomethanes) is 80ppb (parts per billion), for HAAs (haloacetic acids) it is 60 ppb and for Endocrine Disruptor compounds (EDCs) it is about 10 ppb.) The US Congress refused in 2002 to lower these limits despite the urging of EPA under provisions of the clean water act of 1972. EPA then enacted its "Stage II" rule to help reduce cancer appearing in males directly attributable to drinking water toxins. This rule places more stringent requirements on water treatment districts when their water is tested for the MCLs (concentration levels) of THMs, HAAs and EDCs, as noted above. All of these, except the EDCs are byproducts of disinfection where chlorine or chloramine is used.

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"Only one of the systems studied by EWG – Davenport, Iowa – exceeded the EPA's upper legal limit of 80 parts per billion of trihalomethanes in drinking water. But, since that regulation was issued in 1998, a significant body of scientific research has developed peer-reviewed evidence that these chemicals cause serious disorders at much lower concentrations. Among the research are two Taiwanese studies conducted in 2007 and 2012 that associated increased risks of bladder cancer and stillbirth to long-term consumption of tap water with trihalomethane contamination greater than 21 parts per billion. Some 168 of systems, or 84 percent of the 201 large systems studied, reported average annual concentrations greater than that level." EWG report found here:

Human urine is commonly found in drinking water as are pharmaceuticals, herbicides, and pesticides. None of these are screened for. Tiny amounts of pharmaceuticals -- including antibiotics, hormones, mood stabilizers, and other drugs -- are in drinking water supplies in 24 major metropolitan areas where drugs were found. Drugs get into the drinking water supply through several routes. One way is flushing unneeded medication down the toilet. A second way medicine gets into the water supply is that some medication is absorbed while some passes out in urine or feces. Pharmaceuticals remain even after wastewater treatments (sedimentation, flocculation) by water treatment plants, investigations have shown. The expense to remove them is far too prohibitive. Washington D.C. fiscal budget spending on water delivery infrastructure was less than 0.1 % of the total budget in 2014. The tragic irony of this fact is that the nation's Capital owns one of the oldest water delivery systems in the country and has on average 1 ½ water main breaks per day.

Concentration Levels of these drugs are measured in ppb and now in ppt (parts per trillion). Utility companies contend the water is safe - as they expect it to be. But this is most often not correct. Biochemists, molecular biologists and other members of the medical profession from private organizations and government research agencies say they can't be sure the levels of drugs in drinking water are low enough to discount harmful health effects. What is far worse is that studies since 2005 have been showing that parts per trillion are extremely dangerous to human organs while the EPA-mandated MCL standards are 1000 times higher than this (in the ppb range cited above).

II. LINDA BIRNBAUM - ADDRESS TO CONGRESS

"Each year in the U.S., lead in drinking water contributes to 480,000 cases of learning disorders in children and 560,000 cases of hypertension in adult males."

Doctor Linda Birnbaum Is EPA National director of Toxicology and head of NIEHS (National Institute of Health). In her address to Congress (2010 and 2012) she says "Endocrine disruptors are naturally occurring or man-made substances that may mimic or interfere with the function of hormones in the body. Endocrine disruptors may turn on, shut off, or modify signals that hormones carry and thus affect

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the normal functions of tissues and organs. NIEHS has had a longstanding interest in these chemicals with its support for research dating back to the beginning of the Institute in the 1960s. Endocrine signals govern virtually every organ and process in the body. That means that when outside chemicals interfere with those systems, the effects can be seen in many different diseases and conditions – some of which we are just learning to recognize as the result of endocrine disruption. It is apparent that endocrine disruption is an important emerging public health concern."

She continued:

"Regarding the broad range of effects: As our understanding of mechanisms has grown, so has our recognition of the many ways these compounds interact with the body and the many health outcomes that are influenced. The early work on endocrine disruption started out focusing mostly on outcomes that were known to be sensitive to the effects of steroid hormones, such as cancers of the reproductive system, and on mechanisms that involved hormonal receptors located in the cells' nuclei.

However, in addition to working through normal nuclear hormone receptors such as estrogen, androgen, thyroid, and retinoid receptors, we find that these molecules interact with many other kinds of receptors, such as membrane (non-nuclear) receptors, neurotransmitter receptors, enzymatic pathways involved in steroid biosynthesis and metabolism, and all the other mechanisms that enable hormone systems to do the work they need to do, which in turn enables the organism to function normally and react to changes."

"So the universe of potential health effects has grown commensurately to include non-reproductive cancers, immune effects, metabolic effects, and brain development and behavior, in addition to non-cancer abnormalities of the reproductive system, such as reproductive tract abnormalities, precocious puberty, disorders of fertility and fecundity, and endometriosis. For example, endocrine control of glucose homeostasis can impact development of diabetes, obesity, and cardiovascular disease. Researchers have now identified model systems and mechanisms by which developmental exposure to EDCs such as tributyltin , genistein and diethylstilbestrol may potentially cause weight gain in animals later in life. NIEHS-funded researchers are working on understanding biochemical and physiological aspects of environmental contributions to obesity, and we expect this work to have an impact on the development of interventions and preventive strategies to deal with this huge public health issue."

Dr. Birnbaum concluded her remarks this way, *"In conclusion, let me stress that I believe this area of environmental health sciences to be of the utmost importance. Our endocrine systems keep our bodies in balance, maintaining homeostasis and guiding proper growth and development. With NIEHS's leadership, we are learning more and more about how these finely tuned systems are sensitive to unanticipated effects from chemical exposures. This information is critically important for creating effective strategies to prevent disease and promote better health, as well as to ensure safe drinking water".*

It is clear from numerous studies that routes to disease and cancer are through the water we drink in addition to the complex of environmental factors (herbicides on food, overhead power transmission lines, Fukushima radiation now increasing on the West Coasts of North America, toxic rivers, atrazine on American-grown crops, etc.). Below is a 2010 excerpt from Environmental Working Group, a consulting agency to DOE, DOI, NIH and the White House council for Environmental Affairs.

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FOR IMMEDIATE RELEASE: HTTP://WWW.EWG.ORG/NEWS/NEWS-RELEASES/2010/05/06/PRESIDENT%E2%80%99S-CANCER-PANEL-WARNS-PUBLIC-CHEMICAL-DANGERS

THURSDAY, MAY 6, 2010

Washington, D.C. – In a landmark report issued today, the **President's Cancer Panel** asserts that public health officials have ***"grossly underestimated***" the likelihood that environmental contaminants trigger a large proportion of the cancers diagnosed in 1.5 million Americans annually.

"The grievous harm from this group of carcinogens has not been addressed adequately by the National Cancer Program," the panel told President Obama. "The American people—even before they are born—are bombarded continually with myriad combinations of these dangerous exposures."

"The incidence of some cancers, including some most common among children, is increasing for unexplained reasons," the panel said.

"There are far too many known and suspected cancer-causing chemicals in products people, young and old, use every day of their lives," said Kenneth A. Cook, president and co-founder of Environmental Working Group (EWG). "Tests of umbilical cord blood are proof positive that American children are being exposed to hundreds of carcinogenic chemicals before they are born. Many of these chemicals are believed to be time bombs, altering the genetic-level switching mechanisms that lead to cancerous cellular growth in later life."

In groundbreaking studies of cord blood in 2005 and 2009, EWG found a total of 201 known and suspected carcinogens in 20 babies. In a series of 11 research studies of the human body burden, from newborns to elderly people, EWG has detected up to 493 chemicals in people.

"As this prestigious group's report underscores, the federal government has failed to take aggressive action to protect people from chemicals that cause cancer," Cook said. "The tide is shifting, thanks to irrefutable scientific research and a strengthening of political will in Washington."

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The panel's findings are expected to intensify pressure on the chemical industry and its allies in Congress to endorse toxic chemicals policy reforms proposed in the Senate by Sen. Frank Lautenberg, D-NJ, and being drafted in the House by Reps. Bobby Rush, D-IL, and Henry Waxman, D-CA."

"The risk of disease associated with public drinking water has passed from the theoretical to the real", Carol Browner, Former EPA Director, March 2012. Note the water delivery systems for public parks is another 21,000 systems in addition to the 54,000 residential water treatment plants in the USA.

III. WATER MAIN BREAKS

EPA Standards for Potable Water, the MCLs (maximum contamination levels), are based principally on carcinogenic factors (pathogens). They are not based on neurotoxicity, hormone disruption, or immune system impacts in children and adults.

The American Society of Civil Engineers estimates that over 860 water main breaks occur per day. Every day. As the water delivery system for the USA uses pipes in most towns and cities that is over 100 years old; the water main breaks typically look like the photographs shown below:



Bacteria enters these breaks and the water flowing to the community. Because chlorination was used to defeat microorganisms at the treatment plant, much of the giardia, cryptosporidium, legionella, reaches the tap water unaffected by the stronger chlorine concentration. UV is strongly recommended for any whole house water treatment unit because of this. Montana State University microbiologist and water researcher Timothy Ford argues that as pipes corrode and break, water escapes and diseases enter the system, posing a serious threat to public health. Go here: To illustrate the magnitude of the problem, Washington DC water main breaks are frequent due to infrastructure being the oldest in the country. The Water Control Board estimates that 0.1% of annual budget allocations are devoted to repair and replacement of aging water pipes.

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IV. FETAL CORD BLOOD STUDIES

Low birth weight (LBW) and preterm birth are the leading cause of infant mortality and precursors to future morbidity, and both have increased significantly in the US since 1990

BPA acts as "synthetic estrogen" that disrupts the endocrine system and causes harmful effects, even at very low doses. In test animals, BPA induces abnormal reproductive system development, diminishes intellectual capacity, causes behavioral problems and has induced reproductive system cancer, obesity, diabetes, early puberty, resistance to chemotherapy, asthma, cardiovascular system problems and other chronic ailments.

BPA is found in food, beverages and infant formula sold in metal cans (lined with BPA-based epoxy resin), drinks in polycarbonate plastic containers (made from BPA). Because epoxy resin and polycarbonates are unstable, BPA in food packaging leaches readily into any food or liquids the packaging touches. A readable description of phthalate chemistry (plastics) can be found here:

What is little understood by opponents of cord blood studies is that - while agreeing that BPA is ubiquitous and yet at birth babies may "appear" to be doing fine,- their arguments fail the evidence test on three counts. Children born to mothers whose third trimester delivers even trace amounts of BPA to fetal tissue have a - as yet not understood - chemical pathway for magnifying the concentration of BPA to over twice that which the developing embryo sees in the cord blood; somehow the fetus is able to amplify the BPA concentrations in the mother's blood.

Secondly, what was acceptable at a "dangerous level" – i.e. tap water with above 10 ppb for phthalate chemistry (BPA, diethylstilbestrol, etc.) - has now been shown to be chemically active at ppt concentrations (parts per trillion). These are 1000 times smaller concentrations and yet have an enormous ability to trigger chemical mechanisms leading to compromised immune health, mental acuity, and other onset diseases later in the child's life. Thirdly, the studies showing serious fetal cord consequences leading to ectopic pregnancy, low birth weights, compromised immune systems in children and lower IQ scores for these children, are primarily from public health research laboratories in European countries and are met with huge resistance from American Big Pharma and an American corporate climate hostile to studies that can adversely impact their bottom line. Studies showing strong, incontrovertible evidence of links to prostate cancer in men and BPA concentrations are abundant.

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"A large body of evidence indicates that BPA can disrupt the hormone system at very low concentrations. At some very low doses the chemical causes permanent alterations of breast and prostate cells that precede cancer, insulin resistance (a hallmark trait of Type 2 diabetes), and chromosomal damage linked to recurrent miscarriage and a wide range of birth defects including Down syndrome (vim Sala 2005). As of December 2004, 94 of 115 peer-reviewed studies had confirmed BPA's toxicity at low levels of exposure. Few chemicals have been found to consistently display such a diverse range of harm at such low doses. ("Low doses" are typically defined as those that produce tissue concentrations at or below those in the typical range of human exposures.)"

IV. THE SOLUTION

10,500 17 ounce water bottles is the equivalent of one
1500 gallon stainless steel thin water tank

The company TSWS, Inc. proposes a protocol for testing a product that provides high flow rate (gallon/minute) of source water into a building which has undergone a three-stage CB (carbon block) filtering treatment. This technology is a whole-house membrane carbon block device that can dramatically reduce Bromine, Nitrates, Iron, Arsenic, Chromium III, Lead, Boron, at gpm rates superior to existing whole-house systems. These components are typical of the difficult, extremely small metals and molecules that require very slow 2gpm membrane filtration.

The system described is application-specific. However, the TSWS system of course easily traps the THMs and HAAs, byproducts of chlorine, at flows sufficient for residential whole house requirements with or without the "fast flow" design if hard-to-reach contaminants are not an issue in a given locale. All "finished" water has a UV third stage component in our Point of Entry (POE) systems. Our units treat 300-400 gallons of potable water per day per building. Typical 4-person households use 300 – 400 gpd in the US, while 25 – 50 gpd per person are common in many European countries.. The company's hi-flow appliance is under patent filings 2013, 2014, 2015.

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Electrochemical adsorption techniques varying concentrations, temperature regimes and polarity of contaminants will be applied to improve the adsorption isotherm for carbon, thereby improving the total contaminant removal capacity. The design study is to test the company's improved hi-flow POE application that meets/exceeds typical maximum surface loading rates of 6 gpm/ft^2.

We expect to show significantly reduced endocrine-impacting molecules across a wide range of source contamination. The innovation of treating all water into the building, as opposed to the common Point of Use (POU) remedies is a hallmark of TSWS designs. All sinks, all showers are now as contaminant free as possible, short of applying a reverse osmosis solution. The latter is however not recommended as, for a typical POU RO application, about 7000 gallons of water a year is wasted, lost to the drain.. This is about three weeks worth of potable water; thrown away because three - four gallons are never filtered per day but are required just to push a single gallon through the RO membrane daily. Also RO removes Ca++, Mg++ and Na+ which are dissolved solids we wish to leave in water. Much of the diet's DRI of the minerals Calcium, Magnesium, Sodium and even Iron come from clean water.

POU devices available on the market help ensure healthier water at a specific point of use thereby helping reduce neurological, immunological and endocrinal routes to disease through drinking water at that point. All POU locations, showers, sinks within the building are treated with the company's POE (point of entry) unit. Pathological effects, however are minimized through the UV stage iii of the unit. AWWA standards will be met.

In summary, with regard to the public health aspect, the protocol leads to products designed to reduce components of potable water not eliminated or treated by the 57,000 water utilities in the United States: 1] ***neurotoxicity,*** *2]* ***immune response impact,*** *3]* ***endocrine response impact.*** *Continuing degradation of our environment is undoubtedly responsible for observed epigenetic changes in mammalian biology, has led to alarming concentrations of toxic components in ever decreasing watersheds in most locales. These inevitably find their way into public drinking water systems and residential systems serviced by 78,000 water utilities across the United States.*

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With regard to water conservation, the company has designed the SMART TANK SOLUTION which may be found here: . Digitally controlled, this storage device is designed for the urban landscape. It has a slender profile for hard to fit places, provides large volume water storage no less than 6000 L (about 1500 gallons). The product is designed with a built-in 2.5" American Standard fire hose outlet in the event of fire. (visit the Kochek tank fire valve here:). It will include an immediate system "smart" status through a heads-up display app. for the end user, making it convenient and easy to use.

An 80% full tank provides 30 minutes of water at 50 gallons/ minute to thoroughly defend against ember attack ahead of advancing grass or forest fire. The large volume tank "smart feature" ensures an empty tank when rain is imminent, so rain is collected, stored, treated and made potable. Otherwise the tank system ensures a constant replenishment from well or mains water supplies in order to be full should drought or fire demands require. Estimates are that for over nine months the tank is 100% full on average with an overall 80%-filled condition.

The all-weather enclosure for the unit is engineered to be robust while allowing easy access for change-out of filters at recommended intervals. The unit is designed for the urban landscape and is a "standalone" unit. Provision is made for a similar but larger unit to accommodate a second water source should a slimline 304 stainless tank for rain collection be part of the system.

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