VSEP Vibes Newsletter

Welcome to the New Logic Research Newsletter.

PFAS Found in Reno Drinking Water

Polyfluoroalkyl substances (PFAS) are a group of man-made chemicals used for decades in many consumer goods. These chemical do not decompose and last forever. These have migrated into soils and water supplies everywhere in the world. This has only recently come to the attention of regulators. Guidelines for discharge are only now being formulated and make take years to be implemented. Meanwhile it is too late and the horse is out of the barn. There are some studies indicating that these chemicals when consumed will have health consequences. But the full picture of what level is safe and what the health implications are is not fully understood. This is a ticking time bomb and is something that is not discussed that much. The EPA has only recently required public water systems to measure PFAS and report it.

These chemicals move quickly through the environment and have accumulated after decades of use. They don't disappear and simply increase in concentration in the soil and water over time. EPA data shows that it has detected PFAS in 7,237 public water systems in the United States. Hundreds of these have levels above the proposed limits of 4-10 parts per trillion. Beverage companies that use municipal water to make their product will also have unsafe levels of PFAS and this has already led to litigation. PFAS was recently found in Hershey candy bar wrappers. PFAS was detected in rainfall in Florida. RO membranes can easily remove PFAS materials and VSEP has installed projects running for many years to remove these chemicals effectively.

I was evaluating a VSEP system proposal for a company who will build a new bottled water facility in Reno. They were told that they could not discharge brine since the municipal effluent will just pass the salt into the Truckee River. I got ahold of the water report from the City of Reno so that I could prepare a mass balance and a projection for zero liquid discharge. Spiral RO membranes would be used for the initial stage. Then a VSEP system can be used to increase the yield and minimize the concentrated brine. The VSEP reject would feed to an evaporator for full ZLD. What I found was that many of the PFAS chemicals are found in this water. Four of these including PFOS were higher than the proposed upper limit of 10 parts per trillion. Another three of them were above the 4 ppt lower limit. Only one of them listed was below 4 ppt. So, even the pristine Truckee River that flows from Lake Tahoe to Pyramid Lake is now contaminated.

Additional Monitoring: As part of an ongoing evaluation program the EPA has required us to monitor some additional contaminants/chemicals through the Unregulated Contaminant Monitoring Rule program. Information collected through the monitoring of these contaminants/chemicals will help to ensure that future decisions on drinking water standards are based on sound science.

CONTAMINANTS	Highest Value Detected	2023 Reported Unit	Range Low	Range High	Typical Source
Lithium	18.2	ppb	ND	18.2	Naturally present in the environment
PFBA	0.0068	ppb	ND	0.0068	PFAS are a group of synthetic chemicals used in a wide range of consumer products and industrial applications.
PFBS	0.0057	ppb	ND	0.0057	
PFHpA	0.0039	ppb	ND	0.0039	
PFHxA	0.012	ppb	ND	0.012	
PFHxS	0.015	ppb	ND	0.015	
PFOA	0.0055	ppb	ND	0.0055	
PFOS	0.020	ppb	ND	0.020	
PFPeA	0.013	ppb	ND	0.013	

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VSEP Performs at Russian Landfill

Serpukhov is located about 100 km south of Moscow. The area is a hub for many industries including textile, furniture, and paper making industries. The city has two large landfills. The Syanovo 1 was closed in 2017 after a major fire. The Lesnaya was closed in 2021. Both still have leachate to deal with. The city is a medieval town first established in 1339 to protect the southern approach to Moscow. The town frequently fell prey to Crimean Tatars and other Steppe conquerors.

Serpukhov Landfill

Russia produces about 70 million tons of garbage a year, and a lot of it ends up in landfills. The landfill sites are growing and threatening people's health. The town of Serpukhov is the center of toxic waste disposal, with several legal and more than half a dozen illegal landfills. The Lesnaya landfill is one of the most dangerous, with chemicals seeping into the water and poisoning the people who live close by. Reclamation of the Syanovo landfill is currently underway.

Kote Sotkilava has worked with VSEP in Russia and has a LP pilot machine. Kote is currently running pilot trials at a Serpukhov landfill in conjunction with New Logic's distributor, Ioteh (https://ioteh.ru/), based in Moscow. The results show that the VSEP with a RO membrane can take the raw leachate with no pretreatment and reduce the conductivity from 19,800 µS to 1,100 µS with one pass. The VSEP was operated at 300 psi with a flux rate of about 18 GFD (30.6 LMH). Samples are currently being tested for COD and Ammonia to see if additional Spiral RO polishing is needed.

New Logic has installed more than 20 landfill projects around the world. VSEP is uniquely able to filter the untreated leachate directly with RO and then make clean water that can be surface water discharged. The concentrate from the VSEP can be evaporated, but is mostly returned to the landfill. The water balance and the removal of excess water is really the main issue to be solved.

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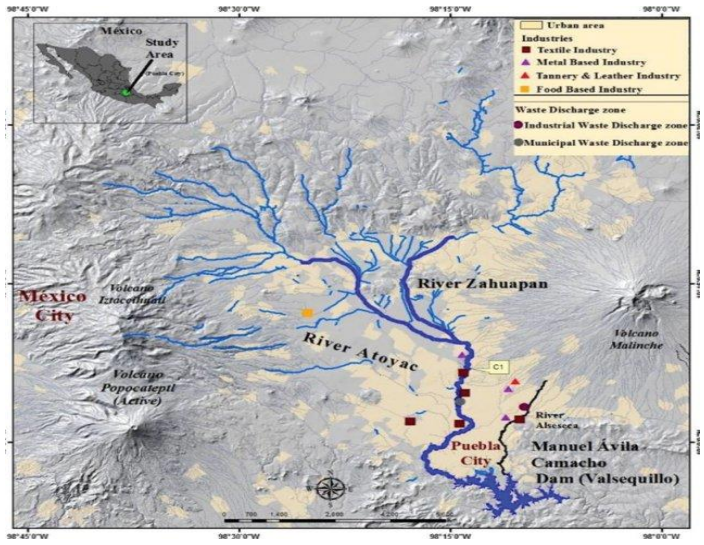
VSEP Proposed for Polluted River Water

The Atoyac river originates in the Sierra Madre del Sur mountain range southeast of Mexico City. It is the primary waterway through the state of Oaxaca and it is vitally important for thousands of people who rely on it for agricultural uses and for drinking water. This river is very polluted. It is not only a source of fresh water but is the discharge point for municipalities and industry. The poor water quality affects the health and wellbeing of thousands in the area. The untreated river water does not meet conventional drinking water standards.

In addition, the water is used for irrigation to the fertile soils surrounding the Atoyac river where the community relies on cultivation of corn, beans, and coffee. The river is also culturally significant and for many indigenous people the river is regarded as sacred. As with so many places in the world, there is no access to clean drinking water that is safe and healthy to drink. Contaminated water like this leads to health problems and gastrointestinal issues that cannot be calculated. The cost to society is immense. This river is reported to be the third most polluted river in Mexico. A local newspaper reported that 80% of the pollution comes from



urban wastewater, 15% from industrial effluent, and the rest from agricultural products such as pesticides. The city of Puebla and the towns of Huejotzingo and San Martin Texmelucan are severely impacted by the lack of safe water. The Santa Ana Xalmimilulco wastewater treatment plant has been offline despite being rehabilitated in 2013. This means that raw sewage is discharged and then used downstream. The Atoyac river has been described as being eight times more polluted than the national drinking water standard.

There are many many places in the world where this happens and it is unfortunate. New Logic has recently met with a large multinational food and beverage company who undertakes projects that help local communities. These efforts have nothing to do with their business or products that they make. This is simply a generous contribution to the community. New Logic will be proposing a drinking water system that will take raw river water and purify it using reverse osmosis to make clean water for the community. VSEP is uniquely able to take raw water with no pre-filtration or pretreatment and filter directly with RO. VSEP resists fouling from organics and humic material and is not limited by solubility of things like Silica.

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Dairy Manure Pilot Project

If constructed and managed properly, the age-old lagoon method of manure handling is a reliable method of storing and treating livestock waste. Lagoon storage followed by sprayfield application on local farms has proven to be a very symbiotic and effective method throughout the ages. However, the recent trend in the hog and cattle industry is towards larger centralized operations housing thousands of animals in a confined area. The problem that arises is that the local biosphere used for dispersing the waste is fixed in size and has limited capacity to absorb manure fertilizer. Nutrient overload, pathogen release, excessive odor emissions, and tributary eutrophication are potential threats when operating a manure production facility at or near the limits of the land. Problems in Wisconsin have arisen where thousands of dairies land applying manure for decades have now see Nitrogen leaching into the ground water and Phosphorous runoff to local surface waters.

Many Dairy operations have gotten extremely large. New Logic recently pilot test a dairy manure project in the Western United States where the client has 1 million gallon per day of liquid manure that needs disposal. Land applying 694 gpm of manure slurry can be problematic in many ways. Volume reducing this would have economic benefits. In the dead of winter, we conducted outdoor pilot testing on the manure just as it drained into the pit outside the cow barns. A centrifuge was used prior to the pit to remove large solids. We used a vibrating screen after the pit to be sure that all the sand and large solids were removed. VSEP RO followed by spiral RO was tested in series.

VSEP	Screened Feed mg/L	VSEP Permeate mg/L	Spiraal Permeate mg/L	VSEP Reject mg/L	Estimated Reduction
Boron	2.000	0.280	0.180	5.19	91.00%
Calcium	1,000.000	0.024	0.024	2,857.10	100.00%
Copper	2.000	0.170	0.190	5.40	90.50%
Magnesium	500.000	0.420	0.015	1,427.79	100.00%
Phosphorous	480.000	0.009	0.040	1,371.41	99.99%
Potassium	2,320.000	48.000	2.200	6,539.43	99.91%
Sodium	1,500.000	40.000	1.000	4,211.43	99.93%
Sulfur	380.000	6.210	1.257	1,074.18	99.67%
Zinc	32.000	0.270	0.270	90.93	99.16%
Ammonia	110.0	72.0	3.0	180.6	97.27%
Total Nitrogen	3,210.0	190.0	80.0	8,818.6	97.51%
Suspended Solids	36,950.0	15.0	5.0	105,543.6	99.99%
Dissolved Solids	10,950.0	230.0	22.0	30,858.6	99.80%
Conductivity	20,600.0	900.0	100.0	57,185.7	99.51%

The two pass RO system was able to make clean water that can be reused as drinking water or flush water for the animals and was able to concentrate the solids from about 4% to 13%. Two thirds of the volume was removed as clean water. This would mean that only 230 gpm of concentrated slurry would need to be handled and disposed of. Additional equipment could be added to dry this material so a bagged fertilizer product could be sold. The client is considering this option. Steer manure sold at home depot has a good price.

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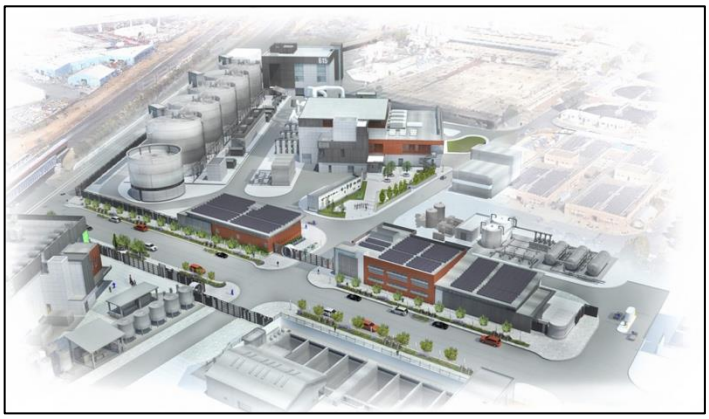
San Francisco Spends $3B to make Methane

The Southeast Treatment Plant in the Bayview area of San Francisco was built in 1952 and handles 80% of San Francisco's stormwater and municipal sewage. 57 million gallons per day (40,000 gpm) of effluent is treated using digesters and clarifiers and then is discharged into the San Francisco Bay. During the process solids known as biosolids will settle and do not decompose and are normally removed and then landfilled.

San Francisco will be spending more than 3 Billion dollars to install a biosolids digester system that will produce biogas from these carbon based solids. Biogas is Methane which is also known as natural gas. Natural gas is normally produced commercially by oil companies who drill wells to extract the methane from the ground. Biogas digesters are another way to produce methane. These are preferred by some because it can be called a renewable energy source. The San Francisco project will use public funds to produce methane and this will be injected into local PG&E gas distribution lines. The press release about the project says that more than $3B will be spent to build the project. It does not say how much methane they expect to produce or what the revenue would be from that and if the project would ever pay for itself. Unlike Solar or wind electricity,



Methane produces Carbon Dioxide when it is burned. Carbon Dioxide is a greenhouse gas.

San Francisco has awarded the design/build contract to a joint venture between PCL Construction and Stantec who will be the engineering company that designs the project. The San Francisco officials believe that the sea level could rise by 36" (one meter) and so Stantec will be designing for this future elevation change. It will also be designed to withstand a 7.8 earthquake. The construction contract requires local hiring of workers and subcontractors. The Bayview area is near the Hunters Point area of San Francisco which is predominantly populated by minorities.

Stantec has begun the design engineering on the project. After the methane is extracted from the anaerobic digesters, there will be an effluent generated. It is not clear from reports what will happen to this effluent. The spent biosolids will need to be dewatered and would presumably be landfilled after water removal. VSEP has been used many time to treat digester effluent with only wire mesh screening as pretreatment. VSEP RO can also remove Phosphorous, Ammonia, and other potential pollutants. The plan here may be to blend this effluent with the other 57 million gallons of effluent. But a better option would be to treat this digester effluent using membranes to reduce the Phosphorous and Nitrogen content of the water discharged into the sensitive San Francisco Bay.

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Rep Spotlight – Techno Alpha

Techno Alpha has been a distributor of VSEP now for 21 years. This makes them one of the longest running distributors of VSEP. The company is based in Japan and offers their clients many different technologies including the VSEP. Over the years, Greg Johnson has traveled to meet with Techno Alpha on several key projects. One in particular was a solution for the radioactive waste from the Fukushima power plant after the earthquake that damaged the facility. Makoto Hirayama and Greg worked diligently to get meetings with the Tepco managers to try to offer the VSEP as a real and functioning solution to treat all of the bad cooling water that was just being stored in tanks. This cooling water purge could have been filtered to remove salt and then recycled to minimize the waste volume. This effort was unsuccessful and eventually, the decision was made to discharge this water contaminated with radioactive Tritium into the ocean.

Tatsunori Yuwaki, Landon Graham, Taizo Nakamura

Makoto Hirayama, Hiroyuki Nakahata, Giants Game

Techno Alpha has installed many VSEP projects including Suntory, Kaneka, Chiba, Kunimine, Kakusan, and Kyowa. The applications include PVC Latex, coffee extract filtration, soy sauce effluent, manure, and many others.

Recently Landon Graham, New Logic's lab/pilot manager, met with Tatsunori Yuwaki and Taizo Nakamura at Techno Alpha's office in Tokyo to discuss existing and future projects including the possible future expansion of a VSEP system used for PVC Latex concentration. This system has been running for many years and the client is not asking about expanding the system

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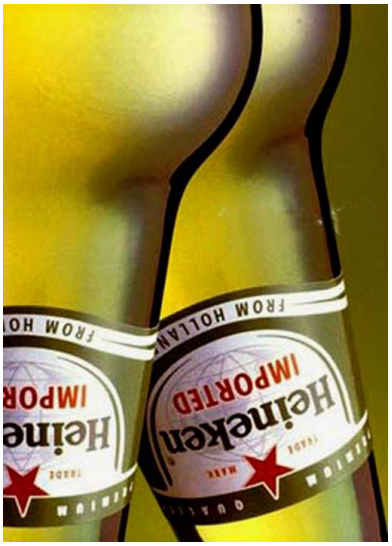
Beer Bottoms

Yeast is used to ferment beer in a fermentation tank. After a period of time, the beer is decanted and packaged as a beverage product. At the bottom of the tank, a layer of spent yeast remains with a significant amount of beer that cannot be easily decanted or separated. This results in the loss of some product and when this beer is recovered more product is produced. Separation of the beer from the spent yeast can be problematic. Crossflow membranes and centrifuges can be used. But, the problem is when the yeast cells are damaged this can produce a bad taste in the recovered beer. However, with the gentle flow through a VSEP filter, the yeast is not damaged and the flavor is maintained. We have found the same this with algae dewatering to make biodiesel. The algae cells are not damaged and the encapsulated oils can be recovered after dewatering. Even though the membrane is oscillating 50 times per second and is moving very rapidly, the laminar flow is gentle and not destructive.

25 years ago, New Logic licensed its vibrating membrane technology to Pall Corporation. At the time, they installed many vibrating membrane systems at breweries in Europe to filter the spent yeast to recover beer. One of these was the Bitburger Brewery in Northwestern Germany. After the expiration of the license agreement, New Logic has been promoting its VSEP technology to the brewery and beverage industry.



The spent yeast can have value, but shipping it as a slurry is difficult. One customer we tested for planned to sell the VSEP concentrate to a Hog Farmer as a feed additive. The filtered liquid would be recovered as a beer product. During pilot testing, the beer bottom slurry fed to the VSEP had 8% total solids. Most of these are very fine solids that don't settle very well and are kept dispersed by Brownian motion. The VSEP was able to recover about 50% of the volume as clean filtrate using a 0.05 micron Teflon membrane. This resulted in a concentrate with about 14% total solids and a clear filtrate with about 1.4% solids and no turbidity.

This customer was a small artisanal brewer and only had about 700 gallons per day of spent yeast slurry. Because VSEP comes in many sizes, it can be applied for any flow rate, even small ones like this. In this case a P-50 VSEP with 50 square feet of membrane would have been the correct size. This VSEP would have produced 350 gallons of recovered beer per day that could be sold. So the economics were very attractive.

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Data Centers Need Power and Water

Data centers store computer data such as cloud data. These server racks require huge amounts of electricity. An average power rack will consume 7 kW and some can demand as much as 15 kW. With some high performance computers, the power density can reach 100 kW. The typical data center uses about 40 Megawatts. In coming years, it is expected that larger data centers using 250 Megawatts or more will be constructed. It is estimated that data centers are one of the largest power consumers and use 1% to 1.5% of all electricity produced worldwide. Because of the very high power demand, data centers are often located where electricity costs are low. Additionally, power substations are often co-located with a group of data centers. An example of this is in Quincy Washington. There is a large group of data centers with a co-located substation. The electricity is generated by hydroelectric facilities on the Columbia River and is relatively inexpensive.

People know about the electrical demands for data centers, but many don't think about the water demands. As the electricity is consumed by the power racks, heat is generated. Heat sinks or fins that dissipate heat are installed on all the power racks. This transmits heat into the air in the room. These buildings must be cooled to maintain the temperature in a safe range to protect the equipment. This can be done with roof mounted evaporative coolers. When the hot air passes through the wetted fibers, the air is cooled by 30 degrees as the moisture evaporates. By evaporating this water, the dissolved solids present in

the water are concentrated. These solids must be purged or blown down to prevent solids build up that can scale the heat exchange surfaces. One data center can generate large volumes of the cooling water blowdown. They will also evaporate large amounts of water.

New Logic recently reviewed a data center project in Quincy Washington with Jacobs Engineering. This client had brine ponds that were near overflowing and disposal of the brine was a problem. By adding a VSEP RO system, the brine can be filtered so that most of the water can be recycled and used as cooling water makeup. At the same time, the concentrated brine volume for disposal would be reduced.

Cloud computing has caused a rapid growth in data centers. The global electricity demand is expected to grow exponentially in the coming years due to the high energy consuming technologies such as artificial intelligence (AI). There is a real risk that demand could surpass supply in many areas. The international Energy Agency (IEA) reported that the overall capital investments by Google, Microsoft, and Amazon exceeded that of the US oil and gas industry in 2023. Electricity demand from data centers, cryptocurrencies, and AI could reach 1,000 Terawatt Hours by 2026. This is roughly equal to the power consumption of Japan. All of that electricity in confined spaces will generate a lot of heat and will require water. This will also generate massive amounts of concentrated brine what will need disposal. Adding salt to inland rivers is problematic and salinity levels have been rising where surface waters are used for drinking water.

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California will Soon Ban Nitrogen

The European Union has already created a new strict rules that went into effect at the end of 2016. The directive calls for ever increasing reductions in Nitrogen emissions including Nitrogen Oxides, Ammonia, and other gases. It also addresses agricultural manure that is land applied. One of the Nitrogen emissions of concern is Nitrous Oxide (laughing gas). It is used commercially as an anesthetic and to stabilize whipped cream and to keep it free from bacteria. It can be created naturally when the Nitrogen contained in manure undergoes a microbial process known as denitrification which will oxidize the Ammonia to create various forms of Nitrogen Oxides including Nitrous Oxide gas. These Microbes will convert the Ammonia to Nitrate (NO_3), Nitrite (NO_2), Nitric Oxide (NO), and Nitrous Oxide (N_2O). The most thermodynamically favorable reaction is for Nitrate, but some Nitrous Oxide can leak out as a gas. Nitrous Oxide is a greenhouse gas and this is the primary reason for the rule in Europe.

However, increasingly, land application of manure is leading to Nitrate leaching into the ground water or surface water used for drinking water. This has been observed in Wisconsin where there is a high density of dairy farms. Many groundwater wells are showing high levels of Nitrate. There also is the issue of Phosphorous in run-off getting to lakes where it can cause algae blooms. California is now addressing this issue. The California State Water Resources Control Board (CSWRCB) has issued a draft order for review that will establish new protection requirements for all California Dairies. The proposed rule would limit Nitrogen to the same level as drinking water standard. This could potentially mean that land application of dairy manure is not possible. This would have ground shaking implications for the huge dairy industry in California. The dairy industry is criticizing the new rule and points out the benefits of adding nutrients to the soil. The draft regulation will be commented on with a workshop in mid 2025. The rule is expected to be finalized by the end of 2025 or early 2026.

In 2009, New Logic conducted a long term pilot study that was funded by the CSWRCB for the San Jacinto Resource Conservation District. It was observed back then that runoff was contributing to nutrient overloading in Canyon Lake and Lake Elsinore. The pilot scale test was done at the Abacherli Dairy in Menifee California. The VSEP operated at a recovery rate of 77% and produced a reduction of nutrients and salt of about 96%. So a solution for dealing with this waste is possible and has been demonstrated to dairies and to State officials. VSEP is uniquely able to take screened manure and directly filter it using a reverse osmosis membrane make water that is clean and safe to irrigate with or discharge to surface waters.

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Bi-Annual New Logic Board Meeting

Recently the founders of New Logic met for a Board meeting to discuss expansion and market opportunities. Ric Johnson and Brad Culkin founded the company in 1987. Since then the company has been owned and operated by the founders. This is a rare thing these days with all the normal mergers and acquisitions. New Logic has been in business for 37 amazing years. The Bureau of Labor Statistics shows that half of all new businesses shut after 3 years. Only 16% are able to last 30 years. So New Logic has a proud record of accomplishment.

The board members discussed the blooming vertical markets that include power generation, bottled water, landfills, and others. Plans for growth include new staffing and the construction of a 2nd manufacturing building next door to the existing facility. The founders also had a great time reminiscing about the starting days of the company and how they made it through some very tough times at the beginning. The company has never had deep pockets or investor money and has sustained itself and has grown simply by earning credibility and doing what it says it will do and by selling and installing systems that actually work. There were many good stories told about the mega deals at the beginning that cemented our future thanks to the marketing skills or Ric Johnson and the science acumen of Brad Culkin. In the early days, there were no references or happy customer to point to and as with any new product that is a tough sell. But thanks to Ric's incredible marketing and sales skills we were able to prove the nay-sayers wrong.

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