VSEP Vibes Newsletter

Welcome to the New Logic Research Newsletter

Diamonds and PFAS are Forever

The EPA has recently modified the rules for the National Primary Drinking Water Standards. There are about 7000 drinking water systems in the United States where Fluorinated Polymers known as PFAS have been found and exceed the limits the EPA will regulate. These materials have been produced for decades and do not decompose and have migrated throughput the environment. They can now be found everywhere including in rain water. PFAS is suspected to be a health hazard, although, more study is needed and specifically what health hazards exist if not fully understood. PFAS are known as forever chemicals and include a wide ranges of more than 40 fluorinated chemicals that have been used in most consumer products until recently.

The EPA rule requires public drinking water systems to measure for PFAS materials and report the results to the consumers. After a period of time, these drinking water systems will have to implement changes that will supply water to the system with levels of PFAS below the EPA set guidelines. This will require an enormous amount of effort and cost and this is why time is being given for compliance. The EPA will also be helping with subsidies to help offset the costs and help to keep water bills from rising too much.

As part of the recent changes, the EPA has extended the deadlines for compliance giving more time for stakeholders to develop a plan and implement changes. A similar thing happened when the EPA reduced the limit for Arsenic in drinking water from 50 part per billion to 10 parts per billion. Many water suppliers had to discontinue using certain wells or water sources and find alternate options. The PFAS regulations were to take effect in 2029 and this has been extended to 2031. These regulations will be especially difficult for rural water systems and small communities with limited resources. It will also be difficult in the Western States where water can be

scarce and surface water supplies like the Colorado River are dwindling.

Previously, the regulation was to cover only five of the dozens of PFAS chemicals. The amended rule will apply to PFOA and PFOS, but the requirements for PFHxS, PFNA, and HFPO-DA have been rescinded. Nearly all leachate from Landfills contains PFAS chemicals. Historically, in the United States, leachate is hauled to a local municipal sewage treatment plant where it is blended with sewage and then treated and discharged. But the treatment system cannot remove PFAS and these will just be diluted and the discharged to surface waters that feed the drinking water system. The EPA is also developing rules for leachate discharge.

New Logic has completed fabrication of a leachate treatment system for a landfill in Minnesota where the objective is to remove PFAS chemicals and other pollutants from the leachate. The system will be commissioned in early 2026. The EPA is aware of this VSEP project and will be using it as a case study to inform them on the leachate rules they are developing.

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Power Plant Leachate

Coal fired power plants burn coal to make steam to generate electricity. The flue gas from combustion requires a scrubber where a mist of water is sprayed at the top of the flue to capture heavy metals and other pollutants. This also prevent Sulfur from being emitted which can cause acid rain. The scrubber water is known as flue gas desulfurization (FGD) effluent. New Logic has installed projects and has more in the pipeline for treating this effluent to a very high purity.

Another byproduct of coal combustion is the ash that is leftover when the coal is burner. This ash is very light and small and can be carried up the flue with the combustion gases. Modern power plants use an electrostatic precipitator or filter to capture this ash. The bottom ash and the flue ash (called fly ash) is removed and piled in storage mounds on the property. Because it is lightweight, it makes a very nice additive for concrete and also as a road base material. After combustion, the ash is primarily made up of metal oxides such as Aluminum Oxide, Iron Oxide, Calcium Oxide, and Silica. Along with these various trace elements can be carried by the ash. Some of these are bad pollutants such as Arsenic, Cadmium, Chromium, Mercury, Selenium, and other heavy metals.

When the piles of fly ash are rained on, the moisture will percolate through the pile and is collected as fly ash leachate. This leachate pond water will eventually need to be treated. The dissolved solids (TDS) concentration of these ponds can be very high and even as high as 150,000 mg/L (15%). TDS levels this high can make membrane filtration difficult because high pressure is needed to overcome the osmotic pressure produced by the dissolved solids. Fortunately, the primary anion in this leachate can be sulfate which is divalent and does not produce the same strong osmotic pressure as all Chlorides would. Also, because it is divalent, it can be removed with Nanofiltration which can run at lower pressure than Reverse Osmosis.

To make the leachate go away, the best solution is to dewater with membranes as much as you can and then thermally evaporated the remaining water. During evaporation, care must be taken to prevent volatile substances and mercury from being exhausted and a condensate can be collected that can be treated by the membrane system. New Logic has pilot tested this effluent many times. VSEP is uniquely able to resist fouling and scaling because of the intense oscillation of the membrane. No softening or pretreatment is required.

Typical pilot test results using Nanofiltration for this application shows that VSEP can achieve 24 gallons per square foot per day (GFD) for a throughput rate. For an average TDS level of 6% consisting mostly of Sulfates, VSEP can remove about 80% of the volume as NF filtrate leaving only 20% to be evaporated. Because the TDS is mostly divalent, VSEP with NF can produce filtrate that is about 1000 µS from a starting value of about 30,000 µS. If needed, additional polishing can be done using a conventional spiral RO membrane. Either the NF permeate or the polished permeate can be reused as cooling tower make up or scrubber water make up. It can also be clean enough for sewer or surface water discharge.

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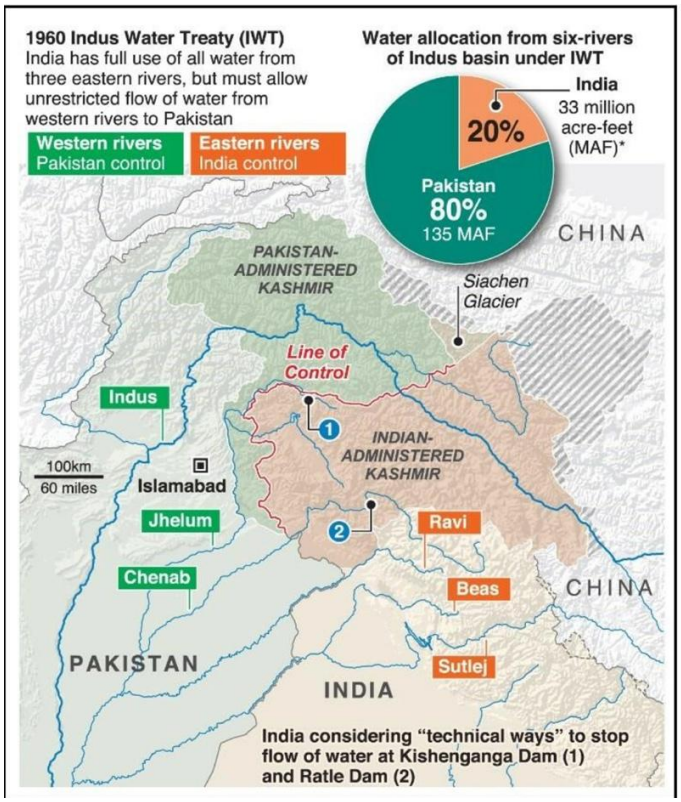
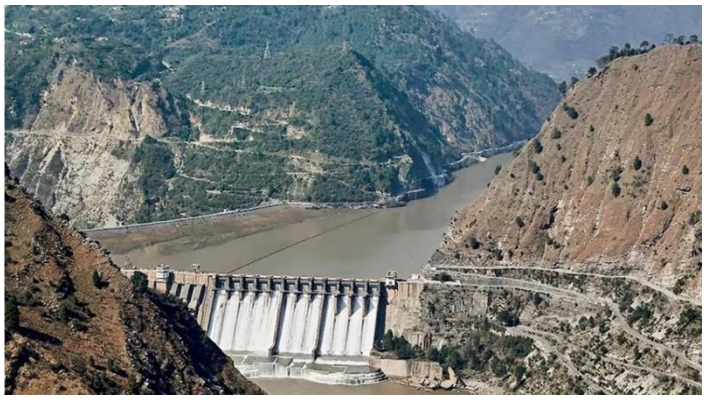
Water is the most Precious Resource

Water is needed for everything we do. Having enough is crucial to our lifestyle. Water disputes are becoming more and more common. There are many areas in the world where rivers and water bodies are shared between countries and treaties have been made to establish a framework for sharing between countries. This is true when rivers flow from one country to another. Such is true for the Colorado River and the Rio Grande which are shared between the United States and Mexico. Treaties made nearly 100 years ago when the demand for water was much less are now being reconsidered.

Another area of the world where water sharing disputes could lead to extreme violence and disruption is in the Kashmir region between Pakistan and India. There are six rivers that flow from India into Pakistan. In 1960, the Indus Water Treaty was established.





According to the treaty, India has full control and free use of three eastern rivers. But the other three western rivers including the Indus, Jhelum, and Chenab rivers are supposed to flow freely without restriction to Pakistan for its use. Recently a terror attack by a group called the Resistant Front occurred in the Indian controlled area of Kashmir. The dispute quickly escalated as the Indian government claimed that the Pakistani government. India has told Pakistanis with Visas to leave the country. Pakistan has closed its airspace to Indian aircraft. Also, India has cancelled the landmark water treaty. Pakistan is warning that this is an act of war. As tensions escalate, water is the key factor in the dispute.

Access to clean water can be a life or death situation and with populations around the world growing and the fixed amount of clean water available becoming limited, these kind of struggles will become more common. New ways to delivering clean water need to be addressed. Water recycling whenever possible needs to be expanded. This can be done if industries filter their effluent and reuse the water they consume. Reclaimed water from municipal sewage can be reused. VSEP has been working more and more in these kind of projects. New Logic has recently started pilot testing for a large EV car company who will be taking reclaimed tertiary effluent from the city where they reside. This recycled water will be used in the plant and will offset fresh water that would have been taken from rivers or groundwater sources.

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Oil and Water in Texas

The Permian Basin is located in west Texas and is the largest oil producing area in the United States. The area currently produces 4.2 million barrels per day of crude oil. It is named after the Permian geologic period when the basin was formed. 80% of the oil reserves are found less than 10,000 feet below ground. Some are only 3000 feet down. The first oil well was commissioned in 1921 and oil have been flowing ever since.

As with any operation of this size, there are some environmental concerns. Because of the expansion of oil operations, pipelines have not kept pace with oil production. Natural gas (methane) is produced with the oil and because of lack of pipeline access and the lower value of the gas, it is often flared as a way of disposal. It is also estimated that 3.7% of the methane in this region escapes to the atmosphere.

Additionally, water is produced with the oil that is extracted. The amount varies depending on the age of the well, but there can be as much as 8 volumes of water for every one volume of oil that is extracted. This produced water is typically reinjected into disposal wells and this is common in Texas. It is almost impossible to get a disposal well in other areas of the country, but there are many permitted wells in Oklahoma and Texas. Some speculate that these are causing earthquakes in the region.

In May of this year, the Texas Railroad Commission which regulates disposal wells sent notices stating the permits for new disposal wells would be restricted due to increasing ground pressure issues. Five years ago, the USGS reports that these disposal wells were leading to increased seismic activity. As a result, drillers began to dispose of their wastewater in shallower wells. In some areas, the disposal well reservoirs can't handle the volume and these are being pressurized in order to get the water down there. The Railroad Commission is concerned that the pressurizing of shallow wells can harm mineral or fresh water sources. One company is now suing Devon Energy claiming that their disposal activities are harming their production facilities.

New Logic has installed its VSEP equipment for the treatment of produced water from operations. A RO membrane can be used to remove organics, minerals, and salt so that clean water can be recovered and easily disposed of. New Logic has also participated in beneficiation studies where this produced water can be turned into clean useable water that can be used for irrigation or aquifer recharge, especially in the Central Valley of California. In Northern Alberta, steam is used to improve the extraction of heavy crude in the tar sands. VSEP has been shown to treat the produced water there is make steam quality water for reuse.

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Are Farms too big?

A State lawmaker from New York City has presented a bill that would limit the number of cows a farmer can have in rural New York State. According to State Senator Jabari Brisport, farms should be limited to 699 cows. In 2022, there were 9.4 million dairy cows in the United States which was actually 100,000 fewer than the year before. New York has 630,000 cows distributed over 2880 dairy farms. They produce about 2 Billion gallons of milk per year.

The population of the United States has doubled since 1960. As a result, more food is needed and more farming and ranching naturally follows. Because Dairy production is a low margin business, scale is needed to be profitable. We have outsourced many things in this country and we really don't make things any more, but, import them. For now farming and ranching is still done domestically to feed the population. "Buy Local" is a slogan you see are super markets. Transportation costs are a big expense in the food industry.

Senator Brisport is concerned about the risk to air and water from large dairy operations. Ammonia and Methane can be generated from large storage ponds. Land application of dilute manure can lead to runoff that can pollute local surface waters. Unless milk is imported from Mexico, New York would need the same number of cows, but spread out at more farms. This may not result in cleaner water and air. The Governor has not indicated a preference one way or the other. The future of this proposed legislation is not certain, but this reflects the ongoing risk that dairies face. It also highlights the tension between urban and rural communities. Running a dairy takes huge capital investments and is a low margin risky business to begin with. To mitigate this risk, manure management is key.

Dairy with VSEP installed for manure

New Logic has installed many pig and cow manure projects. In Europe, this has been done to deal with the maximum Nitrogen legislation. Here in the US, it has been to mitigate Nitrogen pollution of wells or to reduce hauling costs. VSEP can volume reduce the manure slurry and can eliminate the need for risky storage ponds that can emit gases and can suffer from berm failure or breaches allowing for unwanted surface or ground water discharge. The VSEP concentrate can be a good source of volatile solids for Biogas production, or it can be dried as a fertilizer product.

New Logic installed a VSEP RO treatment system at a large dairy north of Denver a couple of years ago. This dairy was hauling using dozens of truck per day to take the cow manure to an anaerobic digester to make methane biogas. To reduce the number of truck trips and also to be able to recycle clean water for use in the dairy, they installed a 6 module VSEP system with a spiral RO system to polish the VSEP permeate. The system has been in operation since 2023 and it is reported that the VSEP concentrate that is hauled to the anaerobic digester produces more methane than digesters processing more dilute manure.

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Leather Tanning needs new Technology

The tanning industry is one of the oldest in the world. The treatment and disposal of the wastes generated from this process is a problem as old as the industry but one that must be handled properly. Uncontrolled release of tannery effluents to surface waters has created a great health risk to humans and a huge pollution issue for the environment. Now is the time when environmental regulations are forcing this industry to take a closer look as the way it handles wastewater.

There are a great number of steps to taking a raw hide and making it into a consumer leather product. Throughout the process there are many steps requiring the addition of water. The water is used as a carrier for the chemicals, for cleaning the hides and to allow the penetration of chemicals into the fibers of the skins to alter the properties of the final product. The water in the process is added and then later removed in pressing or wringing operations. It is during these water removal steps that wastewater is generated and then must be treated. The wet processes in the tannery are the main contributors of the wastewater.

The water consumption per kg of hides processed varies by tannery and season. In general a tannery will consume between 34-56 m^3 (~9,000-15,000 gallons) of water per ton of raw hides [1]. This estimate of water consumption is for conventional technology. For more modern tanning facilities with advanced technology, the water consumption is greatly reduced and can be one-third to one-fifth of the previous estimates.

New Logic successfully installed a 36" VSEP unit in Australia for the treatment of tannery effluent cured with salt brine. The system is removing the fats, grease, suspended solids, proteins and blood from the brine effluent stream. This is the effluent that is generated when the salt preserved hides arrive at the facility and are then rinsed. The system has been in operation since mid 2004. The filtered salt brine is dried and reused.

Initial testing identified a PVDF membrane with a 250,000 molecular weight cutoff. However, due to concerns for limited pH tolerance and free chlorine limits, the customer selected a 0.05 micron Teflon membrane instead. The customer operates the unit at 70°C and runs at a feed pressure of 100 psi. The standard cleaning is flushing with warm caustic. A periodic cleaning with a chlorine solution for sanitation is also helpful to maintain the life of the filter pack. Performance has been predictable and stable to date.

This customer is also reviewing the current data from our test work on chrome concentration as well as our work on the lime stream. These two streams are also an environmental discharge problem for their facility. So far the preliminary evaluation indicates that these streams are economical for treatment with VSEP. The advantages are simple one-step process, small footprint, energy efficiency and the ability to treat these streams independently at the source.

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Immediate Expensing for VSEP Equipment

The US government just passed a mega bill known as "One Big Beautiful Bill", or H.R. 1 for short. It contains a lot of changes and many of these are not widely known. One that has to do with industry has to do with the ability to immediately expense 100% of the cost for some capital expenditures. The reason behind this is to help companies be more competitive when manufacturing in the United States in a world where global competition presents many challenges.

Previously, things like new equipment would need to be depreciated and expensed a little at a time over many years. The new legislation allows for immediate 100% expensing for capital equipment and expenditures. This should lead to a large increase in domestic spending on capital equipment and new factories. New capital investments are what drives economic growth and job creation. The Section 179 of the bill provides for:

- Full expensing for new factories and factory improvements
- Full expensing for domestic R&D to encourage innovation
- Full expensing for machinery and equipment

This is according to:
https://www.finance.senate.gov/chairmans-news/the-one-big-beautiful-bill-boosts-made-in-america-manufacturing

When selling our systems as capital equipment that would need to be expensed over many years, it has been difficult for many companies to come up with the needed capital and justify the purchase. Typically, our customer would like to see a payback period of less than two years to justify the investment. This payback allows them to recover the money spent on the equipment, but this expense still needed to be deducted over many years. A payback period of 3-5 years has value, but is not low hanging fruit. This new expensing legislation will change this dynamic. By getting full expensing on the purchase of a VSEP system, this expense can offset net income for the year that it is purchased and can immediate reduce the tax liability for that year.

Many of our customers have a forced compliance issue and must install our system to meet discharge requirements. But many others are looking for ways to improve the quality of their product, improve sustainability goals, or reduce operating costs. For these customers, the reduced tax burden will be a great benefit.

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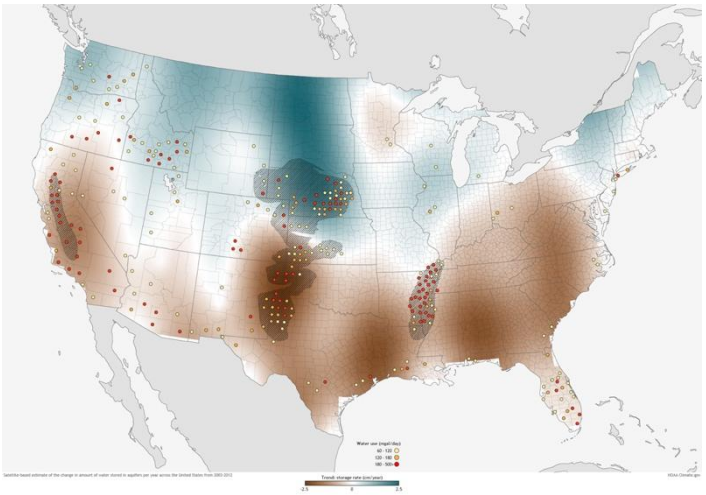
Turning Water into Wine

In 2014, I visited a large winery in the Central Valley of California. This is the nation's bread basket and this area produces an enormous amount of food. It is also located near very large population centers and the food industry can deliver fresh food products quickly without a lot of transport costs. Water wars are common in California now with a population of nearly 40 million people. During periods of drought, people in the cities are told to not water their lawn, or wash their cars, and take short showers. Many farms have gone fallow due to lack of water and diversion of water to the Delta near San Franscisco to preserve the endangered Delta Smelt, a small fish similar to a minnow.

The winery I visited was pumping nearly 1000 gpm (230 m3/hr) of water from the underground aquifer 24 hours a day for its operations. It takes about 7 gallons of water to produce one gallon of wine. This winery is only one of thousands of food industry operations in the central valley and most of them use groundwater since surface waters are not available and new reservoirs to capture Sierra snow melt have not been built since the 1960s when the population of the state was only 15 million. Because of the massive extraction of groundwater, the aquifer in the San Joaquin Valley is shrinking and collapsing. The ground level in the valley is also lowering every year. On average, the valley floor has sunk 12 inches (30 cm) and in some areas as much as 30 feet (9 meters) since 2006.



Nobody is regulating this and companies are free to pump out as much water as they need. To prevent further subsidence, the aquifer needs 220 billion gallons of water to recharge every years. That is far less than is being done. The State is not taking action to promote recharge or to invest in alternative water sources. The current rate is not sustainable. Once the volume of the aquifer is reduced by subsidence, it cannot be reinflated and is permanently reduced.

When I met with the winery 10 years ago, they seemed a little concerned about the amount of water they were consuming and we did pilot testing and offered them a wastewater treatment system that would have recovered 92% of their wastewater that could be recycled and reused. But after finishing the project with them, I gathered that they were just looking for a plan B and not really serious about sustainability or conserving water. For the last 10 years, they have been pumping at least that much water from the ground.

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Cloud Computing Requires a lot of Water

With the advent of cloud computing and high speed mega computers data centers are proliferating. Data centers are the locations with the many Terabytes of data from the internet are stored on thirst servers. The heat that is generated by these electrical devices must be controlled to avoid damage to the components. Like other electrical devices, these servers will have a "heat sink" on them which are fins with surface area to dissipate heat. Fans are also used to keep the device cool. The heat is transferred into the room air and this must be cooled to keep a constant safe temperature.

Sometimes closed loop cooling systems can be used where there is plentiful water available. The cool water is taken in and then absorbs heat in a heat exchange process and then the hot water is discharged. This is a once through operation. But in areas where water is not so plentiful and where humidity needs to be controlled as well, evaporative e coolers are used to condition the air. Evaporative coolers loose water as it turns to gas. In the process, dissolved solids increase in concentration. So, a blowdown or purge of this water must be done to prevent scaling of the heat exchange surfaces. There are roughly 12,000 data centers worldwide with about half of them in the United States. This number is growing at a rapid rate. Google is one of the larger data center operators and their centers used nearly 6 Billion gallons in 2023. One of these data centers in Council Bluffs Iowa alone use 1 Billion gallons in 2023, (2.89 M GPD). The following is the top ten list of Google Data centers and the water consumed in 2023:

Council Bluffs, IA	980M
Mayes County OK	815M
Berkeley County SC	763M
Douglas County GA	346M
Lenoir NC	337M
The Dallas OR	302M
Montgomery TN	289M
Leesburg VA	173M
Henderson NV	159M
Jackson County AL	142M

Much of the water used with evaporative cooling leaves by evaporation, but a lot of it is purged and discharged after the salinity is increased. New Logic has installed many cooling tower blowdown projects where this purge water can be desalinated with VSEP and 80% of it can be returned as make up water. This would be a major part of a sustainability plant that many of these tech companies espouse.

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