VSEP Vibes Newsletter

Welcome to the New Logic Research Newsletter.

Another VSEP Zero-Liquid Discharge Project

With populations rising, water sources becoming stretched, and difficulty expanding infrastructure capacity, increasing attention is being paid to how water is used and reused. Industry, agriculture, and domestic water users are all competing for this most precious natural resource. Many of the Southwestern United States are seeing dramatic population growth rates, while population levels in the North and Northeast are remaining fairly stable. The problem is that populations are increasing in areas of the countries with the most limited water supplies. For example, the U.S. Census Bureau estimates that the population of Arizona will double within the next 25 years.

In a recent article by the American Water Works Association (AWWA) titled "The Dawn of the Replacement Era", it is estimated that of 20 utilities counted, there are projected expenditures of $250 Billion USD needed just to replace existing municipal water infrastructure. Much of the nation's infrastructure was installed during the late 1800s in response to a surge in population growth. There was another surge in infrastructure development during the great public works projects of the 1930s. A great deal of our critical infrastructure is nearing or has surpassed its design lifespan. Simply performing the needed retrofits will be a challenge for the nation's water and wastewater districts. Increasing capacity and infrastructure to account for increased demand on top of the necessary system replacements may prove to be too much.

Clearly, the case for retrofits and additional capacity has been made. The EPA's Office of Water recently estimated the capital required over the next 20 years for both water and wastewater upgrades is nearly $500 Billion USD (EPA, The Clean Water and Drinking Water Gap Analysis, 2002). These estimates are not adjusted for inflation and use current value terms. The EPA attributes these costs to retrofitting treatment plants and infrastructure that are obsolete, more stringent drinking water and wastewater standards, and increasing expense and controversy associated with capital improvement projects.

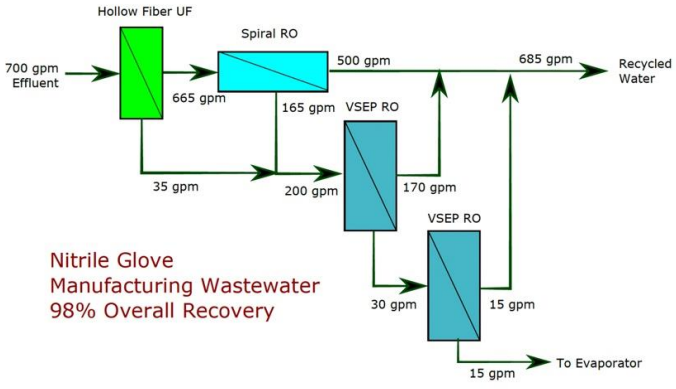
As population and demand continue to grow and as environmental compliance becomes more stringent, and with little or no matching State or Federal funds for capital projects, local water and wastewater utilities are faced with a conundrum. It is quite predictable that much of this burden will be shifted to commercial and industrial water consumers. In an ever increasing global economy with new competitive pressures,

industries that use a lot of water should work on developing plans for the future to conserve water and reuse as much as possible.

During the recent virus pandemic, it became a concern that nearly all of PPE such as masks and gloves are made in Asia. Rapid response and the ability to get millions of masks and gloves quickly became an obvious problem. Governments did take action to provide incentives for domestically manufactured product. One of these is a Nitrile glove manufacturing facility in the Eastern United States. A pharmaceutical company built a new Nitrile Glove manufacturing facility. But to get a permit to operate, they had to agree to recycling water and to having no wastewater discharge. This is becoming more common and New Logic is contacted all the time by companies like this who can build a new facility but have to be zero-liquid discharge (ZLD).

Nitrile gloves are made by dipping a molded plastic hand into a latex bath and then drying them and then removing them from the mold. This is all done in rapid fashion. The molds and equipment must be cleaned and this generates huge volumes of effluent. The effluent can contain high levels of suspended solids and latex particles. In addition, there are surfactants and mold release chemicals.

New Logic recently commissioned a membrane system for this project that yields a 98% water recovery rate leaving only 2% of the volume that is sent to an evaporator. The first step in the treatment process is a hollow fiber (HF) UF system supplied by another vendor. This concentrates the suspended solids. After that the UF permeate is fed to a spiral RO system provided by New Logic. The effluent flow rate is 700 GPM (160 m3/hr). The spiral system recovers 75% of the volume as RO permeate. Then the 25% reject volume that is left is blended with the reject from the HF system and its backwash and this is fed to a 12 module VSEP RO system. VSEP's RO membranes can handle suspended solids. This VSEP system squeezes out another 85% of the volume as RO permeate and the remaining reject is sent to a high pressure VSEP system to reduce the reject volume by half. The result is that 685 GPM of clean water is returned to the glove washing process and only 15 GPM is sent to a final evaporation step



VSEP Vibes Newsletter

This is a very typical flow sheet for our ZLD projects. Because the VSEP is used for volume reduction of the brine, a 15 GPM evaporator was used. Without the VSEP, it would have required a 165 GPM evaporator.

The facility is bringing more glove lines online and will be expanding in the future. Because VSEP is modular, this planned expansion will be very easy to complete. The system was installed outdoors with no cover. We recommended that at least a canopy roof be installed to protect the equipment from rain and UV. Our engineers, Matt O'Brien and Oleg Tsabilev did the commissioning during pouring down rain, but managed to get everything working well in spite of the weather conditions. The customer may decide to add a cover at some point,

New Logic's field engineers are used to all sorts of difficulties. Some trips to projects can take 30 hours one way to South Africa for example. Often our engineers need to walk the project and fix things that are outside of our scope of work so that the VSEP can be brought online. This is all just in a day's work for our guys.

Acid Purification for the Nolans Rare Earths Project

New Logic has recently completed one year of pilot testing and modeling for a Rare Earth Metals mine in central Australia for the company developing this project, Arafura Rare Earths. The pilot testing involved purification of Phosphoric Acid and Sulfuric Acid using New Logic's VSEP Nanofiltration (NF) technology. The vibration of the membrane that occurs with the VSEP limits fouling and scaling and allows for filtration of strong acid slurries that contain suspended solids and also that may be saturated in solubility where crystallization may occur. VSEP does not require pretreatment and unlike ion exchange will capture impurities without regard to selectivity.

The completion of the test work has shown that the VSEP NF filtration system is able to purify the Phosphoric Acid to meet merchant grade quality so that this acid can be sold as a value added product. The VSEP was also able to purify the Sulfuric Acid stream to a level where it can be recycled in the process. To highlight this success, New Logic and Arafura Rare Earths presented a technical paper on the results of testing.

The paper is co-authored by Dr. Alex Elliot and Lourdes Valle of Arafura Rare Earths and by Landon Graham and Greg Johnson of New Logic Research. The paper was presented at the

VSEP Vibes Newsletter

ALTA 2023 conference in Perth Australia. The annual ALTA conference is a world-class metallurgical conference now in its 27th year and was held at the Pan Pacific Hotel, Perth Australia, on May 1-5. The themes running through the conference reflect key current and developing technology trends.

The title of the paper is: *NOLANS RARE EARTHS PROJECT: INNOVATIVE RECOVERY AND PURIFICATION OF PHOSPHORIC ACID BY VSEP NANOFILTRATION*

A full copy of this Abstract can be found here. Arafura-New Logic Abstract

Rep Spotlight – Inovaya

New Logic has recently started working with a new company in France to solve problems and provide solutions to industrial companies in the region. Creation of Inovaya was founded by its three co-founders, Khaled Al Mezayen, Justine Vidil and Guillaume Lonchamp. As the company name implies, they all believe in solving problems using innovation and technology

The company is expert in membranes and filtration and became interested in VSEP as a bolt-on technology for maximum volume reduction and for the use of membranes where conventional membranes cannot be applied. The company has acquired two VSEP LP Pilot units and can now offer pilot testing of the VSEP to its clients.

Working with Inovaya's process engineering team, Sylvain Masson and Elisabeth Mary, we are currently evaluating the VSEP of VSEP for many applications including tannery effluent, yogurt whey wastewater, laundry wastewater, textile dye effluent, and several others.

V✧SEP Vibes Newsletter

Inovaya's mission is to help to reserve our precious water resource and to find creative ways to reuse water and to treat industrial effluent in an economical and sustainable way. For more information:

https://inovaya.com/en/home/

665 rue Pasteur
38670 Chasse-sur-Rhône, France
+33 428 294 231
info@inovaya.com

Risky Business - Landfill Leachate

Operating landfill is not always an easy task. There are many tasks that must be managed properly. A landfill is actually a very highly engineered structure. Like anything involving engineering, quality counts. There are landfills everywhere on the planet. The vast majority do not suffer any major problems, but some do if neglected.

Most landfills have a plastic liner at the bottom of the trash pile. The shape of the bottom liner is bowl shaped, so the trash pile acts like a bathtub. It is important to manage the rain water and other moisture that filters to the bottom and is collected near the liner at the bottom. If the bathtub gets to full with too much moisture, the trash pile can liquify and the a landslide failure can occur. This has happened in Manila, Sarajevo, Shenzhen, Istanbul, Bogota, and many other places. Several of these have resulted in fatalities

In Bogota, they did not have a treatment process for leachate, so they would simply reinject the leachate back into the landfill. The operators became concerned because they had to use higher and higher pressure to get the leachate reinjected. Eventually, the bathtub burst in 2002 and lead to many fatalities. The landfill has still not installed a proper leachate treatment solution. Another landslide occurred at the Bogota landfill in 2020.

Some moisture is desirable since this enhances to decomposition of the organic materials in the trash pile. So you don't want it too dry. Once the leachate is pumped out from the trash pile, it is typically stored on large ponds. One way to deal with your leachate is to keep building storage ponds and make the bigger. This is what has been done at the Bordo Poniente landfill in Mexico City. In this case the leachate pond is so large it can be seen from outer space.

Building storage ponds is not inexpensive and a failure of a pond can be very expensive. The best solution is to design a well-engineered storage pond that is not too large and then to acquire and adequate leachate treatment system so the excess water can be discharged. Landfills have a water balance problem. When it rains, all of this water becomes leachate and must be handled. You can't keep accumulating water and eventually it must be discharged.

VSEP Vibes Newsletter

Many landfills in the United States are able to haul leachate to a local municipal sewage treatment plant. It is blended with the town sewage and treated and then discharged. This is sort of solution by dilution. Leachate can contain many pollutants including heavy metals, arsenic, nickel, PFAS materials, pesticides, solvents, and many other things. A conventional sewage treatment plant will have limited ability to treat this kind of water. Because of this problem, some POTWs have stopped taking leachate or are considering that.

Because of all the problems described above, landfills have sought onsite treatment options. Spiral membrane modules have been tried but because of the limitations on what can be fed to these, spiral membranes are almost never used for leachate treatment. The BOD, suspended solids, and hardness levels are too high for stable operation. Membranes are preferred because of the incredibly good treated water quality that can be produced. The most common method tried for treating leachate is biological digestion. Many of these systems have been installed and can reduce BOD and COD and some of the pollutants. But these cannot reduce total dissolved solids, heavy metals, and recalcitrant materials found in leachate from household and industrial waste. Membranes can remove all of these things. The other alternative is thermal evaporation, which will work and will make a condensate water stream that is very clean. However, the capital and operating costs of these are out of reach of many landfill operations.

Of all the possible applications for wastewater, VSEP seems to fit best for treating landfill leachate because it has none of the disadvantages described above. Unlike a digester, VSEP can remove all solids from the water and can make drinking water quality. Unlike spiral membrane systems, VSEP's only limitation is the osmotic pressure. Unlike evaporation, VSEP is low priced and can be afforded by most landfill operations. VSEP is less expensive than hauling, evaporation, biological, or any other method that can be used to treat leachate. Because of these reasons, VSEP is being deployed to landfills around the world.

New Logic has installed about 20 landfill projects. One of the challenges is to properly maintain the equipment and to assign qualified operators to

VSEP Vibes Newsletter

look after the equipment. We did have one of our customers who spent a great deal of money on a new VSEP system and a fancy building and tanks and all the other necessities. But after making the capital equipment purchase, they let the system age and deteriorate. We advise customers that the membranes should be replaced every few years. This customer never replaced their membranes. Also, they would not replace any small valves or bearings or pump seals when they failed. Over a 10 year period, this can happen. Instead of replacing parts when needed, they would take parts off of one module and put it on another to keep at least some of the system operating. This worked for a while, but eventually, they just stopped using the system which had worked perfectly for the first few years. It would have continued to work perfectly if they just replace a few small parts and replaced filters as advised.

Idled VSEP System Flooded after pond failure

Eventually, their leachate ponds got full and then a big rain storm happened and their leachate pond failed. This led to a very expensive clean up operation. It is a good lesson learned situation. They could have spent a small amount of money on maintenance and skilled operation, but they took the risk and ended up spending a great deal more.

Get to know New Logic – Vaishali Yasala

New Logic has recently recruited Vaishali Yasala, who holds a master's degree in Electrical Engineering from San Jose State University. After graduating in 2020. Vaishali worked on AWS Cloud Computing platforms developing ways to compute, store, and secure data. She worked on data pipelines to dynamically upload data. She was tasked with simplifying the data pipeline for analytics and validation.

VSEP Vibes Newsletter

Because of her academic record and superior performance, she received a 100% scholarship with tuition free during her four year undergraduate studies. In 2019, she coauthored a paper on the Design and Implementation of an Automatic Welding Machine.

During her post graduate work, she explored and executed diverse methodologies for photovoltaic differential power processing to optimize power extraction from solar panels under partially shaded conditions. This involved the utilization of a maximum power point (MPP) algorithm in conjunction with a DC/DC converter to handle the current disparity per panel, thereby reducing the stress on the switch.

Vaishali's referral can from Brad Culkin, one of the founders of New Logic. We look forward to Vaishali adding her intellect and skill to the VSEP product.

About the newsletter author:

Greg Johnson is CEO of New Logic Research and is responsible for the development of VSEP technology since 1992. gjohnson@vsep.com

New Logic Research, Inc.
2527 Aviation Way
Minden, NV 89423 USA

775-783-7600

www.vsep.com
info@vsep.com

September 2023 Newsletter Edition