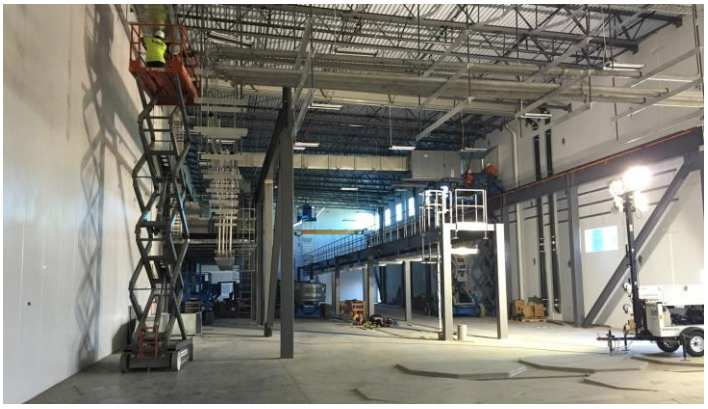
VSEP Vibes Newsletter

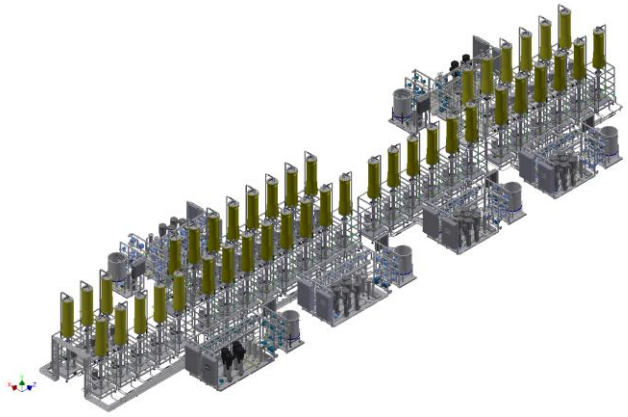
**Completion of the Largest VSEP Installation**

Rialto is a city having a population of about 100,000 and is located inland from the ocean in Southern California near San Bernardino. In 2015, a large bottled water company wanted to construct a new bottling facility there right in the midst of one of the worst droughts in California history. This was also at a time when the City of Rialto put restrictions on its citizens about water conservation including when it was OK to wash your car or water your lawn. Even without the drought, water infrastructure is very strained due to the huge population increases in the State in recent years. The Los Angeles area was a desert prior to settlement by the pioneers. Water for the region comes from as far away as the Colorado River in Arizona and the mountain rivers in Northern California by way of aqueduct.

Rialto gets 67% of its city water from groundwater wells. It gets another 19% from the neighboring town of San Bernardino. And it gets the final 14% from the California aqueduct. The city produces an average of 7.6 MGD. The water bottling company was requesting permission to build its facility using 2.2 MGD of town water. That was a big request as it is almost 30% of the average water produced by the city.

In order to get permits and permission to construct the facility, the company needed to assure the City that





the water taken from the City system would be used efficiently. Since the company was planning to use a conventional spiral RO membrane system to filter the town water prior to bottling, minimizing the volume of reject water left was critical. In addition, the sewage from Rialto is treated and then discharged to the Santa Ana River. Because of concerns about the rising salinity of this river, discharge of salt or brine is prohibited. Permits are only allowed for typical sanitary sewage and not for industrial effluents high in salt. For discharge of brine, the company would have had to haul the spiral reject to a brine line that discharged to the ocean. For this, there would be the high cost of transportation and the fees for discharging to the line.

To accommodate the City's concern about water efficiency and the fact that the reject brine could not be sewer discharged, the company decided to install a high efficiency VSEP system to treat the reject volume coming from the spiral RO system. This work was done in two phases. In 2015, New Logic installed the first phase of this. The VSEP system was commissioned and processed 176 GPM (40 m3/hr) of concentrated reject from the spiral system. The overall recovery of the process was 98% leaving only 2% of the volume that needed to be hauled to the brine line.

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The spiral reject feeding the two-stage VSEP system has TDS of about 2,162 mg/L. This concentrate is high in Silica which was the limiting factor for the spiral system which operates at 80% recovery. The VSEP system performs an 80% recovery in the primary stage of filtration. Then a second VSEP system is used to concentrate the concentrate from the first VSEP system with an additional 70% recovery.

While the spiral RO system was limited due to Silica, the VSEP RO system did not have this limitation and is able to function as a crystallizer precipitating Silica during the filtration process. Scaling of some interconnecting piping was observed and large amounts of precipitated solids were found in the concentrate tanks, but the VSEP membrane is able to function without scaling and only periodic cleaning is needed to keep a steady state throughput rate. Maintenance is required to pump out the solids found in the destination tanks.

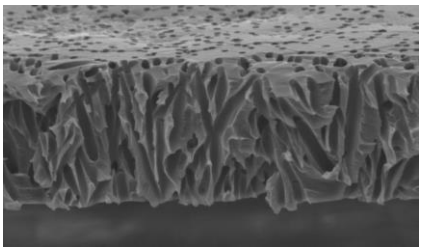
No pilot testing was done for this project and only modeling was used by VSEP engineers to design this system. The VSEP client had a lot at stake given the promises made to the City and its inability to sewer discharge any brine leftover. From the beginning of the project, the VSEP system has performed as expected.

Three years later now, the client has decided to double the capacity of its plant and ordered more VSEP equipment to add to the existing plant. New Logic is currently installing additional VSEP modules and is now building the last 8 modules that will complete the expansion. When fully installed, this project will have 40 VSEP modules and will be the largest VSEP installation in the world. The 40 module system will be processing 352 gpm (80 m3/hr) of spiral RO reject.

Due to the limitations on the use of town water and the limitations on brine disposal, this client would not have been able to build their bottled water facility at this location without the VSEP system. Rialto is a suburb of the greater lucrative Los Angeles area. Transportation costs are one of the major operating costs for a bottled water company. So their ability to locate so close to this large population area was critical to company profitability. Even though this company did its due diligence on VSEP and visited other operating systems, they made a big gamble on VSEP and it paid off.

**Word of the day: Donnan Equilibrium**

Donnan Equilibrium is a condition where charge neutrality is maintained across a membrane. Cations and Anions will migrate through a semi-permeable membrane in both directions randomly. Disassociated, (ionized or charged), mono-valent ions are able to pass more easily than disassociated multivalent ions due to their lower electrical potential. However, they can only do so in quantities so that charge neutrality is kept equal. Un-ionized molecules, if small enough in size, will pass freely since there is no electrical impedance or balance that must be maintained. Donnan Equilibrium is the state at which positive and negative electrical potential is equal.



# VSEP Vibes Newsletter

**New Distributor Spotlight: Clinty Chemicals**

New Logic is glad to announce its partnership with Clinty Chemicals. In terms of water and waste water treatment, Clinty Chemicals specializes in the manufacture and provision of a wide range of flocculent and coagulant solutions for municipal and industrial water and waste water treatment applications. Clinty Chemicals Ltd. was created in 1978 as a means of using indigenous expertise and raw materials to produce unique water treatment chemicals and solutions with dramatically reduced environmental and carbon impact.

The company CEO, Brian McMillen concluded partnership discussions with New Logic CEO, Greg Johnson where Clinty Chemicals will offer the VSEP technology as one of its treatment options to its customers. Brian and his associate, Matthew Welsh recently attended a VSEP seminar where possible landfill and digester effluent projects were discussed.

Clinty Chemicals provides services to Ireland, the United Kingdom and Europe. They will now be able to offer the most robust membrane system on the market to their clients. New Logic will also benefit by access to the customer base of Clinty Chemicals.

**Brian McMillen & Matthew Welsh at a VSEP workshop**

**Application Spotlight: Manure**

Why would someone need a system to treat manure?

The typical method of disposal of manure that has been practiced for thousands of years is to apply the manure to fields to use as fertilizer. However, while this can work easily for small family farms, large farming operations that have thousands of animals need large areas of land available to dispose of the manure. However, as long as this option exists, it costs nothing and so it is the best option for the farmer. Obviously, there is no need to spend money on any kind of water treatment system if land application is possible.

When there are situations where land applying is difficult, expensive, or not possible, then the farmer will need to have a treatment process.

In some cases, in colder regions, the ground is frozen for most of the year. Land application can only occur when the ground has thawed and the water and nutrients will soak into the ground. This is the case for our project in Lithuania. They can only land apply the digested manure for 3-4 months out of the year. And so, they would require very large storage capacity for the manure during the rest of the year. Storing this much manure for that long can be expensive and problematic. In addition, because there is a very short time to land apply and the ground can only absorb so much water, it requires a much larger area of land

to apply the manure than it would if year round land application were possible.

Second, in regions where that are concentrations of large animal farms (pigs or cows), the available land for disposal can be hard to find or far away. This is the case in Northern Italy where we installed a project. Many farmers would need to haul the manure 100 km or more to find land that can accept the manure

Third, constant land application can cause over-fertilization of the land. In Europe, there is too much nitrogen on the land and there are limits imposed by the government on the amount of nitrogen that can be put on the land. In Belgium we installed projects because for thousands of years pig farmers put the manure on the land and now it has very high levels of phosphorous. High levels of Phosphorous reduces the ability of water to absorb into the ground. (It stays muddy). Here again there are regulations on the amount of nutrients that can be land applied.

So in all the cases above, the farmer does not have a choice and must haul long distances or must treat the manure to reduce the volume or dry it so it can be shipped as a dry and bagged fertilizer product. These are all cases in Europe where VSEP has been used. Farmers that can land apply would never call us, because they don't need anything.

## Why would a dairy or pig farmer choose a VSEP?

Manure or digested manure is very high in ammonia, dissolved solids, and COD (Chemical Oxygen Demand). If the water is going to be treated it might be able to go to the sewer, or it can be used as irrigation water, or is can be discarded to the river or other surface waters. However, for any of these options, the water should be pretty clean. Even for irrigation water, the soil can only accommodate so many nutrients, so the nitrogen, potassium, phosphorous and other dissolved solids need to be removed.

Typical digesters that are used in conventional municipal sewage treatment plants are often used, but these alone cannot always meet the discharge limits for treated water. Municipal sewage is much more dilute than the manure effluent.

While many people have tried to use conventional spiral membranes for this application by using very elaborate pre-treatment, there aren't any successful projects where this is being done. Membranes are the perfect method for treatment because RO membranes can make drinking water quality from any effluent. But, because the spiral membranes plug, VSEP is the perfect answer

If the farmer wants to discharge the water and it needs to be clean and he wants a small and simple treatment method, then VSEP is the best solution. VSEP by itself may seem like an expensive system, but a total installed VSEP project would cost far less than a complicated typical sewage treatment plant that would normally be used for a small town. VSEP costs about $2/m3 to operate. Any time that a farmer is hauling manure more than just a few kilometers, he could save money by volume reducing it with VSEP and then haul 20% of the volume instead.

# VSEP Vibes Newsletter

## VSEP LP Pilot Training

The LP VSEP is the perfect size machine for pilot testing at the customer's site or for bench testing in the lab.

It can be operated in Lab Mode (L Mode) where a single sheet of membrane about 28 cm in diameter is used to quickly determine the performance of a certain type of membrane. After the membrane type is selected, then a larger filter pack assembly can be installed where the LP is operated in Pilot Mode (P Mode). The membrane area for this assembly is about 1.5 m2.

Several years ago, New Logic produced a training video that describes the operation and set up of the LP VSEP for both of these operating modes. This training video can be found in our website at this address:

http://www.vsep.com/video/lp-training-video.html

For more information, contact our Pilot Manager, Landon Graham

lgraham@vsep.com

or call +510-655-7305

## Pilot Test – Cheese Whey

Sigma Alimentos (Sigma) is an international food company producing cheese, yogurt, and deli meats. They recently contacted New Logic's Mexican distributor, TSS Internacional. They spoke to Mr. Raul Guerrero of TSS about their problem in handling large volumes of whey which is a very dilute byproduct. Sigma produces cheese at their facility in the town of Sabinas Hidalgo which is about 60 miles North of Monterrey Mexico. The whey byproduct that is generated at the Sabinas Hidalgo facility is hauled by truck to a Sigma plant in Monterrey where it is concentrated using a four stage evaporation process to get it to about 37% whey protein. This is then sold as a whey protein food product. The high cost of transportation and evaporation presented an opportunity for dewatering of the whey prior to shipment.

A pilot test was arranged and New Logic's engineer, Tom Henry, traveled to the plant to conduct testing using a VSEP LP pilot machine. An ESPA RO membrane was selected and was installed on the VSEP.

The starting concentration of whey was relatively high at about 8.6% (8.6 Brix). This presented some osmotic pressure and so the LP VSEP was operated near the maximum pressure of about 500 psi (38 Bar) for the standard VSEP design. A total of 8 batch concentrations were completed. At this pressure the VSEP was able to double the whey concentration

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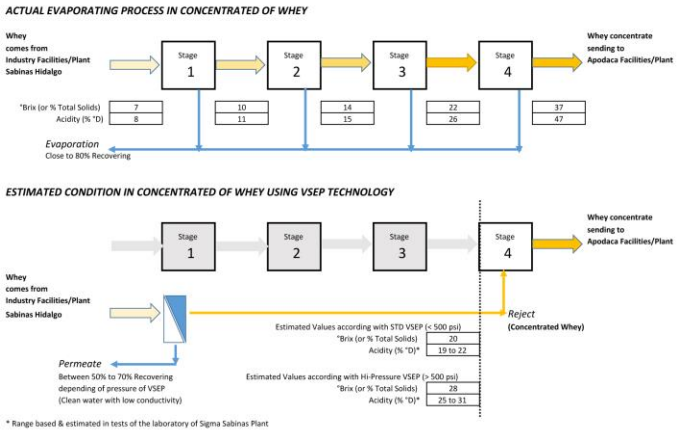
removing half the volume as water. This would reduce the hauling and evaporation costs by half.

Then to see what the limit would be, the VSEP was operated at 800 psi (55 Bar). By increasing the pressure to overcome the osmotic pressure, the VSEP was able to reach about 73% recovery or volume reduction concentrating the whey to 28 Brix.

One chemical cleaning was done at the end of the testing, but simple hot water flushing at the end of each batch worked just as well as chemical cleaning.

**Feed and Permeate samples from a Whey Pilot Test**

With the current evaporation scheme used by the client, if VSEP is used to remove half the volume as water, two of the four evaporators can be eliminated. If the high pressure VSEP option is chosen with VSEP producing 28 Brix, then 3 of the four evaporators can be taken out. This also reduces the hauling and energy costs for evaporation by 73%.




The client is currently processing about 300 m3/day which is about 10-15 trucks per day hauling the liquid 60 miles to the Monterrey plant. Sigma is expected to realize very large cost savings by installing the VSEP equipment at the Sabinas Hidalgo facility.

New Logic has finalized its food grade 3A system design and is proposing a 3 module standard pressure VSEP system as a primary stage. Then an optional 2 module high pressure VSEP system could be used after that for maximum volume reduction.

TSS Internacional has been a VSEP distributor for more than 10 years and has been successful in installing several VSEP projects in Mexico.

For more information, contact Raul Guerrero

rguerreroa@tssinternacional.com

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**VSEP Update: Moscow Power & Engineering Institute**

New Logic has recently completed a collaboration agreement with the Moscow Power Engineering Institute in Moscow. This has been facilitated by New Logic's local distributor, Ion Exchange Technologies (http://ioteh.ru/products/vibroosmos). New Logic will provide a fully automated LP VSEP pilot system that will be used by the University to study various water and wastewater projects.

Moscow Power Engineering Institute (MPEI) is a National Research University and is one of the largest institutions of its kind. It is one of the leading technical universities in the world in the area of power engineering, electronics and IT. It is located in Moscow, Russia, and was founded in 1930. University motto: Energia omnium fundamentum. Several Nobel Laureates teach at this University. At MPEI there are 12 institutes, 65 departments, 176 research laboratories, a pilot plant factory, a unique thermal power station, and the largest scientific and technical library in the country. Lecturers include 7 Academicians who are corresponding members of the Russian Academy of Sciences, 262 doctors of science, and 715 post-graduate doctoral candidates of science.

The MPEI trained over 200 thousand specialists in various fields of science and technology. The main directions of research activities: energy efficiency and energy saving, thermal and nuclear energy, electric power systems and networks, renewable sources of electric and thermal energy, ecology and energy safety. New Logic is very proud to be associated with this University and its research work. MPEI is often chosen by the Russian government and by industry to research and solve very difficult water treatment problems. The addition of VSEP to their pilot plant facilities will give the University a very power tool when it comes to solving these problems.

# VSEP Vibes Newsletter

**Contact New Logic**

New Logic has recently moved out if its Emeryville facility and now has a sales & engineering office in Concord California and a manufacturing headquarters facility in Minden Nevada. New Logic is expanding will be soon be relocating to a larger manufacturing facility in Nevada.


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