

# SUCCESS IN STEPPING OUTSIDE THE NORM

Do you ever find yourself doing the same thing over and over again because it is just the way "it has always been done?" Knowing there could be a better way to accomplish what you need to do, but the risk of trying something different and potentially failing seems so high? Yet, knowing a better way could be highly advantageous? This is the scenario a generating station Maintenance Manager found himself in when handling recurring maintenance issues with diaphragm pumps.

#### BACKGROUND

The Magnet Cove Generating Station of the Arkansas Electric Cooperative Corporation (AECC) was experiencing a high level of maintenance with their Neptune diaphragm metering pumps. These pumps were part of the plant's selective catalytic reduction (SCR) process. The power plant operator injects a solution of 29 % aqueous ammonia and 71 % water into the system to reduce nitrogen oxide (NOx) emissions. This process takes place in the heat recovery steam generator (HRSG) and is crucial to the operation of the plant. The hot gases being discharged into the atmosphere from the HRSG must meet government regulations with regards to NOx emissions for public safety. If the SCR process malfunctions, the entire system has to be shut down and no power can be generated.

#### **TASK AND TARGET**

The high level of maintenance required by the diaphragm pumps was not only costly, but a safety hazard to the maintenance crew. Whenever you are dealing with aqueous ammonia, you have to take precautions and there is a safety risk. The maintenance crew spend approximately 16 hours a month working on these pumps and around the aqueous ammonia solution.



Generating stations need regular inspections and maintenance.

#### **APPLICATION DETAILS**

• Transporting a 29 % aqueous ammonia water solution in the recovery steam generator

#### **KEY SPECIFICATIONS**

- Three metering pumps replacing high maintenance diaphragm pumps
- Process modification
- Varying media state: from liquid to gaseous
- Varying amount of pressure due to valves opening and closing in the piping

# HANDLING VARIOUS PRESSURES AND MEDIA STATES

#### COST SAVINGS LOWER TOTAL COST OF OWNERSHIP

**INCREASED SAFETY** 

### 100% REDUCTION IN MAINTENANCE

INCREASED ENERGY SAVINGS

### NO ADDITIONAL EQUIPMENT NEEDED

### INCREASED RELIABILITY

SEEPEX PRODUCTS Metering Pump MD Range: • 3x MD 05-6 LT Joey Vanmeter, Maintenance Supervisor at AECC, states, "We would have to rebuild each of the pumps once a year. This was a huge expense at \$1,500-\$2,000 in parts alone, plus the maintenance time. We were replacing the bladders three times a year at \$500 each as well. Operators and maintenance personnel were constantly in the pit having to make adjustments to the old diaphragm pumps. This was a huge safety risk."

#### SOLUTION

Caleb Carter, Sales Engineer, with Tencarva Machinery Company, a SEEPEX distributor, was responsible for calling on the Magnet Cove Generating Station. Caleb learned of the high maintenance level the diaphragm metering pumps were requiring and suggested Joey a closer look into a progressive cavity metering pump through SEEPEX.



The MD dosing pump effortlessly transports liquids and gases.

Joey was familiar with progressive cavity pumps working well in oil applications, but was hesitant to switch to a different product for such a critical process. Diaphragm metering pumps are the most commonly utilized pump for this application in the generating plant world. Switching to something different and going outside the "norm" would be a huge risk.

Joey also knew he would have to have a pump that could handle a range of suction pressures, specifically down to low levels. Within the SCR process, valves open and close on demand, varying the flow rate, and therefore varying the amount of pressure in the piping. Aqueous ammonia, with the chemical name "ammonium hydroxide", begins vaporizing at approximately 85°F. This change from a liquid state to a gaseous vapor also results in a change in pressure. These two factors, along with the installation being outside and varying high summer temperatures, mean that the net positive suction head available (NPSHa) can dramatically decrease. A pump with a low net positive suction head requirement (NPSHr) is needed to keep the operation running smoothly throughout all levels of NPSHa.

## **VARYING AGGREGATE STATES**



Ammonia vapor pressure graphic chart.

NPSH is the difference between suction pressure and vapor pressure. The net positive suction head available (NPSHa) and the net positive suction head required (NPSHr) are critical to understand whether the system is designed correctly and the pump selected is the correct type for the system. NPSHa refers to how much pressure the system has available for the pump to use and NPSHr is the minimum amount of pressure with which the pump can operate without cavitation. NPSHa must always be greater than NPSHr.

SEEPEX progressive cavity pumps have a low NPSHr and therefore represent a solution for this type of application. The unique design of the interference fit between the rotor and stator allows for the low NPSHr. A pump with a high NPSHr and not enough NPSHa would cavitate and ultimately fail.

Joey continued his research and spoke with a manager at a water treatment facility in Florida utilizing SEEPEX metering pumps on a solution of bleach and 19% aqueous ammonia. The reference spoke highly of the SEEPEX pumps – how well they worked, the low maintenance, and the fact they do not run dry. He could not say enough good things about them.

After hearing an end user's positive feedback, Joey decided to move forward with the purchase of a SEEPEX MD 05-6LT metering pump to utilize as a trial. The pump was installed temporarily to ensure it would work before taking out the old Neptune diaphragm pumps. This was a big change in the thought process for this application and had some inherent risk. If the SEEPEX metering pump had failed on this critical application, Joey would need the redundancy of the installed Neptune diaphragm pumps to insure he would be able to get the system up and running.

# **ALLROUND GAIN**

#### RESULT

The SEEPEX metering pump had no problems during the trial installation and was later installed permanently along with two more that replaced the three previously utilized Neptune diaphragm metering pumps. Since installation, Joey has had nothing but praises for SEEPEX.

The SEEPEX metering pumps have been installed since April/May of 2019 and have required no maintenance. This has made Joey quite happy with a 100% reduction in maintenance and an elimination of a large safety risk for his crew.

The energy savings have also been welcomed. The SCR system that controls the NOx emissions now runs on one SEEPEX metering pump instead of three Neptune diaphragm pumps.

Overall, Joey is glad they stepped outside the "norm" for their industry and went with a SEEPEX metering pump. Joey commented: "The reliability has been great. The upfront costs and maintenance costs are lower, they work, no pulsation dampeners are required, we are saving energy, and the safety benefits are all positives. We had to change our mindset, but it was an allround gain."