



## Providing Successful Pretreatment of Challenging Feed Water at Egypt's First ZLD Plant



### THE CHALLENGE

As Egypt instituted new environmental regulations prohibiting wastewater discharge, the Egyptian Ethylene and Derivatives Company (ETHYDCO), the largest polyethylene (PE) production facility in Egypt, was determined to implement Zero Liquid Discharge (ZLD). The initial design phase review estimated that the finished plant would consume a staggering 2,600 cubic meters per hour ( $\text{m}^3/\text{hr}$ ) and needed to optimize the water consumption through conservation and recycling, reducing it by nearly 70 percent at 700  $\text{m}^3/\text{hr}$ . Thus, to maximize the lifecycle of incoming water from The River Nile and preserve freshwater resources, ETHYDCO worked with Engineering for the Petroleum & Process Industries to provide Egypt's first ZLD water treatment facility designed to recycle wastewater, allowing it to be continuously used in the production line. The plant, which was installed at ETHYDCO's site in Alexandria, needed to identify a reliable filtration system capable of successfully handling inconsistent water quality with high TSS peaks in order to allow the treated water to achieve ZLD. The pretreatment is required before the ZLD as high efficiency reverse osmosis (HERO) systems call for highly filtered water, free of solids and with very low turbidity.

### THE SOLUTION

Pall Water was the pretreatment step to the ZLD system delivered through its Aria™ FLEX membrane filtration system. The Pall system's ability to treat the challenging feed water, which is a composite mix of treated effluent and water from The River Nile, was a driving factor in its selection. The quality of the feed water varies throughout the year resulting in seven different cases for the feed water based on varying total suspended solids (TSS), feed turbidity and other feed water characteristics. Pall's ability to design the filtration system with special controls to allow operation at different feed scenarios was a differentiator, as Pall was able to provide a complete, smart solution.

“I first conceptualized this plant in 2004 and worked with the Pall Water team to turn this concept into a process solution. ENPPI and ETHYDCO worked together to engage Aquatech, a Pennsylvania based company, to deliver the ZLD solution. The Pall Water team was incredibly accessible and professional during the production process. We are extremely pleased with the strength and reliability of the filtration system, which has helped us meet environmental regulations and gain global recognition.”

**Hossam El-Fahmy**  
**Engineer and General Manager for**  
**Utilities & Offsite**

The Pall Aria FLEX solution is based on six trains with a total filtration area of 22,800 m<sup>2</sup>. Hydraulically, the system is capable of flow of more than 1,500 m<sup>3</sup>/hr, but to accommodate the various scenarios, it is designed to operate between a range of 900-1,090 cubic meters per hour (m<sup>3</sup>/hr) of filtered water to meet the ZLD plant's massive capacity.

## THE RESULT

Following production, Pall's Aria FLEX system treats all of the ETHYDCO facility's collected wastewater, purifying the water to a high enough quality allowing it to be used again in the polyethylene production process. Despite the inconsistent water chemistry and difficulties associated with the feed water, the strength of Pall's fibers were capable of running constantly at high recovery levels – ranging from 91-93 percent – at 100 percent production. Well-suited for the challenges of the feed water, the reliability of Pall's membrane system has proven crucial for operating at full capacity despite spikes in TSS, which at times can reach 177 parts per million, and varying feed conditions.

With Pall's pretreatment system and the complete ZLD plant operational, ETHYDCO was able to meet all of the requisite norms of ZLD established by the Egyptian government to minimize water consumption and protect the country's only life-giving aquifer, The River Nile. With the successful completion of this project, ETHYDCO became the pioneer in ZLD and the model for all industries in Egypt and across other Gulf Cooperation Council countries. It is also the first ethylene plant globally to achieve this. This achievement has made ETHYDCO 100 percent environmentally friendly with no liquid waste released into the environment. As a result, ETHYDCO was a recipient of the 2016 Global Water Awards.



**aria**<sup>flex</sup>

The Pall system is capable of running at full capacity despite varying feed conditions to provide successful pretreatment at Egypt's first ZLD plant. Overall, the Aria FLEX operation was able to meet the following requirements:

- Successfully achieve ZLD and meet environmental discharge regulations
- Robust system capable of handling varying feed conditions
- Allows water to be recycled and reused in the polyethylene production process



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