S2.3.4 REVERSE OSMOSIS AND NANOFILTRATION AS INTERMEDIATES TO ZERO-LIQUID DISCHARGE IN INDUSTRIAL WASTEWATER APPLICATIONS

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Zero-liquid discharge (ZLD) can be a necessary but costly approach for handling complex industrial wastewaters. In this presentation, we show how many of these challenging waters can benefit from minimal liquid discharge (MLD) using reverse osmosis and/or nanofiltration to enable water reuse and minimize discharge or evaporation waste streams. Design criteria and case studies in several different applications will be reviewed, including coal to chemical, textiles and a particular focus on flue gas desulfurization (FGD) in the power industry. The high COD, hardness and dissolved solids in many of these waters can present operational challenges associated with fouling, scaling and osmotic pressure that can be mitigated through optimized treatment and membrane selection. Pre-treatment with precipitation softening and even ion exchange resin polishing may be needed to eliminate hardness, allowing the RO trains to maximize recovery. Nanofiltration membranes are also discussed, which can be applied in ZLD projects in industries such as textiles and coal to chemical to separate and recover valuable salts from the wastewater concentrate. In the power industry, ZLD of FGD wastewater is emerging as an attractive strategy to meet environmental discharge regulations. We will present two examples of facilities in China using membranes to pre-concentrate their FGD wastewater ahead of final ZLD steps. One of these facilities has been operational since 2014 and has consistently been able to achieve stable operation with 70-75% recovery of FGD WW for industrial reuse.