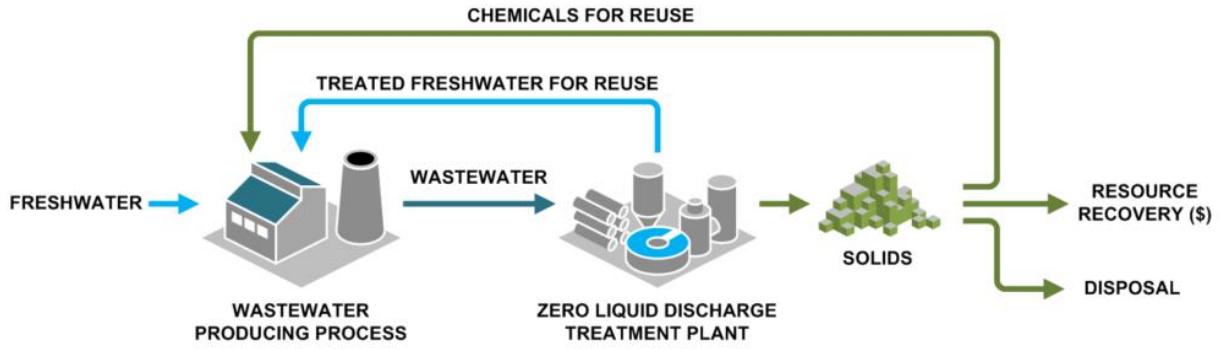
What is Zero Liquid Discharge & Why is it Important?

Zero liquid discharge (ZLD) is an engineering approach to water treatment where all water is recovered and contaminants are reduced to solid waste. While many water treatment processes attempt to maximize recovery of freshwater and minimize waste, ZLD is the most demanding target since the cost and challenges of recovery increase as the wastewater gets more concentrated. Salinity, scaling compounds, and organics all increase in concentration, which adds costs associated with managing these increases. ZLD is achieved by stringing together water treatment technology that can treat wastewater as the contaminants are concentrated.



There are a number of benefits to targeting zero liquid discharge for an industrial process or facility:

- Lowered waste volumes decrease the cost associated with waste management.
- Recycle water on site, lowering water acquisition costs and risk. Recycling on-site can also result in less treatment needs, versus treating to meet stringent environmental discharge standards.
- Reduce trucks associated with off-site waste water disposal, and their associated greenhouse gas impact and community road incident risk.

- Improved environmental performance, and regulatory risk profile for future permitting.
- Some processes may recover valuable resources, for example ammonium sulfate fertilizer or sodium chloride salt for ice melting.

Several methods of waste management are classified as zero liquid discharge, despite using different boundaries to define the point where discharge occurs. Usually, a facility or site property line that houses the industrial process is considered the border or 'boundary condition' where wastewater must be treated, recycled, and converted to solids for disposal to achieve zero liquid discharge.

Certain facilities send their liquid waste off-site for treatment, deep well disposal, or incineration and they consider this to qualify as zero liquid discharge. This approach to zero liquid discharge eliminates continuous discharge of liquids to surface waters or sewers, but can significantly increase cost.

Some engineers describe their designs as near-zero liquid discharge or minimal liquid discharge to highlight that they discharge low levels of wastewater, but do not eliminate liquid in their waste. For some facilities, it may be more economic to approach but not achieve complete ZLD by concentrating brine to lower volumes. Furthermore, it may be possible to avoid the creation of liquid waste on-site through careful water conservation or by treating contaminants at their source before they can enter the main flow of water.

[Download our ZLD infographic for detailed information on costs.]

Why is Zero Liquid Discharge Important?

In a world where freshwater is an increasingly valuable resource, industrial processes threaten its availability on two fronts, unless the water is treated. Many industrial processes require water, and then reduce the availability of water for the environment or other processes, or alternately contaminate and release water that damages the local environment.

Although the history of tighter regulations on wastewater discharge can be traced back to the US Government's Clean Water Act of 1972, India and China have been leading the drive for zero liquid discharge regulations in the last decade. Due to heavy contamination of numerous important rivers by industrial wastewater, both countries have created regulations that require zero liquid discharge. They identified that the best means to ensure safe water supplies for the future is to protect rivers and lakes from pollution. In Europe and North America, the drive towards zero liquid discharge has been pushed by high costs of wastewater disposal at inland facilities. These costs are driven both by regulations that limit disposal options and factors influencing the costs of disposal technologies. Tong and Elimelech suggested that, "as the severe consequences of water pollution are increasingly recognized and attract more public attention, stricter environmental regulations on wastewater discharge are expected, which will push more high-polluting industries toward ZLD."

Another important reason to consider zero liquid discharge is the potential for recovering resources that are present in wastewater. Some organizations target ZLD for their waste because they can sell the solids that are produced or reuse them as a part of their industrial process. For example, lithium has been found in USA oil field brines at almost the same level as South American salars. In another example, gypsum can be recovered from mine water and flue gas desalinization (FGD) wastewater, which can then be sold to use in drywall manufacturing.

Regardless of an organization's motivations to target zero liquid discharge, achieving it demonstrates good economics, corporate responsibility and environmental stewardship. By operating an in-house ZLD plant, disposal costs can be reduced,

more water is re-used, and fewer greenhouse gases are produced by off-site trucking, which minimizes impact on local ecosystems and the climate.

Considering Zero Liquid Discharge? We can help.

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