Leachate Pumping System Performance: Evaluation after Expanding Landfill Footprint and Use of Booster Pumps

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Evaluating the performance of any existing pumps along with new pumps when a lateral expansion is designed ensures optimal performance with minimal wear on the pumps.

Pumps on the primary and secondary risers at a disposal cell leachate structure

Regulatory and siting restrictions are such that many solid waste operators prefer to expand their existing landfill footprint as much as possible instead of finding a new disposal footprint at a different location. As landfills are getting larger in height and greater in footprint area, the location of leachate tanks, leachate ponds, or discharge points to an onsite or offsite leachate treatment plant usually does not change. A larger footprint means leachate force mains are getting longer forcing the existing pumps to work harder to push leachate through the system to a target point. Some operators carry on with the same pumps for decades and do not monitor the performance of the pumps after expanding the landfill footprint, which could be more costly in the long-term.

The longer leachate force main with possible additional bends in the line increases friction in the line and causes flow rates to reduce to unexpected levels. We recommended that landfill operators evaluate the performance of the existing pumps along with new pumps when designing a lateral expansion. Such an evaluation may require hydraulic analysis of the entire network of pipes along with pumps, or only the segment of the network affected by the expansion. However, the effort is minimal in comparison to the operating costs of inefficient flow and overtaxing the equipment.

Sometimes the results of a hydraulic evaluation may require upsizing all or specific pumps in leachate sumps because not enough flow can go through the force main due to high friction loss in the expanded leachate force main. Upsizing pumps may be achievable depending on the type of the leachate sump, i.e., riser system or vertical manholes. If the upsized pump in a riser system is too long to fit inside a riser system, or so long that it makes routine maintenance too cumbersome, your engineer may consider enhancing the functionality of the design.

A junction of leachate force mains coming together from various operations

Booster pumps located along an expanded leachate force main can certainly be an option. Booster pumps can be the inline or offline type. Install the inline pumps on the actual force main and position the offline type on the side so that liquids go through bends and elbows to reach the pump, and again through bends and elbows to get back in the force main. In either case, the booster pump adds hydraulic energy to the flow inside the force main to push the liquids at a compensated pressure through the remainder of the force main and to the target point.

Operators need to be aware of the dynamic nature of the leachate piping network and the role of booster pumps in the dynamic environment. Changes to the flow in the force main may change following a landfill expansion when the new cells are coming online increasing leachate generation. Alternatively, after closing portions of the landfill slopes, leachate generation decreases over time. Sometimes booster pumps have to be upsized or downsized depending on the flow and pressure in the system.

The cost of replacing pumps, upsizing, or downsizing, is insignificant

Booster pumps on a network of leachate force mains before connection to an offsite discharge line

compared to the revenue that landfills generate. Proper adjustment of the pumping system keeps the entire network operating at the appropriate range of pressure, and velocity in the line, increasing the life of the pumping system. Less wear and tear on the system produces a reduction in maintenance costs along with less equipment downtime. Lower maintenance requirements may also reduce the number of personnel required to keep the system in operational condition. Landfills with a large pumping system employing a second technician because of the high maintenance of multiple pumps may find a single technician sufficient for the upkeep of the system. Proper sizing of pumps and operating the pumping system as designed within the evaluation parameters can significantly reduce the cost and frequency of pump maintenance.

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