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Overdosing, Underdosing, and How To Get Precise With Wastewater Treatment Chemicals

In almost all things, wastewater treatment operations need to strike a delicate balance. They are asked to maintain cutting-edge processes but to remain within budget. They are expected to deal with the effects of climate change but remain energy efficient. And when it comes to meeting effluent regulations, the right balance can be even harder to maintain.

To keep effluent within the bounds of their permits, wastewater treatment operations are focused on both biological and chemical means of treatment. When it comes to issues as prevalent as nutrient pollution — the presence of nitrogen and phosphorus in wastewater that can form toxic algae if released into source bodies — chemicals can be a treatment operator's greatest tool. So long as the tools are used correctly, that is.

Problems With Overdosing or Underdosing

The costs associated with underdosing are fairly self-evident. A failure to introduce enough chemicals to keep wastewater quality within regulatory limits can lead to exorbitant fines, operational mandates, and irrevocable hits to an operation's reputation.

But on the other hand, operations need to be just as cautious when it comes to using too many chemicals. The temptation to be safe rather than sorry, to overdose with the chemicals necessary to get wastewater effluent within permitted quality, is understood. But overdosing brings a breadth of problems that should make treatment operations think twice.

For instance, when a treatment operation increases its use of precipitant for phosphorus removal, it will create more sludge, consume alkalinity, and possibly affect the pH of the water. An increased mass of sludge means increased sludge treatment and disposal costs, along with an increase in the mass of solids in the recycle stream which steal capacity and raise costs of mainstream treatment. Changes to the pH of the water can affect biological treatment, impact sludge settleability, and increase compliance risk. Making one seemingly minor change to the treatment process to reduce phosphorus can have multiple downstream ripple effects.

And even if operations avoid a mistaken chemical reaction when overcompensating with chemicals, they are certainly throwing money away with every unnecessary addition. An estimate of a plant processing 100,000 cubic meters of wastewater per day put the total cost of chemicals at $21,000, about 6 percent of this plant's average continual costs. With shrinking budgets and rising energy and technology expenses, these operations can't afford that price to rise any higher, particularly when the use of excessive chemicals is meant to avoid violation fines in the first place.

The Tools For Balance

With equally problematic outcomes stemming from overdosing and underdosing of effluent with chemicals, wastewater treatment operations must ask themselves how to find the right balance to treat adequately and cost effectively. More and more are finding their solution at the cutting edge in measurement technology.

While over- or underdosing may have once stemmed from a misunderstanding of what constituents made up an operation's waste stream or what levels of chemicals were needed to correct it, advances in chemical meters and instrumentation should now eliminate that issue. Advanced chemical technologies, like laboratory meters with the ability to automatically recognize testing parameters and calibration history or instrumentation that can provide real-time data on waste streams to operators, are now available and should be put to use.

The key to proper chemical dosing seems to lie in accurate measurement, both of the exact, up-to-the-minute needs of a waste stream, as well as the precise amount of chemicals being added to it. Of course, it's also paramount that treatment staff have a complete understanding of how wastewater constituents will react once certain chemicals are introduced. But even the most knowledgeable operators have been known to make dosing errors, and giving them the best tools available will be the easiest way to avoid those pitfalls in the future.

Overdosing and Underdosing

Periodic lab analysis may not reflect the full range of variation that online monitoring provides. This can result in lowered plant efficiency and higher energy usage.