California Tackles Nitrogen from Onsite Wastewater Systems

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Approximately 25 percent of U.S. households use onsite wastewater systems to treat and disperse wastewater into the soil, representing ten percent of the wastewater flow generated in the United States. Onsite wastewater treatment systems include septic systems and a variety of small biomechanical treatment and disposal systems that discharge wastewater underground into soil. Thirty percent of new buildings are using onsite wastewater systems for their sanitary needs, suggesting a rise in their use. The pollutants from domestic wastewater that cause the greatest concern for human health and the environment include biochemical oxygen demand (BOD), total suspended solids (TSS), nitrate (NO_3^-) or total nitrogen (TN), and bacteria. Due to a lack of significant degradation in groundwater, nitrate limits are increasingly being imposed on onsite wastewater systems.

In California, onsite regulations are typically based on the decades-old Uniform Plumbing Code, which uses prescriptive measures as a surrogate for exact science to mitigate public health risks. Many of its regulations seem generally effective, such as those pertaining to separation to groundwater, setbacks to wells, and burial depth for leach fields and seepage pits. The code works especially well when lot sizes are large and onsite wastewater systems are spread apart; the vast majority of onsite wastewater systems continue to perform satisfactorily in protecting water quality and human health. However, development pressure in some areas has increased the amount of construction on smaller lots and in marginal soils, leading to increased incidents of onsite systems failures.

Focus on Onsite Systems

For many decades the big sanitation push was building sewers and centralized treatment systems across America. The lowly septic system was relegated to a technologically inferior caste. Health and water resources agencies anticipated hooking up unsewered areas as soon as feasible, but the cost benefits of sewering the whole country never materialized. Toward the end of the last century, the percentage of households without sewers stabilized. Yet emerging water quality problems suggested that septic systems were not always doing the job they were intended to do, particularly with regard to bacteria and nitrate. In a sweeping and supportive policy shift, "onsite wastewater systems" were suddenly the focus of federal initiatives. Led by the U.S. Environmental Protection Agency, a surge of innovative solutions offered improved physical performance and regulations with the aim of better protecting water quality and human health.

In most states, EPA simply transferred regulation down to state-level public health departments. Virtually every state has onsite wastewater regulations that streamline implementation at the local level. But in California the task was not so easy. With 58 counties in nine major watersheds, California is one of only two states (besides Michigan) lacking statewide regulations. Every California county and even a few cities have their own coveted version of onsite wastewater regulations. Nine regional water quality control boards oversee the watersheds, applying regulations that also vary. For large counties, this means that as many as three regional boards impose and enforce diverse regulations on a county. For designers of onsite systems, the experience of tracking differences in regulations has seemed unscientific and counterproductive.

Concurrent with federal policy changes were market-driven changes, with entrepreneurs commercializing small biomechanical treatment systems suitable to the scale of onsite wastewater needs. These systems initially addressed BOD and TSS, the same water-quality parameters that the Clean Water Act requires large municipal wastewater systems to treat. As the ability to treat BOD and TSS was being proved at the onsite scale, regulatory demand for treating nitrate and bacteria arose as well. Small advanced treatment units were soon addressing nitrate effluent limits of 25 milligrams per liter (mg/l) nitrate-N with relative ease. Then regulators recognized the capacity of ammonia, nitrate, nitrite, and sometimes

Photo: Barbara Bradley

An onsite wastewater treatment system for a restaurant in Malibu, California; underground treatment tanks are in the foreground and secondary treatment units are on the right. A portion of the treated wastewater goes to subsurface drip irrigation in a green belt.

organic nitrogen to convert from one to the other under certain conditions, and removal of TN, not just nitrate, became required. Lacking a regulation specifically calling out limits for dispersing nitrogen-containing wastewater into the subsurface, regulators in California looked to the safe drinking water standard of 45 mg/l nitrate as their guide for limiting larger (commercial) onsite systems. Applying drinking water standards to wastewater effluent seems questionable, but the absence of a more relevant standard triggered the fallback to a legally enforceable and precautionary standard. Gradually this morphed into a limit of 10 mg/l TN.

New Law Forces State Regulations

In 2000, the nonprofit environmental group Baykeeper sought to reduce the impacts of septic systems on coastal water quality and successfully lobbied for legislation requiring California to adopt statewide onsite wastewater regulations. California's State Water Resources Control Board (SWRCB) was assigned the task of converting the two-page law, AB 885, into useful regulations. The first challenge was to quantify the exact risk and pollutant levels that arise from onsite wastewater systems. No statistically significant study had linked statewide groundwater quality impairment to onsite wastewater systems, calling into question the perception of onsite systems as an inadequate sanitation method.

The draft regulations set the total nitrogen effluent limit at 10 mg/l, a limit that is challenging to achieve, but becoming feasible through new technologies.

When SWRCB collected data from residential wells in rural areas and found bacteria and nitrate present, it also found resistance from local agencies in accepting these results or the draft regulations that would change their codes. Territorialism and professional differences between the state and local agencies produced schisms that ultimately blocked the revision of many prescriptive measures such as setbacks. Today dozens of different versions of prescriptive measures remain in effect statewide.

However, some of the draft regulations are technologically progressive. Under specific conditions, AB 885 requires biomechanical treatment systems to treat BOD, TSS, and sometimes TN and bacteria, prior to dispersal into the subsurface. The draft regulations set the TN effluent limit at 10 mg/l, a limit that is challenging to achieve, but becoming feasible through new technologies.

Eight Years and Counting

Prior to and during the eight years of rulemaking, several local agencies unilaterally modernized their regulations, allowing and sometimes requiring advanced treatment technologies to protect groundwater. However, many others balk at requiring or even allowing treatment systems that are more sophisticated than septic systems. Some steadfastly maintain that onsite systems are not a source of groundwater pollution. With so few studies available to support or refute that claim, controversy rages, stalling final approval of AB 885.

After eight years, California still struggles to finalize regulations incorporating changes befitting the modern technological era. To succeed, schisms must be bridged through continued dialog, compromise, and the willingness to transform institutions, much as science has transformed the technical capacity of onsite wastewater systems to protect groundwater from nitrate.

As these transformations become instituted, even greater opportunities may arise. Wastewater professionals at the municipal level will also be challenged to reconsider entrenched technical and territorial biases. With technology and regulations in place at this smallest scale of wastewater treatment, opportunities for multiscale wastewater treatment and reuse infrastructure will likely emerge. Driven by water shortages and the general need for affordable infrastructure to sustain communities, new onsite wastewater treatment technologies offer an opportunity to safely use water more than once—even at the household level. Through regulatory changes that match the pace of technological advancements, even greater roles await the once-lowly onsite wastewater system. ■

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