

RESOURCE NOTES

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Dealing With Holding Tank Wastes at BLM Sites

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Background

As recreational use of the lands managed by BLM increases and as regulatory agencies give increased scrutiny to smaller domestic water and wastewater systems, more attention must be given to this infrastructure at our sites. Minor aspects of this infrastructure that can have significant adverse impacts on the resources BLM is charged with managing are the facilities that receive, treat, and dispose of holding tank wastes from recreational vehicles and boats. While these facilities are typically valued by the public that uses them, they are often expensive to properly construct, operate, and maintain. Improper operation, however, can lead to pollution of ground and/or surface waters. Moreover, pollution can occur unnoticed for extended periods when waste facilities fail.

BLM administers two very unique recreation sites near Yuma, Arizona, designated as Long-Term Visitor Areas (LTVA) by Congress. Essentially, the sites are large tracts of land near the Colorado River where a recreation vehicle (RV) can remain as long as 7 months continuously for a modest monthly fee (approximately \$100). No utility services are available, but BLM provides potable water available from storage tanks and waste holding tanks.

One of the "dump stations" serving the South Mesa LTVA, on the California side of the Colorado River, was cited by the California Regional Water Quality Control Board for noncompliance due to high levels of nitrogen and total dissolved solids being discharged into the underground disposal drainfield. BLM personnel subsequently performed

laboratory analyses on the waste received at the dump station and conducted some research on the chemicals used in these holding tanks.

The Nature of the Problem

Most wastewater treatment facilities, including septic tanks and lagoon systems for small developments, employ biological processes to stabilize and remove pollutants from wastewater streams. These biological processes perform best when they approach steady-state conditions which include constant waste stream temperature, flow rate, and composition. In reality, each of these variables tend to fluctuate seasonally and weekly as a result of typical recreation use patterns.

Holding tanks on boats and RVs are used to keep all sanitary wastes onboard when a sewer system is unavailable. Since little or no carriage water is used, as is in typical domestic sanitary waste streams, holding tank wastewater is far more concentrated than typical domestic wastewater. Compounding the problem at South Mesa, additives are introduced into these tanks, primarily to control odors. There are a wide variety of such additives used, the most common of which are formaldehyde-based compounds (including the popular Aqua-Kem®). Other types include those based on quaternary ammonium compounds ("quats," which often impart a pine scent) and enzyme formulations. In general, while these additives work well to control odors aboard the boat or RV, they complicate the treatment and disposal of the resulting mixture.

Generally, treatment facilities are designed on the basis of two primary parameters: hydraulic capacity (gallons per day) and organic strength (biochemical oxygen demand, or BOD) of the waste stream. Usually it is much easier to predict the hydraulic capacity needed for a treatment facility than the organic strength of the wastewater that it will receive. Highly concentrated holding tank wastes, containing variable amounts and types of chemical additives, make proper design of treatment facilities difficult. Further, the typical mode of introducing wastes into

the receiving station - dumping - is not conducive to the steady-state flow needed for optimal biological treatment.

Chemical Variables

Formaldehyde is a relatively simple organic compound, and is biodegradable, breaking down into water and carbon dioxide in one step. It does not control odors by killing the microorganisms that generate them, as is popularly believed. Instead, it reacts chemically with odor-causing compounds to render them less odorous. However, the organic strength of most formaldehyde-based deodorizers is so high that the resulting mixture in a holding tank is fifteen to twenty times stronger than typical domestic wastewater, even after several days residence in the tank. Chemical toilet wastes, which use higher concentrations of chemical deodorizers, can be over one hundred times as strong. Biodegradability is desirable but is not necessarily an indication of ease of or acceptability for treatment. Formaldehyde is likely to be more closely regulated in the future, particularly when part of a wastewater disposal system.

Quats are not biodegradable and deodorize by killing the microorganisms in the holding tank. Studies have shown that even in very low concentrations, quats can adversely affect wastewater treatment processes. Fortunately, these compounds are far less popular than formaldehyde-based chemicals due to their higher cost and reduced effectiveness.

Enzyme-based products employ natural organic chemicals. They are far less popular for use in holding tanks due to less reliability, effectiveness for odor control, and higher cost. However, these compounds are biodegradable and somewhat lower in organic strength than formaldehyde compounds.

Failure of Traditional Solutions

The problem at South Mesa is not unique. Additional RV dump stations at BLM recreation sites have been closed due to failure, while other closures

HAZARDOUS
MATERIALS



are being considered. In addition, the expense of keeping up with "haul away" dump station systems is prohibitive. The bottom line is that waste discharged from holding tanks requires even more treatment than the equivalent waste stream from a permanent home, due to the chemicals added. The treatment facility needed to serve 1,000+ RVs is even more elaborate than one needed to serve 1,000 houses.

Technical literature¹ in wastewater treatment usually recommends that concentrated wastes such as septage pumped from vault or chemical toilets, or holding tank wastes, be slowly metered into the treatment facility so as not to upset the biological processes used. The dearth of practical recommendations for on-site treatment and disposal of such wastes (as opposed to hauling to a municipal treatment facility) may be due to a lack of truly successful installations. Some literature indicates the practical limitations of treatment facilities in terms of the maximum concentrations of formaldehyde or BOD that can be withstood by the specific treatment processes, but these values vary.

The recorded system failures are most often due to the shock imparted on the biological processes by intermittent, rapid introduction of these high strength wastes. Treatment facility designs often have not recognized the magnitude of organic strength and are undersized as a result. Undersized septic tank failures are generally manifested as solids carryover into the underground disposal systems which, in turn, fail by clogging and sending effluent to the ground surface or "backing up." Lagoon system failures are characterized by poor effluent quality, noxious odors, and excessive sludge. Accumulations of sludge can be toxic.

Preventing Failures

The key to preventing failures of waste treatment and disposal facilities that receive holding tank wastes is recognition of the characteristics of these wastes by the designer of the facilities. The controlling design criteria will nearly always be those related to organic loading as opposed to hydraulics. General practical rules of thumb for

receiving, treating, and disposing of wastes from holding tanks, chemical toilets, and vault toilets are:

- Employ whatever means are available to blend holding tank contents with other waste streams to reduce the organic strength of these concentrated wastes prior to treatment. In small developments, this often means providing a mixing or dilution tank upstream from a septic tank in which domestic wastewater from plumbed restrooms or other facilities is mixed with holding tank wastes.
- Size treatment facilities adequately. Generally, required septic tank volumes are significantly more than indicated by the typical hydraulic capacity designs used for treating domestic wastewater. Requirements can be 2 to 15 times the volume resulting from traditional methods. Underground disposal fields also need to be roughly twice as big as those sized for an equivalent flow of domestic wastewater, due to the higher strength of the resulting effluent.
- Monitor septic tank scum and sludge accumulations frequently and pump the tank out whenever the "clear zone" diminishes to roughly 30 percent of the total liquid depth.
- Size lagoons such that surface loading rates do not exceed values that are recommended (by regulators or sanitary engineers) in the specific locale of the facility. Try to maintain liquid depth between 3 and 5 feet.
- Take advantage of opportunities to educate RV and boat users about the chemicals that they use in their holding tanks, including how to avoid using excessive amounts (and unnecessary expense), and how they affect things downstream.

Design, construction, operation, and maintenance costs for wastewater treatment are quite significant. Recognizing the impact of recreational holding tank wastes on the facilities needed for this function is very important in making the appropriate related decisions. Scott DeBock and I have

designed new non-discharging treatment facilities for the South Mesa site. A construction contract is imminent.

For Further Reading

Formaldehyde and Other Aldehydes, National Academy Press, Washington, DC, 1981.

Treatability of Recreational Vehicle Wastewater at Highway Rest Areas, Charles A. Brown, Thesis for the University of Washington, 1982

The Effect of Boat Holding Tank Chemicals on Treatment Plant Performance, John T. Novak, C. Russel McDaniel, and Samuel C. Howard, Journal of the Water Pollution Control Federation, Volume 62, Number 3, May/June 1990, pp. 288-295.

Toxicity of Additives Used to Control Odors in Recreational Vehicle Wastewater, Ervin Hindlin, Washington State Transportation Center, March 1994.

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¹The most thorough discussion of all aspects of holding tank and chemical toilet wastes is a 1984 manual published by EPA entitled *Septage Treatment and Disposal*.