What every operator needs to know about septage

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Knowledge	Principles	Practical considerations
Types of septic tank waste	Effluent, scum, and sludge are the main components of septic tank waste.	Effluent is partially treated, anaerobic wastewater. Scum is fats, oils, and grease or any floating-solid waste. Sludge is anaerobically digesting solids.
Regulatory requirements	Water resource recovery facilities (WRRFs) can accept septage from domestic sources but should not take grease-trap waste or industrial septage.	Domestic septage is regulated under the *Code of Federal Regulations* at 40 *CFR* Part 503. Domestic septage includes the liquid or solid material removed from a septic tank, cesspool, portable toilet, or similar system that only receives domestic septage. It does not include grease-trap waste, shop-pit wastes, car-wash pit wastes, or dry-cleaning waste residues. If these wastes are mixed with domestic septage, then the entire batch of septage becomes nondomestic septage and is no longer covered under the 503 regulations. Nondomestic septage is regulated under 40 *CFR* Part 257.
Characteristics of septic tank waste	Septage is much higher strength than typical domestic wastewater. (× times regular wastewater) Septage also may contain higher concentrations of heavy metals, toxic organics, trash, rocks, and debris.	

	Domestic wastewater mg/L	Domestic septage strength		
		Average	Minimum	Maximum
BOD_5	220	26 ×	2 ×	314 ×
TSS	220	51 ×	1.4 ×	374 ×
TKN	40	15 ×	1.7 ×	26.5 ×
NH_4	25	3.2 ×	0.1 ×	3.9 ×
TP	8	21 ×	2 ×	76 ×
Grease	100	56 ×	2 ×	234 ×

Data taken from Table 2.2 in *Septage Handling (WEF Manual of Practice, No. 24)*.

Knowledge	Principles	Practical considerations
Population equivalents for septage (Metcalf and Eddy, 2014)	Typical per-capita generation rates for: Hydraulic – 100 gallons per capita day (gpcd) Organic – 0.20 pounds of biochemical oxygen demand (BOD) per person per day (ppcd) Solids – 0.19 pounds of total suspended solids (TSS) per person per day	Typical per capita generation rates for flow, BOD, TSS, and ammonia can be used to estimate the number of population equivalents (people) that a load of septage is equal to. This will require laboratory sampling of some or all septage loads received. The basic steps to calculating population equivalents are as follows. ■ Sample and analyze the septage for one or more analytes. Estimate if lab data are not available. ■ Use the lab results in mg/L and the volume of septage delivered in million gallons per day (mgd) to calculate the number of pounds received. ■ Pounds = (mg/L)(mgd)(8.34 lb/gal). ■ Finally, divide total pounds received by the per-capita generation rate. What is the new load (in population equivalents) coming in on a septage truck? (The calculations above are based on average domestic septage strength and use the multiplier factors from the table above.) Hydraulically, a 2000-gallon truck would be equivalent to 20 people. 2000 gal ÷ 100 gpc ≈ 20 people Organically, a 2000-gallon truck would be equivalent to 540 people. 0.002 mg × 8.34 lb/gal × 250 mg/L × 26 ≈ 108 lb BOD_5 108 lb ÷ 0.2 ppcd ≈ 540 people With regard to solids, a 2000-gallon truck would be equivalent to 1063 people. 0.002 mg × 8.34 lb/gal × 250 mg/L × 51 ≈ 213 lb TSS 213 lb ÷ 0.19 ppcd ≈ 1121 people
Equitable disposal fees	Tipping fees for septage haulers should reflect the true cost of treatment. Compare monthly sewer bills for a single-family home to the population equivalent being brought in by the septage hauler. Septage can be a source of revenue, but only if treatment costs are accounted for fully. Accepting septage takes up available treatment capacity. Additional fees to account for tap fees or facility investment fees also may need to be assessed.	Calculating tipping fees requires accounting for all costs incurred during treatment and translating that to a "regular" customer. This example uses a home with four people and an average monthly sewer bill of $50. Assume the same costs for pumping, aeration, and solids: 1/3 hydraulics + 1/3 organic load + 1/3 solids. Calculate the ratio of the population equivalents for the septage as assessed above to the number of persons in your typical household. ■ 1/3 hydraulics ≈ 1/3 (20 ÷ 4) × $50 ≈ $83 per month ($3 day) ■ 1/3 organic load ≈ 1/3 (540 ÷ 4) × $50 ≈ $2250 per month ($75 day) ■ 1/3 solids ≈ 1/3 (1063 ÷ 4) × $50 ≈ $4429 month ($148 day) So, an equitable charge equivalent to other monthly ratepayers would be $196 for a single septic truck containing 2000 gallons of average-strength domestic septage.

Knowledge	Principles	Practical considerations
Septage disposal options	WRRFs	Facilities that accept septage do so at either the headworks or an upstream manhole. Some facilities provide a receiving and equalization station that allows septage to be added at a relatively constant and controlled rate.
	Septage treatment facilities	These facilities are constructed solely for treating septage and generate a higher volume of solids than a typical WRRF.
	Land application	Land application of septage – the most common means of septage disposal in the U.S. – likely is the most economical alternative.
Adding septage at WRRFs	Septage may be received at an upstream manhole, the facility headworks, or the solids handling process.	Accepting septage at an upstream manhole makes for a simple and economical receiving station. Other pros include allowing the septage to be diluted before reaching the WRRF. Cons include increased odor potential near the manhole, increased opportunities for sewer blockages, increased line-cleaning needs downstream of the addition point, potential for hydrogen sulfide corrosion of the collection system at the addition point and immediately downstream, difficulty regulating and controlling access, and effects on traffic patterns and businesses. Accepting septage at the headworks gives the facility control of septage discharge into treatment processes as well as the opportunity for flow equalization and sampling prior to addition. Cons to this approach include increased odor potential at the facility (but greater potential for odor control) and additional staff time to manage facility access. Accepting septage into the solids handling process can be expensive due to receiving station requirements, but it reduces loadings on liquid processes and lessens the chance of a biological process upset. However, septage may affect the dewatering of processed solids.
Record keeping	The facility should maintain a manifest of every septage load.	Manifests should include these sections: ■ wastewater characterization section (*i.e.*, amount of septage, type of waste – municipal, commercial, industrial – and location pumped from) ■ generator's section (*i.e.*, generator's name and contact information and certification statement including type, source, and volume) ■ hauler's section (*i.e.*, name and contact information, permit number and vehicle license number, pump-out date, and signed certification by hauler) ■ disposer/receiver's section (*i.e.*, septage receipt date, sample ID number [if applicable], and signature)
Sampling	Samples should be collected to determine septage strength. This is important for operational control and billing. When sampling for monthly National Pollutant Discharge Elimination System permit compliance, influent samples to the WRRF should be representative of the total load and flow received. This includes septage.	Minimum random grabs recommended include pH, conductivity, visual inspection, chemical oxygen demand (fast results), and organics and metals (if suspected or warranted).

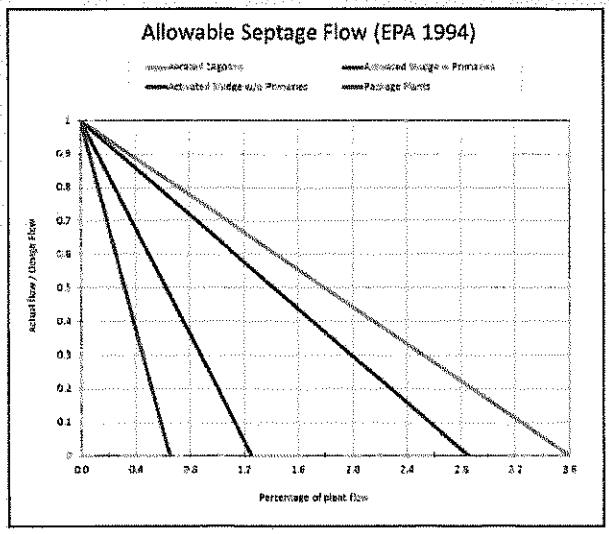
Further Reading:

Septage Handling Manual of Practice No. 24, (1997) Water Environment Federation.

Guide to Septage Treatment and Disposal (EPA 625R94002), September 1994 (available as a free PDF download from nepis.epa.gov).

Onsite Wastewater Treatment Systems Manual, EPA/625/R-00/008, February 2002 (available as a free PDF download from nepis.epa.gov).

Additional Reference: Per capita generation rates taken from *Wastewater Engineering: Treatment and Resource Recovery*, 5th edition, by Metcalf and Eddy (2014) Table 3-13.

Knowledge	Principles	Practical considerations
Operational effects to WRRFs	Hydraulic surge at smaller facilities	A single septic truck may hold up to 19,000 L (5000 gal) of septage. Trucks can discharge their contents in less than 30 minutes. If septage is not flow-equalized, the instantaneous flow rate may be as high as 630 L/min (167 gal/min) or 0.24 mgd. At a smaller facility, this hydraulic surge can disrupt biological treatment and push solids from the secondary clarifier into the final effluent.
	Increased organic and solids loadings	Sudden increases in organic and nutrient loads have potential to pass through the WRRF partially treated or untreated. Excessive organic and nitrogen loading also can depress the dissolved oxygen concentration in the aeration basin if blower capacity is inadequate for the load.
	Damage to downstream equipment	Septage often contains large debris such as rocks, rags, bits of metal, and other items that can damage downstream equipment. Prescreening septage before introducing it to the WRRF is recommended.
	Potential foaming and/or toxicity in aeration basins	Septage contains volatile fatty acids (VFAs) and hydrogen sulfide and may contain heavy metals and organics that may harm biological treatment processes and/or affect biosolids disposal options. VFAs and hydrogen sulfide can encourage the growth of certain types of filamentous bacteria in the activated sludge process. Concentrations of dissolved hydrogen sulfide as low as 1 mg/L have been shown to inhibit nitrification.
Maintenance effects at WRRFs	Additional operation and maintenance (O&M)	Accepting septage means increases in several areas of O&M such as ■ staff time to manage receiving site access, sample collection, manifesting, and record keeping; ■ screenings and grit disposal; ■ odors in headworks; ■ scum in clarifiers; and ■ solids handling and disposal.
Recommended maximum volumes for septage receiving	The amount of septage a facility can accept without upsetting treatment depends on the type of processes used and the strength of the septage. The U.S. Environmental Protection Agency developed a graph as part of its 1994 *Guide to Septage Treatment and Disposal* (625R94002) that enables operators to estimate the quantities of septage that might be received.	For example, a 568,000-L/d (150,000-gal/d) aerated-lagoon system that is operating at 75,000 gal/d (284,000 L) has an actual-to-design flow ratio of 0.5. Reading from the Y-axis on the chart to the green line representing aerated lagoons and then down to the X-axis shows a 1.8% acceptable percentage of septage flow. In this case, it translates to about 10,000 L (2700 gal/d) – that is, design flow times the acceptable percentage, or 150,000 × 1.8%. 

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