

Influent Constituent Characteristics of the Modern Waste Stream from Single Sources: Literature Review

Proper onsite wastewater system (OWS) design, installation, operation, and management are essential to ensure protection of water quality and the public. Ideally, an OWS should perform reliably and achieve the desired risk management goals over a design life that can be 10-20 years or more. Conventional OWS rely on septic tanks for the primary digestion of raw wastewater followed by discharge of primary treated effluent (i.e., septic tank effluent) to the subsurface soils for eventual recharge to underlying groundwater.

In the past 35 years or so, there has been increased application of alternative OWS that rely on additional treatment of the primary treated effluent prior to discharge to the environment in sensitive areas or eliminate use of a septic tank altogether. Waste streams treated by OWS have also changed in recent years due to changing lifestyles including increased use of personal care and home cleaning products, more use of pharmaceutically active compounds (e.g., antibiotics), and less water use because of water conservation efforts. In each case, understanding the raw wastewater composition based on the type of single source is critical for successful OWS design, informed management decisions, and assessment of OWS performance and environmental impacts. This report provides a base of information on the composition of waste streams from single-source OWS.

The research team focused on a literature review to characterize the extent of conventional constituents, microbial constituents, and organic wastewater contaminants in single-source OWS raw wastewater and primary treated effluent. They used cumulative frequency distributions to compare individual constituent concentrations in various specific waste streams. There was limited information for OWS raw wastewater relative to primary treated effluent values. In addition, domestic sources are generally well characterized compared to the diverse variety of other (non-single-family residential) sources. To provide additional insight into the reported data values, the team used data qualifiers to investigate individual parameters that may affect either the expected median value or the variability within a reported data range. They identified five key conditions: methods, frequency and duration, date of study, geography, and literature source.

The team found an apparent regional difference in waste stream composition, with the largest difference between the Midwest and West. The most notable changes in constituent concentrations over the last 30 years were for total nitrogen and total phosphorus.

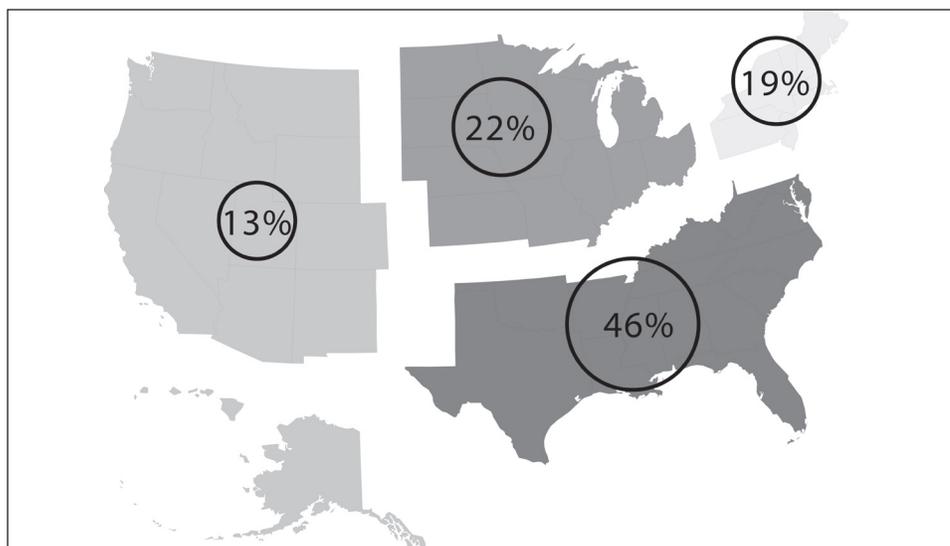


Figure 1. Percentage of All OWS in the U.S. by Region (AHS, 2001).

BENEFITS:

- Provides information on raw wastewater and primary treated effluent composition for single sources.
- Presents cumulative frequency distributions to assess wastewater constituent concentrations and mass loadings.
- Describes onsite wastewater system types and utilization in the U.S.

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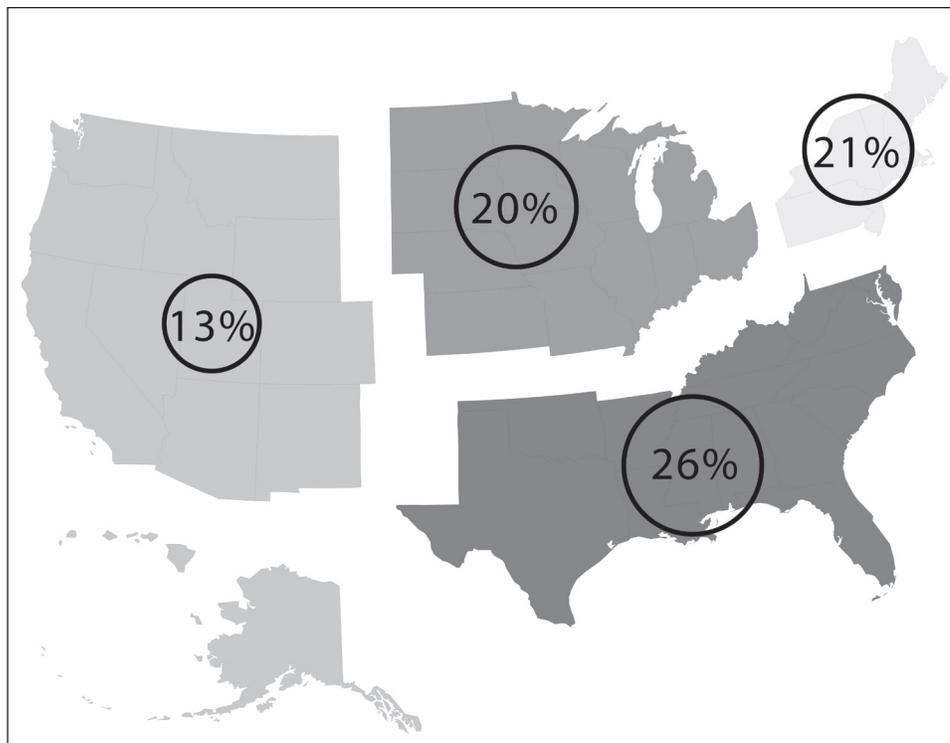


Figure 2. Percentage of Region's Occupied Households Served by OWS (AHS, 2001).

Total nitrogen concentrations appear to have declined between the 1970s and 1990s and have remained relatively low. The study methods were also found to affect the reported data quality. The type of sample (grab or composite) had the largest effect, and analytical methods employed had the smallest effect. Finally, no trend in the reported data was observed based on the literature source, because nearly 90% of all reported literature values were from similar sources.

OWS Prevalence

To supplement information on the single-source OWS composition, the researchers assessed the prevalence of various single-source OWS currently installed and in operation. American housing survey data indicates that 21.0% of all occupied households are served by OWS and that 28% of new construction utilizes OWS. Domestic (residential) sources account for at least 75% of OWS within a state, with a wide assortment of nonresidential sources also identified.

The team also assessed selected demographics that could affect differences in lifestyle habits and, ultimately, the raw wastewater composition. Three distinct regional locations seem to encompass the observed differences in such characteristics: 1) the South, 2) the Midwest and Northeast, and 3) the West.

Several states stand out as representative to capture differences in the OWS prevalence and demographic characteristics. Florida, for example, has a medium percentage of the region's occupied households served by OWS, low annual average levels of poverty, and a medium percentage of individuals over age 65. Colorado has a low percentage of the region's occupied households served by OWS, low annual average temperature and precipitation, low percentage of rural systems, low levels of poverty, and low percentage of individuals over age 65.

A companion report to this literature review, *Influent Constituent Characteristics of the Modern Waste Stream from Single Sources* (O4DEC1), supplements this information with a field monitoring program to assess the composition of residential OWS raw wastewater and septic tank effluent. Field investigations included quarterly monitoring at a total of 17 sites from these regions within the U.S. to ensure that the results and information gained had broad applicability to the management and design of OWS.

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