Saprolite or Deep Installations

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Septic systems are generally used for on-site management of domestic sewage. In a properly functioning septic system wastewater applied daily to the soil in the drainfield of the system must receive treatment while moving away from the area. Hydraulic failure of the system occurs when the volume of wastewater applied to the trenches or directly to the soil through a drip system is greater than the volume of water that moves away from the drainfield. Treatment failure of the system occurs when the soil materials in the drainfield area cannot attenuate chemical and microbial constituents of the applied wastewater. While the hydraulic failure is often determined by observing backing up of sewage into the dwelling served by the system, excessive wetness in the drainfield area, and/or notice of untreated sewage odor; the treatment failure may go unnoticed for many years. In order for septic tank effluent to receive treatment, the soil within a specified distance under the trenches or the drip lines of the system under consideration must remain aerobic. In general, a soil remains aerobic if it remains unsaturated. Under certain conditions deep installation of the trenches may be required or even desirable. Since saprolites are generally found below the soil solum in the Piedmont and Mountain regions of North Carolina, the depth of the trenches installed in them may be deeper than the maximum trench depth of 3-ft (90-cm) as allowed under the North Carolina regulations. To install a septic system at deep depths, one must assure that wastewater can move away from the drainfield and that the soil under the trenches contains adequate oxygen to provide treatment. In using a given saprolite for septic systems, the saprolite will be evaluated to determine its suitability for wastewater disposal (i.e., for hydraulic capacity). In addition, previous studies of saprolite in North Carolina have shown that for most cases saprolite has adequate hydraulic conductivity to allow wastewater to move away from the drainfield. Transfer of oxygen to the depth where wastewater moves through the soil or saprolite, however, has not been investigated in detail. While water in the soil moves as a result of a hydraulic gradient, transfer of oxygen through soil occurs by both convective and diffusion actions. The convective flow of air from the atmosphere (which contains oxygen) into the soil mainly occurs through wetting and drying of the soil. The diffusion of oxygen in the soil, on the other hand, occurs as a result of changes in the concentration of oxygen (i.e., changes in the partial pressure of oxygen) in soil pores. For deep installation, diffusion may be the only viable way for oxygen to reach the soil environment below the trenches. Because of the problems associated with oxygen exchange between the soil and atmosphere, in areas with a deep water table (i.e., thick unsaturated zone) and adequate hydraulic conductivity, pretreatment of septic tank effluent for reduction in concentrations of various chemical constituents (e.g., total organic material, nitrogen) and removal of biological pollutants (through disinfection) may be required for deep installations.