

NITROGEN SOIL CLEANUP GOALS: BALANCING GROUNDWATER PROTECTION AND PRACTICALITY

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Abstract

While most of the nitrogen in groundwater originates from normal fertilizer use, the highest concentrations occur at point sources such as fertilizer distribution facilities. Many states have found it difficult to establish nitrogen soil cleanup goals that are protective of groundwater, yet consistent with normal fertilizer application and the unique behavior of nitrogen in the subsurface. Three methods for deriving nitrogen soil cleanup goals are compared based on the migration-to-groundwater pathway. The SSL method generally leads to nitrate soil cleanup goals that are impractical at most release sites, and ammonium goals that are not protective because they fail to account for nitrification in the vadose zone. Many states have adopted nitrate standards based on SPLP leaching tests, and results of 256 SPLP tests are discussed. Other states have adopted nitrate and ammonium standards based on annual fertilizer application rates. At most nitrogen release sites, cost factors heavily favor source removal over *in situ* remediation. Data from 15 Illinois release sites demonstrate how the mass of nitrogen removed and cost-per-unit mass vary with the solid cleanup goal. Rapidly diminishing returns occur as soil cleanup goals decrease below a concentration of 150 mg/kg.

Key words: nitrogen, source removal, soil cleanup goals, groundwater, fertilizer