Title: **The Prediction of Nitrate Contamination Potential Using Known Hydrogeologic Properties (Study No. 11)**

Investigators:

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Objectives: To identify areas where groundwater is highly concentrated with nitrogen to facilitate focused research efforts, tighten nitrate regulation and require comprehensive well construction standards at vulnerable locations. To predict nitrate concentration in groundwater based on hydrogeologic conditions.

Methods: Four townships which have a high density of existing wells, known nitrate concentrations and a variety of groundwater and land use conditions were chosen to examine the nitrate contamination in relation to hydrogeology . Existing information was used to relate observed nitrate concentrations to the hydrogeologic conditions at wells using a multiple regression process. This process produced equations relating nitrate concentrations to hydrogeologic properties of aquifer type, depth to bedrock, depth to potentiometric surface, amount of clay in unconsolidated materials, soil permeability and the specific capacity of the well.

Results: In a dolomite aquifer, hydrogeologic data identified total clay thickness and specific capacity as important parameters in the initial nitrate infiltration. Clay thickness influences movement of nitrate through the unconsolidated sediment which is mainly sand and gravel, and specific capacity controls nitrate infiltration upon entrance into the dolomite aquifer. Soil permeability is the least important variable because the few feet of soil taken into account in the equation are minute compared to the aquifer depth to well screen. Nitrate concentration increases with depth to water level in this aquifer.

Results of the sandstone aquifer show that soil permeability and depth to water level are the most important hydrogeologic variables to be considered when predicting nitrate concentration. As soil permeability decreases, nitrate concentration increases. The methodology developed in this study can indicate nitrate contamination on a township level, though is not accurate enough for individual well predictions.

Conclusion:

Nitrate concentrations in groundwater are statistically related to hydrogeologic conditions. The relations are dependent upon well construction, nitrate sources, sampling procedures and aquifer type. Equations developed should be useful in accurately predicting nitrate concentration for a township-size area if hydrogeologic conditions are known. The predicted nitrate values are a relative measure of the hydrogeologic potential for nitrate contamination. A map overlay technique which identifies nitrate contamination based on hydrogeologic data can be used with numerous and well documented well construction reports.

Recommendations/ Implications:

Further study is warranted using the methodology used in this investigation of additional townships with wells finished in unconsolidated sediments or sandstone. This will provide more data for multiple regression equations for similar aquifer types. A field study is also recommended to define the hydraulic properties of both the aquifer and unconsolidated materials where hydrogeologic properties are better known.

Availability of Report:

This report is available for viewing and loan at:

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