Wellhead Protection Vulnerability Fact Sheet

Definition

Vulnerability refers to the likelihood that activities at the land surface may degrade drinking water quality at a public water supply well.

Purpose

Vulnerability assessments identify drinking water sources (e.g. wells) that should receive priority for source water protection efforts. The Minnesota Department of Health (MDH) has coordinated the development of its vulnerability assessment methodology between the Community Public water Supply, Noncommunity Public Water Supply, and Source Water Protection Units. The Community Public Water Supply and Noncommunity Public Water Supply Units use this methodology to assign monitoring frequencies to public drinking water sources and to apply for monitoring waivers, as specified under provisions of the federal Safe Drinking Water Act. The Source Water Protection unit phases community and nontransient noncommunity public water supplies into the Source Water Protection program based on vulnerability.

Basic Concepts

Vulnerability assessments consider the following:

a. Geologic Sensitivity
b. Well Construction, Maintenance, and Use
c. Water Chemistry and Isotopic Composition

Geologic sensitivity refers to the intrinsic ability of the earth's geologic materials to protect a well or well field from contaminant sources. Geologic sensitivity must be considered because even properly constructed and maintained wells may be at-risk if the aquifer, which supplies them, is quickly recharged by infiltrating water. MDH recommends that geologic sensitivity be determined using the methodology developed by the Minnesota Department of natural Resources (DNR, 1991). The DNR defines geologic sensitivity as being inversely proportional to the travel time required for water to move vertically from the land surface to an aquifer. Shorter travel times means the geologic sensitivity is higher, whereas a longer travel time indicates a lower geologic sensitivity.

The ***construction, maintenance, and use*** of a well are as important as the geologic setting, for assessing well vulnerability and the approach to contaminant source management in a wellhead protection area. Improper well construction or maintenance may provide for

pathways between near-surface water and deeper aquifers, effectively bypassing any natural geologic protection.

Water chemistry and isotopic composition provide a means for refining the assessment of well vulnerability obtained with the other two criteria. For example, it is possible to rate a well "not vulnerable" based on its geologic setting and construction, and yet it may be contaminated due to the lateral migration of contaminants within the aquifer. Water chemistry refers to the occurrence of different chemical constituents dissolved in the water, whereas isotopic composition refers to the atomic makeup of the water molecule itself. The presence or absence of contaminants, such as volatile organic chemicals and pesticides, isotopic dating of the well water and changes in general water chemistry over time, should be used to 1) verify other vulnerability assessment criteria, 2) characterize the rate of recharge to the well, and 3) provide warning that contaminants are being introduced to the aquifer.

The MDH uses a vulnerability rating method in which points are assigned for conditions that represent a perceived risk to a well. The evaluation includes each of the criteria noted above, where such information is available. Higher point totals suggest relatively greater well vulnerability and vice versa. A numeric cutoff is used to categorize "vulnerable" from "nonvulnerable" wells.

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