

This is the second of three articles discussing groundwater and focuses on several potential sources of activities that can affect drinking water quality.

Common Causes of Changes in Groundwater Quality

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Abundant, high-quality groundwater is essential to our nation and citizens. However, shallow groundwater can easily become unusable by poor management practices. Protecting this valuable resource is a responsibility we each have an important role in.

Naturally-occurring mineral sources probably affects the quality of groundwater than all other activities combined. Natural leaching of minerals to the groundwater is the result of the interaction between water and either the aquifer formation, substances tied up the soil, or minerals in the watershed that feed the aquifer recharge area. Natural water quality degradation can take many forms including increased salinity; the addition of toxic substances such as metals and nitrates; and addition of excessive nuisance minerals which may give the water an undesirable color or taste.

Human-induced impacts on groundwater quality usually involves substances released on or slightly below land surface and, therefore, shallow aquifers are normally considered more susceptible to pollution than the deeper aquifers. These potential sources represent a wide range of activities, including anything from abandoned hazardous waste facilities to leaking storage tanks.

The two dominant characteristics of chemicals that determines its potential to leach to groundwater are its relative occurrence in soil and the lack of binding to the soil. Not all chemicals have equal ability to reach groundwater.

Once a chemical has moved through the vertical soil and enters the groundwater, it will flow in a linear path in a downdip (“downhill”) direction naturally following the geological formations. The rate the chemical moves is dependent upon several factors but primarily the aquifer’s permeability.

Groundwater quality can be impacted by site-specific potential sources or regional potential sources known as nonpoint source pollution. Nonpoint source pollution can occur when many small potential sources combine and collectively have a significant impact on groundwater quality in the area. Examples of this are improperly functioning septic tanks; excess fertilizers, herbicides and insecticides; and oil, grease, and toxic chemicals from urban runoff.

Our everyday practices produce numerous waste materials and by-products that are often deposited or stored on the land surface or in shallow subsurface zones. Improper storage and

disposal can cause the chemical to migrate downward modifying the natural quality of groundwater.

Abandoned Hazardous Waste Facilities

One of the largest threats to groundwater has been abandoned hazardous waste facilities. Federal and state programs work together to identify and respond directly to hazardous waste sites in Indiana that may constitute an imminent and substantial endangerment to public health or the environment. The Superfund program was developed specifically to address these types of sites and others. Most of these facilities were operated before more comprehensive regulations were enacted in the 1970's and 80's.

Land Disposal of Waste Materials

Private residents, municipalities, and industries can generate a wide variety of wastes. Most of these are disposed of on or near the land surface. Improper and illegal disposal sites can be a source of groundwater quality degradation, primarily because of the generation of leachate caused by water percolating through the refuse and ultimately filtering the liquid waste to groundwater. However, properly designed, permitted, constructed and maintained, land disposal of waste materials is rarely a source of groundwater quality degradation. For example, today's landfills have multiple liners, leachate collection systems to collect water from landfills before it reaches groundwater, requirements to solidify waste before placing in the landfill, and extensive groundwater monitoring systems to detect any impacts before the groundwater leaves the facility boundaries.

Abandoned Water Wells

Water wells are conduits between the land surface and our groundwater resources. If not sealed or plugged properly, abandoned wells can contribute to groundwater quality degradation. In many cases, there is inadequate or a total absence of casing within the holes, the surface casing has not been cemented, and many have been left uncapped. The wells are of various depths and in many, hydraulic communication is present between more than one water-bearing unit, allowing inter-aquifer exchange and water quality degradation. These conditions allow potential contaminants such as sewage, fertilizers, and pesticides to enter groundwater during storm related events via vertical leakage from the surface. For more information about plugging or sealing abandoned water wells contact the Indiana Dept. of Natural Resources, Division of Water at water_inquiry@dnr.in.gov or by calling (877) 928-3755.

Leaking Underground Storage Tanks

Underground storage tanks and their associated piping systems are used to store not only petroleum products, but a wide range of other products and wastes. Underground storage tanks sometimes lie within the shallow saturated zone of aquifers. This causes continually saturated conditions to exist in shallow deposits below the tanks. Therefore, when the tanks leak, high concentrations of contaminants may occur.

Aboveground Storage Tanks

Releases from aboveground storage tanks usually result from spills, overflows, operator errors, or leaks. Future leaks of residual materials may also occur when these tanks are improperly abandoned. Tank contents commonly includes hydrocarbons, fertilizers, pesticides, and acids. All tanks should have spill and overflow protection. Spill protection usually consists of an impervious catch basin around the tank, preferably made of waterproof material and should hold 125% of the tanks capacity.

Oil and Chemical Spills

The principal concern from materials transported by highway vehicles or railcars is the spill of fluids which may result in contamination of groundwater. Also, of concern are potential groundwater pollution spills which do not result in prompt cleanup or in cases where cleanup is inadequate. Crude oil and gasoline spills, due to accidental breaks of transmission lines or vehicle tank ruptures can also be a serious problem. If a spill occurs, assess the situation and determine if it is a problem. Chemicals that are safe or disappear very quickly are unlikely to cause a problem. But chemicals that are hazardous, long-lasting, or capable of changing into more hazardous chemicals will need to be cleaned up.

Animal Feeding Operations

Animal farms are places where animals such as cattle, horses, and chickens are raised for pleasure, food, or fiber. When the animals are kept together in one area for feeding and maintenance rather than letting them graze on pasture, it is considered an animal feeding operation. The manure animals produce must be properly managed by the producer. Normally, animals on pasture or range do not produce enough waste concentrations to be of concern.

Whether the Indiana Dept. of Environmental Management regulates an animal feeding operation is dependent on the number of animals the producer plans on housing. If there is enough of one type of a regulated animal on a farm in Indiana, and the animals are confined for at least 45 days a year, it is considered to be a confined feeding operation (CFO) and is regulated under Indiana laws and rules.

The greatest threat of groundwater contamination typically comes from surface activities that are illegal, unpermitted, improperly designed, operated, and/or monitored. Properly controlling and managing possible contaminants is a role we can all play a part in helping protect our drinking water.