If you use a well, be sure your water supply is safe and uncontaminated for household use. Some contamination may occur naturally because of materials in the ground, such as iron or manganese. Little can be done to prevent this problem from occurring. On the other hand, a wide variety of potential contaminants, such as nitrates and hydrocarbons, are introduced into the groundwater by man's activities. Actions can be taken to prevent these sorts of problems from developing.

What is Groundwater?
Groundwater is that water which is found beneath the surface of the ground where the soil and rocks are completely saturated with water. The source of the groundwater is rain and melted snow which soaks into the ground and moves down through the soil until it reaches the saturated area, the top of which is called the water table.

Direction of Flow
Once in the saturated area, the groundwater moves slowly by the force of gravity and eventually is discharged at a spring, wetland area, river or pond. The water usually flows in a down hill direction. Therefore, water that enters the ground at the "top of the hill" will flow under the ground and eventually exit somewhere downslope.

Groundwater moves by the force of gravity to a discharge area.

Depending upon the slope of land, soil and geology, water may exit from the ground as close as a few hundred feet or up to thousands of feet (possibly miles) from its point of origin. If you have a dug well, most likely the water you are using came from the immediate area, while if you have a deep drilled well, the water may have originated from an area quite some distance away.

Land Use Impacts on Well Contamination
Activities carried out on the surface of the ground vary greatly as to kinds and amounts of materials that are used. These "land uses" may pose a threat to the quality of water which flows past a well, depending upon the types and amounts of materials used in the activity. By relating the types of land uses in the area, particularly those upslope of the well, it is possible to get a rough idea about the chances for well water contamination. Listed in Table 1 are several land use activities, the types of contaminants they may contribute, and for which water testing may be appropriate.
<table>
<thead>
<tr>
<th>Land Use</th>
<th>Bacteria</th>
<th>NO₃</th>
<th>Volatile Org. Scan</th>
<th>Hydrocarbon Scan</th>
<th>Pesticides</th>
<th>Chloride</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Tanks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Road Salt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Storage or Use)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landfills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sludge Disposal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Septic Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Possible contributor of contaminants in the category identified.

How Wells Become Contaminated
As the water flows into and through the ground it may pick up contaminants from materials used by the various land use activities. Once these contaminants enter the groundwater, some materials float near the top of the saturated area (gasoline), others dissolve throughout (salt), while others may settle to the bottom.

With surface water, contaminants can easily mix throughout the body of water and become diluted. With groundwater, however, the contaminants do not mix throughout the ground. Instead, the contaminants are contained and form a slug or "plume" which moves with the groundwater as it flows downhill through the saturated area.

The ability of a contaminant to enter the ground and move with the groundwater will vary depending upon the characteristics of soil, underlying rock formations and contaminant material itself.

Contaminants in groundwater usually move in a concentrated plume.

Management Techniques
Once the groundwater is contaminated it is very hard to clean up. Therefore, prevention is the key management technique, whereby materials are not allowed to enter the groundwater. This can be done through prohibition of certain land uses from the area, or by assuring the land uses are managed properly to prevent the introduction of unwanted materials. Once the water is contaminated the only options usually available are treatment or securing a new water source.

Summary
Certain types of land uses located hundreds and possibly thousands of feet upslope of a well can potentially contaminate the groundwater used by the well. Imposition of bans on certain land uses plus proper on-site management of other activities is recommended to prevent contamination of groundwater. Correction of existing problems is costly and difficult.

By Roy Jeffrey, Community Development Agent

References

This material is based on work supported by the U.S. Department of Agriculture, Extension System, under project number 89-EWQI-1-9152.