Testing of Private Wells
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TESTING OF PRIVATE WELLS

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About half the population of Michigan depends on groundwater as the primary source of drinking water. Many of these individuals, especially those residing in rural areas, have their own wells. In light of recent reports of groundwater contamination in many areas of the state, much concern exists about the safety of well water. This bulletin is designed to address this concern and provide a guide to testing private wells.

Groundwater initially fell to the earth as rain or snow and then percolated through the soil. It became trapped in underground layers called aquifers, which consist of sand, gravel and rock. Some of the aquifers are located near the surface, and others are far underground. They are irregular in shape, and wells drilled a few hundred feet apart may reach different aquifers. There may be several aquifers under a particular site, and wells may be drilled into any of these.

Extensive regulations control the construction of wells. In addition, many local health departments require well-water testing before a new well is put into service. However, no regulations govern water quality in private wells. There are no enforceable limits for particular contaminants and no requirements for tests to be made on any regular basis. Often, health agencies will make recommendations as to the suitability of well water based on standards established for public drinking water supplies. These, however, are only recommendations.

Many contaminants are natural.

Where do these contaminants come from? Many are naturally occurring substances such as calcium, magnesium, silica and fluoride. As many as 50 minerals may naturally occur in water; but these generally do not cause health problems, since they usually occur in such small amounts. More often they impart undesirable properties such as unpleasant taste, odor or hardness to the water.

Some contaminants are living organisms, mainly soil bacteria. The ones which cause the most common odor, taste, smell and discoloration problems are the sulfur, iron and manganese bacteria. Occasionally, other types of bacteria, which indicate unsanitary conditions, are present. These may not affect the characteristics of water but are indicators of the possible presence of disease-causing microorganisms.

Other contaminants are man-made.

These include a wide range of synthetic organic compounds, such as trichloroethylene, phenols, benzene and toluene. Other chemicals which may contaminate water are the heavy metals such as lead and cadmium, and salt or brine used on roads. In general, these contaminants pollute groundwater as a result of improper storage or disposal practices. Leaking underground storage tanks and leaking landfills are two common examples. At high-enough levels, these contaminants may render water unsuitable for drinking and may cause adverse effects on health.

Contaminants which reach the groundwater generally move very slowly. In one sense this is a problem, since continued leakage in one spot will lead to gradually increasing levels of contaminants. With slow movement, there is little possibility of dilution. On the other hand, this slow movement means that most contaminants will be confined to a small area, and leakage in one place will not pollute a large region. In addition, the limited spread increases the possibility that the water can be treated and the aquifer restored, at least partially. However, restoration is generally a large and costly undertaking.

Tests of well water have to be very specific. It is not possible to test one well and determine what the contaminant levels are in other wells in that area. A very complex hydrogeological investigation would be needed to make this determination, and this is not generally cost-effective. Thus, it is usually up to the individual well owner to decide if well testing is needed and what particular tests should be performed.

If well-water quality is in doubt, the first thing that a well owner should do is to contact the local health department. Department sanitarians can discuss the problem and recommend further action. In some cases, a visit to the well site will be needed before a decision can be reached. If the situation warrants it, water testing may be the next step. This testing may be done by the local health department, by the state health department or by a private testing firm. Many tests can be done by the appropriate agency, but private testing may be needed due to the limited resources available in these agencies. The agencies work on a priority system, which takes into account both the potential health risk and the number of people who may be affected.

Sampling is the first step

Regardless of who performs the testing, the first step is the collection of the water sample. If the well owner performs the sampling, he or she is usually provided with the appropriate sterilized sample bottle and instructions on how, when and where to collect the sample. This is a crucial step, since the contaminants are generally present in very minute amounts, and careless sampling can destroy the possibility of obtaining accurate results.

Once the sample is obtained, it may be tested for a number of different

types of contaminants. One type of test is designed to detect bacterial contamination. Most odor, taste, smell and discoloration problems are due to bacteria, so this test is performed quite commonly. It is usually done free of charge by the local health department.

A second type of analysis, a partial chemical analysis, is used to detect commonly occurring inorganic constituents, such as magnesium, calcium, sodium, iron, fluoride, chloride and nitrate. Some of these, such as fluoride and nitrate, may be health hazards at high-enough levels. Others, such as magnesium and iron, are usually of concern due only to their effects on water taste, color, odor or cleansing properties. This type of test is more expensive than the bacteriological analysis, but it is still not very costly.

A third, and potentially very expensive, type of analysis is a specific chemical analysis. This is used to look for one or a few particular chemicals which are suspected of being present in the water. It is not possible to simply analyze water for everything; the well owner must narrow down the possible sources of the problem so that a limited set of tests can be conducted. Some of the most common types of specific chemical analyses are:

1. Purgeable halocarbons — tests for organic chlorine and bromine compounds which are volatile (evaporate easily). These include many solvents such as paint strippers and degreasers. The chemicals involved include chloroform, methylene chloride and tri- and tetra-chloroethylene. It is relatively expensive but can identify which specific compounds are present.

2. Purgeable aromatics — tests for organic compounds, especially those found in petroleum products, such as paint thinner, gasoline and fuel oil. Specific chemicals detected include benzene, toluene and xylene. This test is also relatively expensive and can also identify the specific chemicals present.

3. Non-volatile organics — a test to identify specific organics such as PCBs, PBBs and many pesticides. It is relatively expensive.

4. Total organic halogen (TOX) — a test for a large variety of organic chemicals containing chlorine or bromine. Compounds of this type include tri- and tetra-chloroethylene, PCBs, PBBs and many pesticides. This is a relatively inexpensive test but does not identify individual chemicals. (This test is not available at the MDPH [Michigan Department of Public Health] laboratory.)

5. Total organic carbon (TOC) — the most rapid and least expensive of the specific chemical analyses. It can detect the presence of organic compounds and thus suggest the existence of a class of contaminants. It is not a very sensitive test and does not identify individual compounds. (This test is not available at the MDPH laboratory.)

The last two of the above analyses define a whole class of compounds and so do not allow identification of particular chemical contaminants. However, they do narrow down the possibilities and provide clues as to which specific chemical analyses would be worthwhile. If these tests are negative, then all chemicals in each class are either absent or present at levels below the detection limit for that test.

Once the tests are completed, the well owner is faced with interpreting any positive results. The presence of a contaminant is not always an indication of a health hazard. It is the level at which it is found that is most important. Although there are no established levels for private well water, the levels established for public supplies can be used as guides. It is best to discuss results with a sanitarian from the local health department, since he or she will have these established levels available and can help you interpret your results.

If the well owner finds that the well is contaminated with levels that might have significant health effects, the well should not be used. At this point there are five basic alternatives: install a new well, connect with a public system (if available), use bottled water, install filters, or move to another area.

Drilling a new well may not solve the problem if it is drilled into the same aquifer, if the contaminant has also polluted the deeper aquifer, or if the source of contamination has not been identified. It is also expensive.

Bottled water is generally just a temporary solution. In addition to the expense, the quality of bottled water is not always assured although the Michigan Department of Public Health (MDPH) monitors the source and the Michigan Department of Agriculture (MDA) inspects bottling plants.

Installation of filters may appear to be an attractive solution but it also has drawbacks. These devices are unregulated and thus vary in effectiveness; they require careful maintenance and generally lack malfunction indicators. Filters are usually not recommended by health agencies.

The last solution, moving to another location, is a drastic one but may be necessary in extreme situations.

Most people assume that scientists have a good understanding of the health effects of water contaminants. Unfortunately, this is not the case for many substances found in well water. As a result, the well owner is often faced with uncertainty in the interpretation of contamination which may occur. Discussion with appropriate health officials should reduce this uncertainty, but it must be understood that difficult decisions may be necessary. The scientific community is working on these problems, but it will undoubtedly be a long time before the health effects of all water contaminants can be predicted with confidence.

Where to find information

General information and referrals: Your County Cooperative Extension Service Office (listed under your county in the phone book) or The Center for Environmental Toxicology, Michigan State University, East Lansing, MI 48824 (517/353-6469).

For questions about well water testing: Your local Health Department or the Michigan Department of Public Health, Water Supply Division (517/373-1376).

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