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A Web Site for Interpreting Drinking Water Quality Analyses

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A Web Site for Interpreting Drinking Water Quality Analyses

Abstract
Owners of private domestic wells submit samples to analytic laboratories to determine whether their water supplies are safe to drink. Reports from such analyses present a wide range of information, some of which has human health implications, and some of which does not. We developed a Web site that corresponds with a commonly used suite of analyses that reports 27 chemical and physical characteristics of water samples. Our Web site helps to interpret the results by offering brief statements and clear graphics related to existing standards and guidelines after Web site visitors add information to a sequence of forms.

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Introduction

Owners of private domestic wells are a large and growing audience, especially in Nevada. Recent debates about the arsenic standard for public water supplies and well-publicized investigations of what appear to be excessive prevalence of childhood leukemia have raised concern about the potential health effects of naturally occurring and anthropogenic chemicals in private water supplies.

One of the first responses from Extension professionals to such concerns is a recommendation to test water supplies using the services of a drinking water certified laboratory and proper sampling procedures. However, most anthropogenic contaminants of concern that are potentially related to well-publicized health problems are either excessively expensive or require very specialized sampling and sample handling procedures. As a result, most homeowners rely on standard suites of analyses to obtain affordable, albeit limited, information about the chemical quality of their water.

One of the difficulties that we have encountered with such standard suites is in interpretation, especially when health concerns motivate testing. For example, the Routine Domestic Analysis offered by the Nevada State Health Laboratory (Reno, NV) reports results of tests to determine 27 physical and chemical characteristics of water (Table 1). Other laboratories certified for drinking water analysis offer similar types of analytic services, with multiple analyses included for a single price.

The report lists analytic results, with reporting limits defined by analytic limit of detection. Typically, a quality control analyst at the laboratory notes, by hand, results that could be a cause for concern, but does not provide further explanation. Among the results normally reported, six have specified maximum contaminant levels (MCL) that serve as standards for public drinking water supplies. An additional eight have maximum contaminant level guidelines (MCLG), which are not used for regulation. Finally, six other constituents have aesthetic implications that are useful to

understand, especially for specific kinds of home uses. The remaining seven analytes reported have important applications for other purposes, such as assessing utility of the water for irrigation purposes.

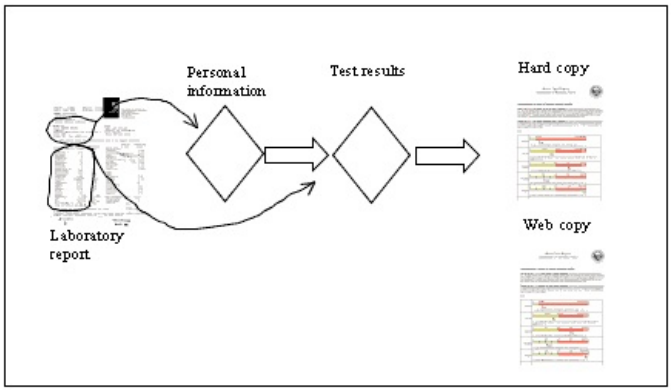
Table 1.
Chemicals and Other Characteristics Reported in the Routine Domestic Analysis Provided by the Nevada State Health Laboratory That Have Maximum Contaminant Levels (MCL), Maximum Contaminant Level Guidelines (MCLG), or Informal Guidelines

Analytes with Specified MCL	
Arsenic	Nitrate
Barium	Fluoride
Copper	Turbidity
Analytes with Specified MCLG	
Chloride	Iron
Magnesium	Manganese
pH	Sulfate
Total dissolved solids	Zinc
Analytes with Informal Guidelines	
Hardness	Calcium
Sodium	Color
Carbonate	Bicarbonate

Web Site Design and Intended Audience

We designed a Web-based tool for use by trained volunteers in Churchill County, Nevada, to provide interpretations of water test results succinctly, accurately, and consistently among the volunteer staff <http://www.ag.unr.edu/ers/water/>. The development of a final report for the homeowner includes three stages (Figure 1): personal information entry (on a welcome page), water test information entry (on a data page), and water test results interpretation (in both hard copy and Web form, with live links for further information).

Figure 1.
Development of Interpretive Reports in Hard Copy and Web Forms. Data Entry Stages Are Indicated as Diamond Shapes.



The Web-based report contains live links to further information that aids in interpretation. These include specific notices about arsenic and nitrate that reflect proposed changes in each. These notices correspond with those printed in Consumer Confidence Reports, which are provided annually to customers of all public water supplies. Other information includes definitions of basic units (such as parts per billion and parts per million) and contacts to obtain further information.

Training and Use

We have trained a group of senior volunteers in Churchill County, who are part of Nevada G.O.L.D. (Guarding Our Local Drinking Water). The G.O.L.D. group promotes water quality protection through education in Churchill County. The volunteers organize public events and often respond to inquiries about the results of water tests. The Web-based template has provided them with a new tool to use as part of interactions with the public. As a primary point of contact for the Extension water program in the community, the Web-based interpretive tool provides the volunteers with a consistent and reliable means of helping private well owners to interpret the results of routine domestic analyses.

Future Applications

As a next step, we will add a component to the Web page that provides information about treatment options, given water chemistry. After homeowners understand the significance of water test results, they are prepared to take action to correct problems. However, the selection of water treatment devices must take into account expected performance, especially related to other chemicals present in water.

For example, some methods used to remove arsenic may be effective in removing a proportion of total arsenic present in water, but this may not be sufficient in terms of meeting water quality standards. We are creating a Web-based companion tool for the interpretive tool described in this article, to offer guidance about the performance of commonly used types of treatment given the chemical and physical characteristics of water reported in the Routine Domestic Analysis.