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Wyoming Department of Agriculture

Wyoming Department of Environmental Quality, Water Quality Division

In cooperation with the Wyoming Department of Agriculture (WDA) and the Wyoming Department of Environmental Quality (WDEQ)

Pesticides in Ground Water - Uinta County, Wyoming, 2002-03

In 1991, members of local, State, and Federal governments, as well as industry and interest groups, formed the Ground-water and Pesticide Strategy Committee to prepare the State of Wyoming's generic Management Plan for Pesticides in Ground Water. Part of this management plan is to sample and analyze Wyoming's ground water for pesticides. In 1995, the U.S. Geological Survey, in cooperation with the Ground-water and Pesticide Strategy Committee, began statewide implementation of the sampling component of the State of Wyoming's generic Management Plan for Pesticides in Ground Water. During 2002-03, baseline monitoring was conducted in Uinta County.

PESTICIDES IN GROUND WATER

Synthetic organic pesticides are used to control weeds, insects, and other organisms in a wide variety of agricultural and nonagricultural settings. The use of pesticides has helped to make the United States the world's largest producer of food (Barbash and Resek, 1996). Pesticide use, however, has also been accompanied by concerns about potential adverse effects on the environment and human health. A potential pathway for the transport of pesticides is through hydrologic systems, which supply water for both humans and natural ecosystems. Water is one of the primary ways pesticides are transported from an application area to other locations in the environment (fig. 1) (Barbash and Resek, 1996).

Pesticide contamination of ground water is a national issue because of the widespread use of pesticides, the expense and difficulty of remediating ground water, and the fact that ground water is used for drinking water by about 50 percent of the Nation's population. Although application rates and the variety of pesticides used may be greater in urban areas, concern over their presence in ground water is especially acute in rural agricultural areas where more than 95 percent of the population rely upon this resource for drinking water (Solley and others, 1998).

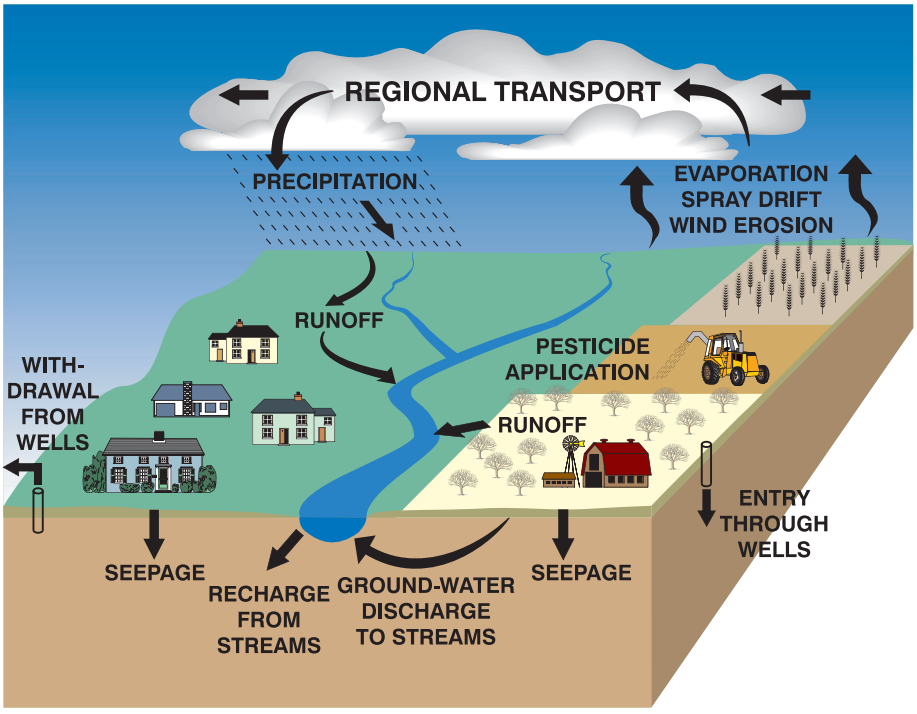

Figure 1. Pathways of pesticide movement in the hydrologic cycle (modified from Barbash and Resek, 1996).

WYOMING'S PESTICIDE MANAGEMENT PLAN

The Ground-water and Pesticide Strategy Committee (GPSC) has developed the generic State Management Plan for Pesticides in Ground Water for the State of Wyoming (SMP) (Wyoming Ground-water and Pesticides Strategy Committee, 1999). Wyoming was required by the U.S. Environmental Protection Agency to have developed an SMP in order for individuals and organizations to continue using certain pesticides in the State. The SMP includes information relating to individuals and organizations involved with implementation of the SMP, methods of preventing ground-water contamination, ground-water monitoring, and the responses required if pesticides are detected in ground water.

One critical part of the SMP is ground-water monitoring. This ground-water monitoring program has two phases. The first phase, baseline monitoring, is designed to determine what pesticides, if any, have leached into the county's ground water. The second phase, problem identification monitoring, is used to gather additional information about the ground water near wells with samples having significant pesticide detections.

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Table 1. Summary of baseline monitoring for pesticides in Uinta County, September 2002 and April 2003

[µg/L, micrograms per liter; NA, not applicable; E, trace concentration, value is estimated; C, estimated value used in calculation]

Pesticide	Pesticide trade name	Pesticide action[1]	Number of detections/ number of samples[2]	Laboratory minimum reporting level[3] (µg/L)	Maximum concentration (µg/L)	Average concentration of detections (µg/L)	Safe drinking water standard[4] (µg/L)
Focal pesticides detected in Uinta County ground water							
Atrazine	Aatrex	Selective herbicide	5/24	0.001	0.01	0.008C	3
Bromacil	Hyvar XL	Herbicide	1/24	0.04	0.1	NA	[5]90
Simazine	Princep	Selective herbicide	3/24	0.005	0.06	0.03C	4
Tebuthiuron	Spike	Herbicide	1/24	0.01	0.01E	NA	[5]500
Non-focal pesticides detected in Uinta County ground water							
Prometon	Pramitol	Non-selective herbicide	11/24	0.02	1	0.2C	[5]100
Focal pesticides not detected in Uinta County ground water							
2,4-D, Alachlor, Aldicarb, Aldicarb Sulfone[6], Aldicarb Sulfoxide[6], Clopyralid, Cyanazine, DCPA, Dicamba, Hexazinone, Metalachlor, Metribuzin, Picloram, Telone							
Focal pesticides not analyzed in Uinta County ground water (no method of analysis available)							
Difenzoquat, Metsulfuron							

[1]Meister (1996)

[2]Each of the 12 wells was sampled twice.

[3]The laboratory minimun reporting level is the lowest concentration at which a pesticide concentration can be quantified without estimation.

[4]U.S. Environmental Protection Agency Maximum Contaminant Level unless otherwise noted (U.S. Environmental Protection Agency, 2002).

[5]U.S. Environmental Protection Agency Lifetime Health Advisory Level (U.S. Environmental Protection Agency, 2002).

[6]Degradation product of aldicarb.

Baseline monitoring is prioritized by a county rank and the vulnerability of the county's ground water to pesticides. During the development of the SMP, the GPSC evaluated each county in Wyoming to determine the potential vulnerability of the county's ground water to pesticides. Each county was ranked according to the extent of cropland and urban areas in the county, as well as the amount of pesticides sold within the county in 1991 (Wyoming Ground-water and Pesticides Strategy Committee, 1999).

A ground-water vulnerability map was prepared for the uppermost or shallowest aquifer (Hammerlink and Arneson, 1998). A Geographic Information System was used to overlay seven layers describing hydrogeology and land use. Ground water is more vulnerable because of either inherent sensitivity of the hydrogeology, or because of the combination of the sensitivity and associated land use. The map was used to assist in the selection of monitoring sites in each county. The monitoring focuses on areas where the ground water is most vulnerable.

The GPSC selected 18 pesticides (focal pesticides) and 2 degradation products to be sampled as part of the SMP (table 1). The analytical method used to detect the focal pesticides can also detect 66 other pesticides and degradation products. Any additional pesticides detected are listed in table 1 as non-focal pesticides. Ground water from all wells in the baseline monitoring program was analyzed for the pesticides listed in table 1, with the exception of difenzoquat and metsulfuron, for which analytical methods were not available.

The goal of the ground-water sampling part of the SMP is to collect ground-water samples for pesticide analyses in all 23 Wyoming counties. To date, sampling has been completed in Goshen (1995-96), Park (1997), Washakie (1997-98), Fremont (1998-99), Lincoln (1998-99), Laramie (1998-99), Big Horn (1999-2000), Sheridan (1999-2000), Platte (2000-01), Johnson (2000-01), Crook (2000-01), Natrona (2001-02), Sweetwater (2001-02), Teton (2001-02), Uinta (2002-03), Albany (2003-04), Converse (2003-04), and Hot Springs (2003-04) Counties. Sampling began in 2004 in Carbon, Campbell, and Sublette Counties.

GROUND-WATER MONITORING IN UINTA COUNTY

Ground water in Uinta County was ranked sixteenth most vulnerable to pesticide contamination in Wyoming (Wyoming Ground-water and Pesticide Strategy Committee, 1999). The vulnerability map created by the Spatial Data and Visualization Center (Hammerlink and Arneson, 1998), identifies ground water found in unconsolidated Quaternary deposits in the county (primarily alluvial and terrace deposits) with urban and agricultural land use as the most vulnerable to pesticide contamination (shown as red in fig. 2). The focus of the sampling was in the alluvial and terrace deposits of the Bear and Blacks Fork Rivers and their tributaries (fig. 3).

Twelve wells were selected in Uinta County (fig. 3) for baseline monitoring. All wells were completed in the Quaternary or terrace deposits. All wells were sampled in September 2002 and April 2003.

Four of the 18 focal pesticides and 1 non-focal pesticide were detected in Uinta County (table 1). Pesticides were detected in 6 of the 12 wells sampled; however, the concentrations of each pesticide detected were generally less than 1/66 of the applicable drinking-water standard (U.S. Environmental Protection Agency, 2002) (table 1). About one-third of the detections were at trace concentrations too small to quantify without estimation. Trace concentrations are denoted with an "E" in table 1.

The most commonly detected pesticide (11 of 24 samples) in Uinta County was prometon, the active ingredient in Pramitol, a general-use pesticide. Prometon's detection is typically associated with urban land use (Barbash and others, 1999). Prometon also was the most commonly detected pesticide in Sheridan, Crook, Johnson, Natrona, and Teton Counties.

The second most commonly detected pesticide in Uinta County was atrazine (detected in 5 out of 24 samples). Atrazine is an agricultural chemical typically used for weed control in corn and other crops (Meister, 1996).

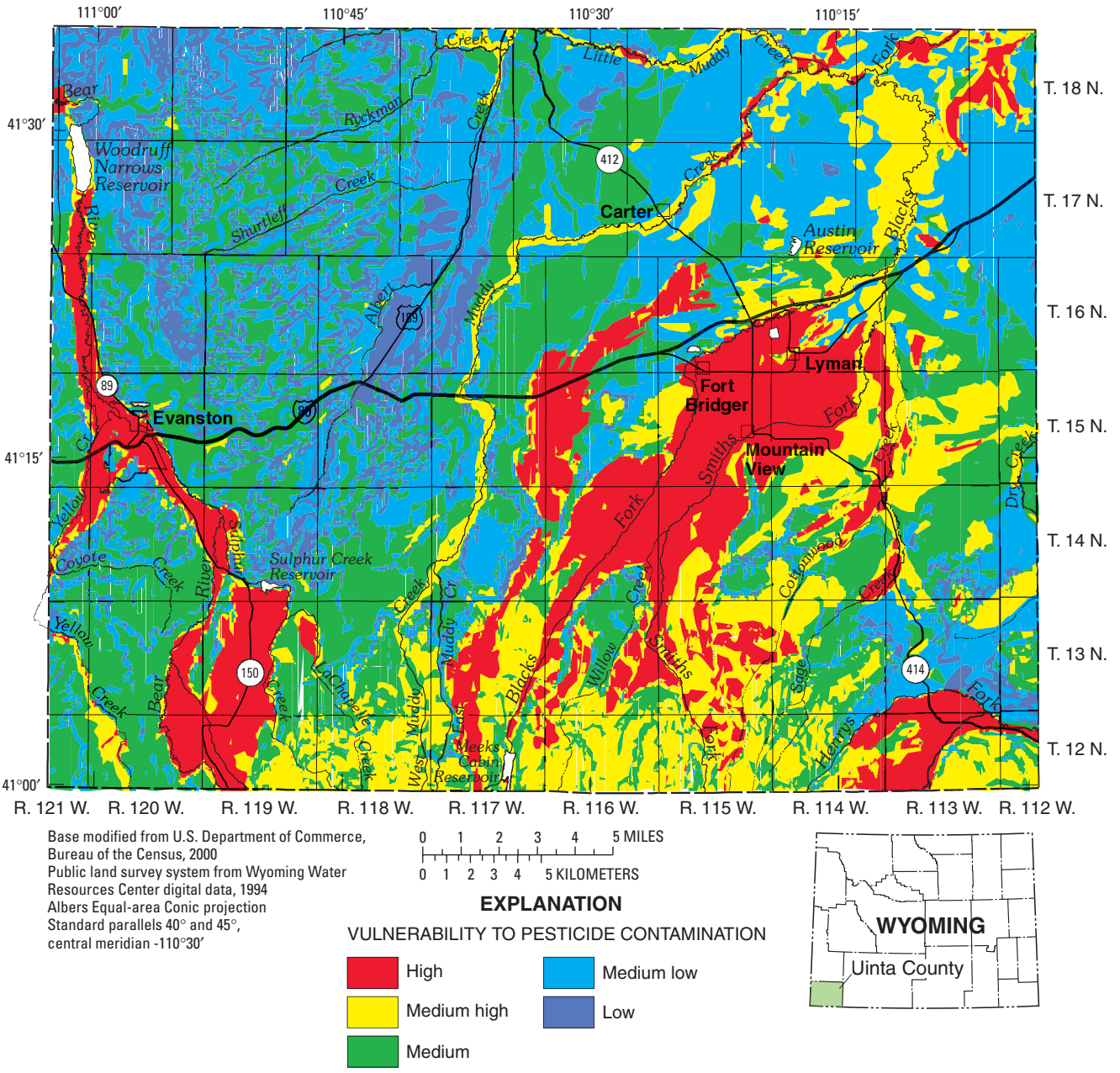

Figure 2. Vulnerability of Uinta County ground water to pesticide contamination (from Hammerlink and Arneson, 1998).

DATA DISTRIBUTION AND AVAILABILITY

The sampling results have been provided to local groups interested in pesticides in ground water in Uinta County. The information can be used by citizens and local governments to help understand current conditions. Analytical results of the Uinta County sampling can be found in Swanson and others (2003), and Swanson and others (2004), or on the internet at *http://waterdata.usgs.gov/wy/nwis/qwdata*. Analytical results and fact sheets for all counties sampled to date are available from the U.S. Geological Survey in Cheyenne either by phone, email, or on the internet at *http://wy.water.usgs.gov/projects/pesticide/*.

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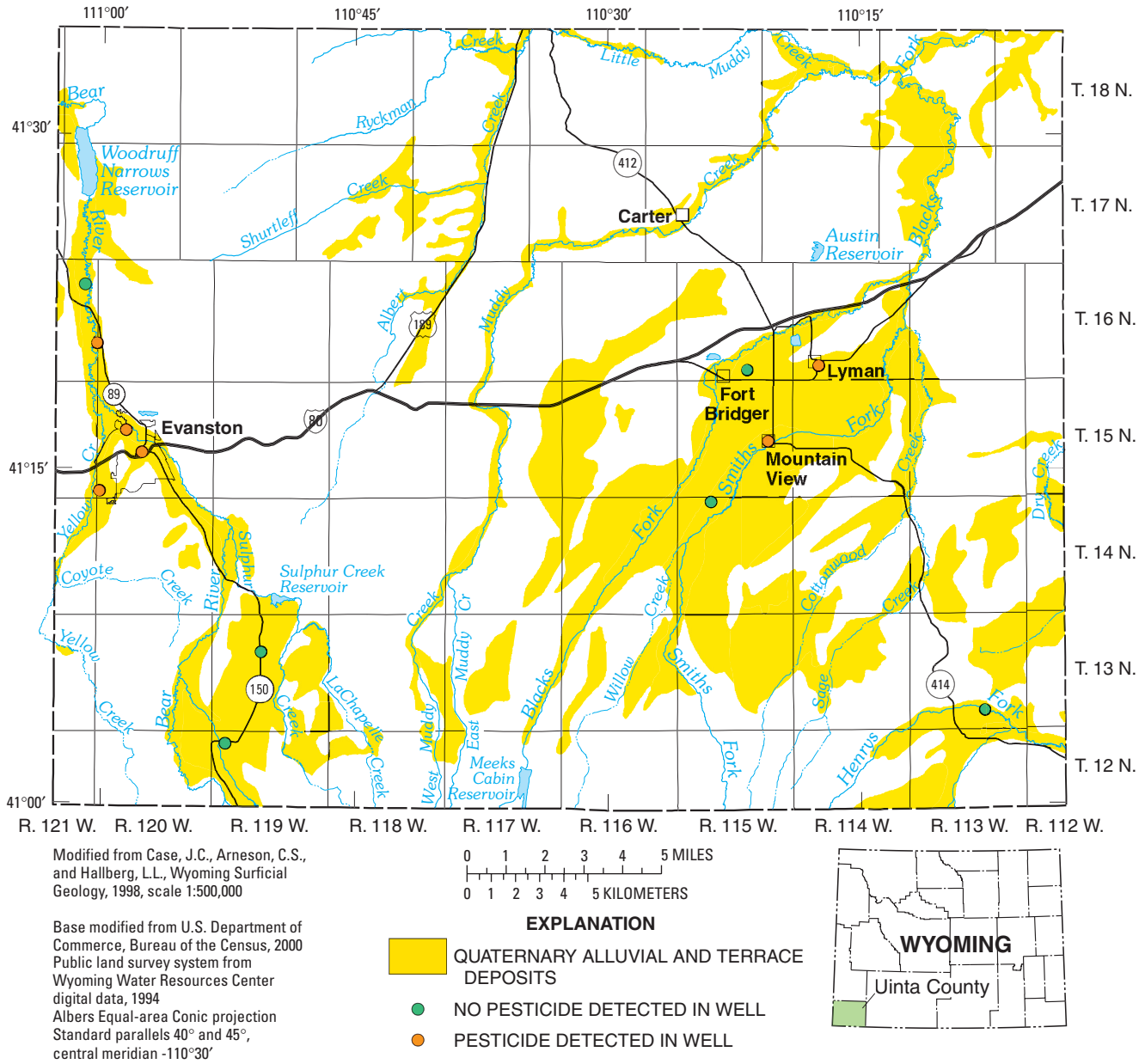

Modified from Case, J.C., Arneson, C.S., and Hallberg, L.L., Wyoming Surficial Geology, 1998, scale 1:500,000

Base modified from U.S. Department of Commerce, Bureau of the Census, 2000 Public land survey system from Wyoming Water Resources Center digital data, 1994
Albers Equal-area Conic projection
Standard parallels 40° and 45°, central meridian -110°30′

0 1 2 3 4 5 MILES
0 1 2 3 4 5 KILOMETERS

EXPLANATION

- QUATERNARY ALLUVIAL AND TERRACE DEPOSITS
- NO PESTICIDE DETECTED IN WELL
- PESTICIDE DETECTED IN WELL

Figure 3. Location of wells sampled in Uinta County, Wyoming, and notation of pesticide detection in each well.

Swanson, R.B., Blajszczak, E.J., Roberts, S.C., Watson, K.R., and Mason, J.P., 2004, Water-resources data, Wyoming, water year 2003, Volume 2. Ground Water: U.S. Geological Survey Water-Data Report WY-03-2, 141 p.

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