USGS
science for a changing world

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 - Converse County, Wyoming, 2003-04

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 2003-04, baseline monitoring was conducted in Converse 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 half 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 (Hutson and others, 2004).

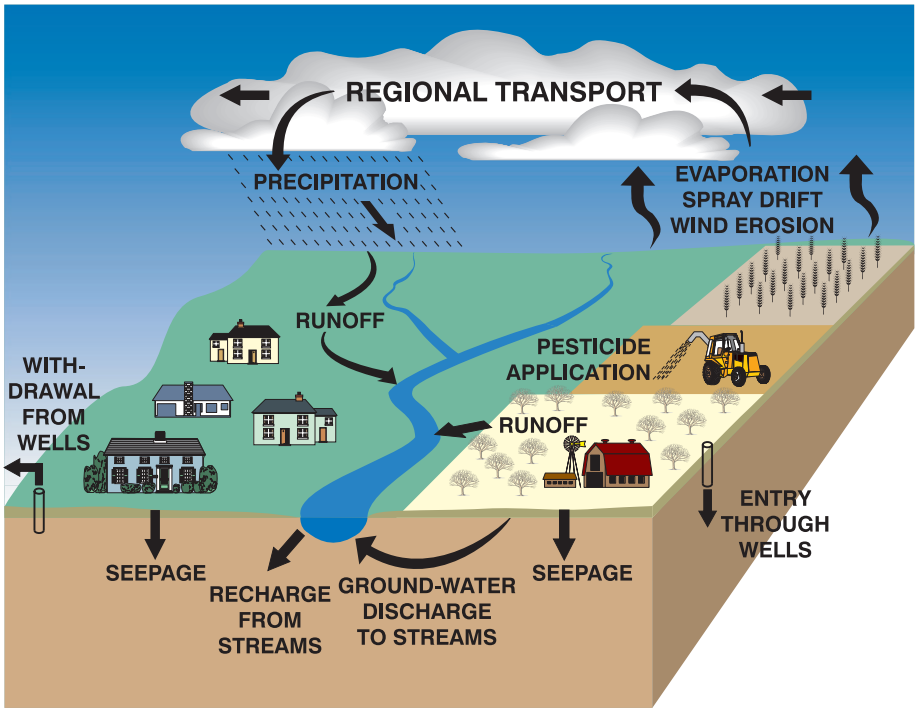

Figure 1. Pathways of pesticide movement in the hydrologic cycle (modified from Barbash and Resek, 1996).

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 a 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.

U.S. Department of the Interior
U.S. Geological Survey

Printed on recycled paper

USGS Fact Sheet 2005-3089
July 2005

Table 1. Summary of baseline monitoring for pesticides in Converse County, September–October 2003 and April 2004.

[µg/L, micrograms per liter; NA, not applicable; T, trace concentration, value is estimated; E, 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 Converse County ground water							
Atrazine	Aatrex	Selective herbicide	2/20	0.007	0.005T	0.004C	3
Clopyralid	Stinger, Curtail	Herbicide	2/19	0.01	22E	22C	1,000
2,4-D	2,4-D	Selective herbicide	1/19	0.02	14E	NA	70
Simazine	Princep	Selective herbicide	2/20	0.005	0.01	0.008	4
Tebuthiuron	Spike	Herbicide	2/20	0.02	0.4E	0.3C	[5]500
Non-focal pesticides detected in Converse County ground water							
Prometon	Pramitol	Non-selective herbicide	4/20	0.02	0.2	0.1	[5]100
Triclopyr	Garlon	Systemic herbicide	2/20	0.02	19E	12C	400
Focal pesticides not detected in Converse County ground water							
Alachlor, Aldicarb, Aldicarb Sulfone[6], Aldicarb Sulfoxide[6], Bromacil, Cyanazine, DCPA, Dicamba, Hexazinone, Metalachlor, Metribuzin, Metsulfuron, Picloram, Telone							
Focal pesticides not analyzed in Converse County ground water (no method of analysis available)							
Difenzoquat							

[1]Meister (2002)

[2]Each of the 10 wells was sampled twice. One well had only one analysis of clopyralid and 2,4-D.

[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.

The second phase, problem identification monitoring, is used to gather additional information about the ground water near wells with samples having significant pesticide detections.

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 (Hamerlinck 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, for which analytical methods are 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 CONVERSE COUNTY

The ground water in Converse County was ranked eighteenth 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 (Hamerlinck and Arneson, 1998), identifies ground water in unconsolidated quaternary deposits in the county (primarily alluvial and terrace deposits) with urban and agricultural land use as the most vulnerable to pesticides (shown as red on fig. 2). The focus of the sampling was in the alluvial and terrace deposits of the North Platte River, Deer Creek, and La Bonte Creek (fig. 3).

Ten wells were selected in Converse County (fig. 3) for baseline monitoring. All wells were located in the Quaternary alluvial or terrace deposits. All wells were

sampled in September or October 2003 and April 2004.

Five of the 19 focal pesticides or degradation products and 2 non-focal pesticide were detected in Converse County (table 1). Pesticides were detected in 3 of the 10 wells sampled in Converse County. Pesticide detections in two of the three wells were at low or trace concentrations. A trace concentration indicates that the pesticide was detected, but at a concentration too small to quantify without estimation. Trace concentrations are qualified with a "T" in table 1. All concentrations of the pesticides detected were less than 1/5 of the applicable drinking-water standard (U.S. Environmental Protection Agency, 2002) (table 1).

The most commonly detected pesticide (4 of 20 samples) in Converse 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 was also the most commonly detected pesticide in Sheridan, Crook, Johnson, Natrona, Teton, Uinta, and Albany Counties.

Clopyralid and triclopyr were detected in one well in the county. The detections are the first for these two pesticides during the sampling program.

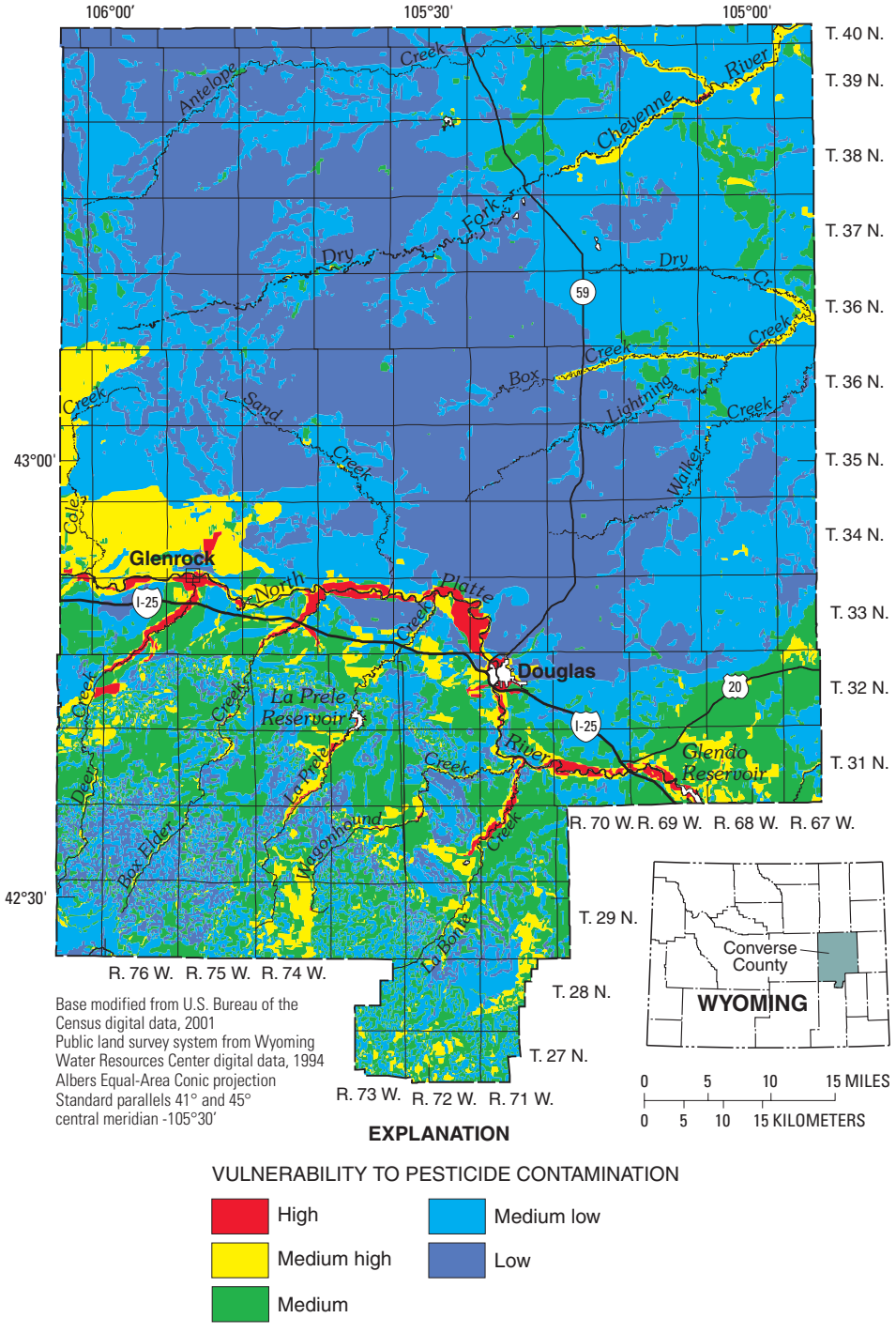

Figure 2. Vulnerability of Converse County, Wyoming ground water to pesticide contamination (from Hamerlinck and Arneson, 1998).

DATA DISTRIBUTION AND AVAILABILITY

Sampling results have been provided to local groups interested in pesticides in ground water in Converse County. The information can be used by citizens and local governments to help understand current conditions. Analytical results of the Converse County sampling can be found in Swanson and others (2004), and Blajszczak and others (2005), 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/*.

REFERENCES

Barbash, J.E., and Resek, E.A., 1996, Pesticides in ground water: Distribution, trends, and governing factors: *in* Gilliom, R.J., ed., Pesticides in the hydrologic system (v. 2): Lewis Publishers, 590 p.

Barbash, J.E., Thelin, G.P., Kolpin, D.W., and Gilliom, R.J., 1999, Distribution of major herbicides in ground water of the United States: U.S. Geological Survey Water-Resources Investigations Report 98-4245, 64 p.

Blajszczak, E.J., Mason, J.P., Watson, K.R., Roberts, S.C., and Miller, K.A., 2005, Water-resources data, Wyoming, water year 2004, Volume 2. Ground Water: U.S. Geological Survey Water-Data Report WY-04-2.

Hamerlinck, J.D., and Arneson, C.S., eds., 1998, Wyoming ground water vulnerability assessment

handbook: Volume 2. Assessing ground water vulnerability to pesticides: University of Wyoming, Laramie, Spatial Data and Visualization Center Publication SDVC 98-01-2, variable pagination.

Hutson, S.S., Barber, N.L., Kenny, J.F., Linsey, K.S., Lumia, D.S., and Maupin, M.A., 2004, Estimated use of water in the United States in 2000: U.S. Geological Survey Circular 1268, 46 p.

Meister, R.T., 2002, Farm Chemicals Handbook: Willoughby, Ohio, Meister Publishing Co., variable pagination.

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.

U.S. Environmental Protection Agency, 2002, Drinking water regulations and health advisories: EPA 822-R-02-038.

Wyoming Ground-water and Pesticides Strategy Committee, 1999, Wyoming generic state management plan for pesticides and ground water: prepared for Wyoming Department of Agriculture, Cheyenne, Wyoming, 103 p.

• *Prepared by* Cheryl A. Eddy-Miller and Kendra J. Remley
• *Layout prepared by* Suzanne C. Roberts

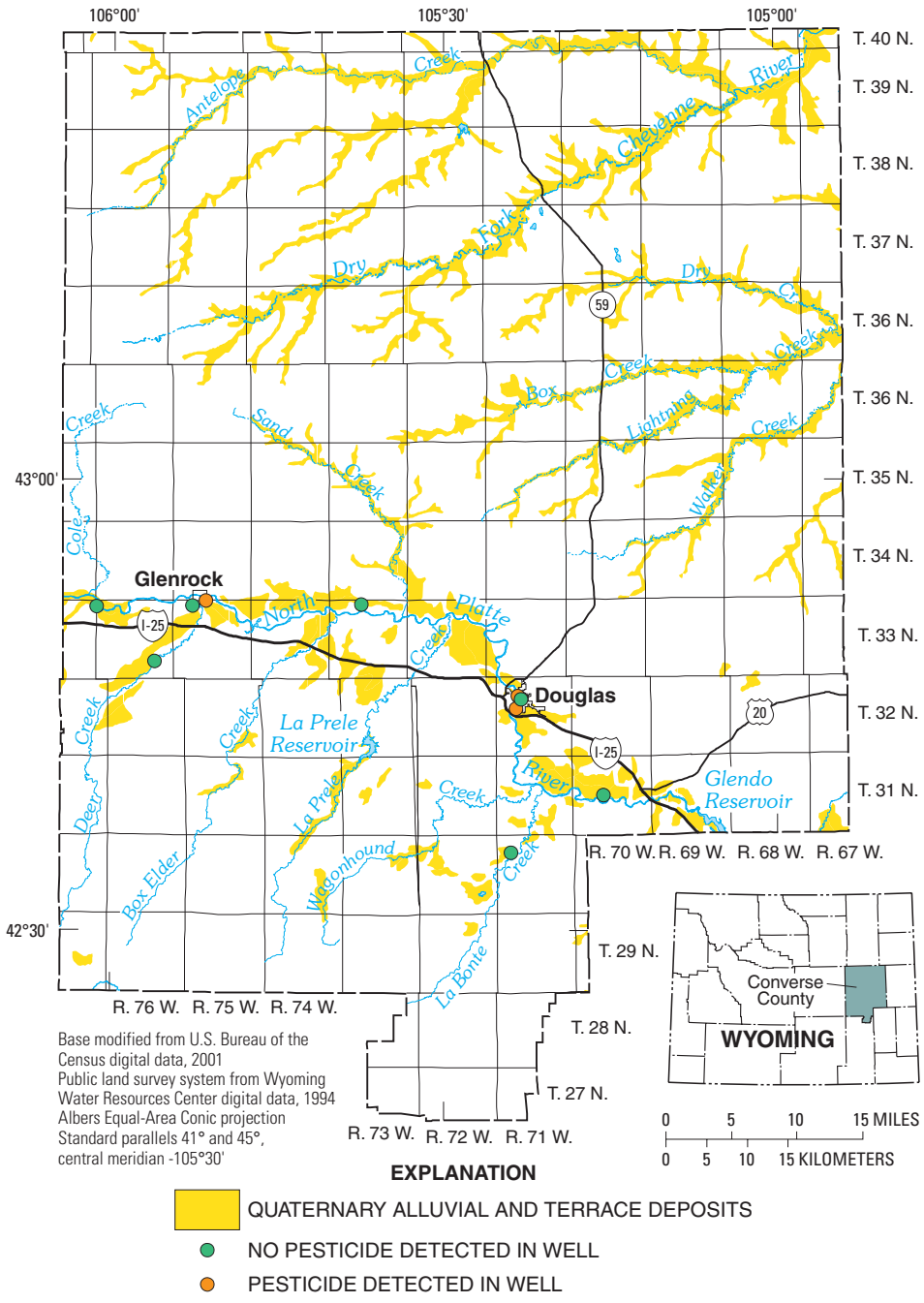

Figure 3. Location of wells sampled in Converse County, Wyoming, and notation of pesticide detection in each well.

FOR MORE INFORMATION, CONTACT:

Roy Reichenbach
Wyoming Department of Agriculture
2219 Carey Avenue
Cheyenne, Wyoming 82002
(307) 777-6590

Kevin Frederick
Wyoming Department of Environmental Quality, Water Quality Division
Herschler Building West, 4th Floor
Cheyenne, Wyoming 82002
(307) 777-5985

Cheryl Eddy Miller
U.S. Geological Survey
2617 E. Lincolnway, Suite B
Cheyenne, Wyoming 82001
(307) 778-2931
Email: cemiller@usgs.gov

This document was prepared by the U.S. Geological Survey (USGS), the Wyoming Department of Agriculture (WDA), and the Wyoming Department of Environmental Quality, Water Quality Division (WDEQ). All agencies are members of the Ground-water and Pesticide Strategy Committee.

This project has been funded in part with a Section 319 grant from the U.S. Environmental Protection Agency to Wyoming Department of Environmental Quality's Non-Point Source Program.