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Wyoming Department of Agriculture

Wyoming Department of Environmental Quality

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

Pesticides in Ground Water - Niobrara and Weston Counties, Wyoming, 2005–2006

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 2005–2006, baseline monitoring was conducted in Niobrara and Weston Counties. This Fact Sheet describes and summarizes results of the baseline monitoring in Niobrara and Weston Counties.

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, also has 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).

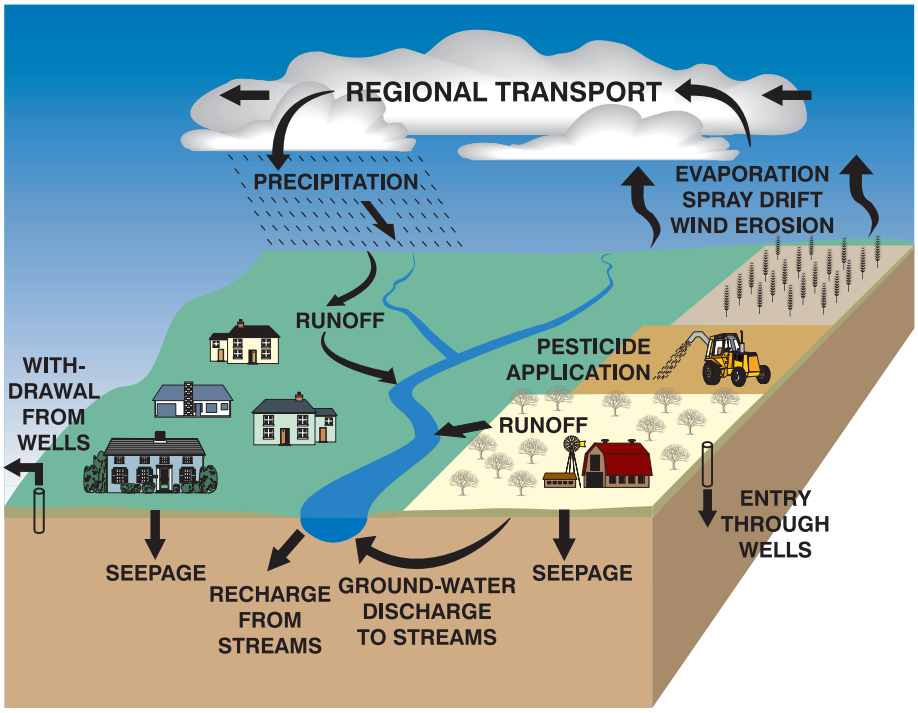

Figure 1. Pathways of pesticide movement in the hydrologic cycle (modified from Barbash and Resek, 1996).

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 40 percent of the Nation's population (Hutson and others, 2004). 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).

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 (SMP) for the State of Wyoming (Wyoming Ground-water and Pesticides Strategy Committee, 1999). Wyoming was required by the U.S. Environmental Protection Agency to have 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 for preventing ground-water contamination, ground-water

Table 1. Summary of pesticides and pesticide degradation products in ground-water samples from Niobrara and Weston Counties, September 2005 and April 2006.

[µg/L, micrograms per liter; E, value is estimated; --, no data; C, estimated value used in calculation; NA, not applicable]

Pesticide	Pesticide trade name	Pesticide action[1]	Number of detections/ number of samples[2]	Minimum reporting level[3] (µg/L)	Maximum concentration (µg/L)	Average concentration of detections (µg/L)	Drinking-water standard[4] (µg/L)
Focal pesticides detected in ground water from Niobrara and Weston Counties							
Atrazine	Aatrex	Selective herbicide	2/22	0.007	E0.006	C0.006	3
Bromacil	Hyvar XL	Herbicide	3/22	.02	E.4	C.2	[5]90
Clopyralid	Stinger, Curtail	Herbicide	2/22	.02	E.1	C.1	[6]1,000
Metsulfuron	Ally, Escort	Herbicide	1/22	.03, .07	E.03	--	NA
Picloram	Tordon	Systemic herbicide	2/22	.03	3	2	500
Simazine	Princep	Selective herbicide	2/21	.005	E.007	C.006	4
Non-focal pesticides detected in ground water from Niobrara and Weston Counties							
Diuron	Farmco, Durashield	Herbicide	2/22	0.02	0.05	C0.04	[5]10
Oryzalin	Surflan	Selective herbicide	1/22	.01	.6	--	NA
Prometon	Pramitol	Non-selective herbicide	4/21	.01	.05	.03	[5]100
Focal pesticides not detected in ground water from Niobrara and Weston Counties							
Alachlor, Aldicarb, Aldicarb Sulfone[7], Aldicarb Sulfoxide[7], Cyanazine, 2,4-D, DCPA, Dicamba, Dichloropropene, Hexazinone, Metolachlor, Metribuzin, Tebuthiuron							
Focal pesticides not analyzed in ground water from Niobrara and Weston Counties (no method of analysis available)							
Difenzoquat							

[1]Meister (2002).

[2]Each of the 11 wells was sampled twice. One well had only one analysis of simazine and prometon.

[3]The minimum reporting level is the smallest concentration of a constituent that may be reliably reported by using a given analytical method. The minimum reporting level for metsulfuron was changed from 0.03 ug/L for late summer 2005 samples to 0.07 ug/L for the spring 2006 samples by the USGS National Water Quality Laboratory.

[4]U.S. Environmental Protection Agency Maximum Contaminant Level unless otherwise noted (U.S. Environmental Protection Agency, 2004).

[5]U.S. Environmental Protection Agency Lifetime Health Advisory Level (U.S. Environmental Protection Agency, 2004).

[6]Bob Benson, U.S. Environmental Protection Agency, written commun., December 30, 2003.

[7]Degradation product of aldicarb.

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 entered into a county's ground water. The second phase, problem identification monitoring, is used to gather additional information about 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 pesticide contamination. 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 pesticide contamination. Each county was ranked according to the extent of cropland and urban areas in the county, as well as to 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 aquifers (Hamerlinck and Arneson, 1998). A Geographic Information System was used to overlay digital information about the hydrogeology and land use. Ground water can be vulnerable to contaminants because of either inherent sensitivity of the hydrogeology (such as a shallow water table or highly permeable aquifer materials) or the combination of the sensitivity and associated land use. The map was used to select monitoring sites in each county. The baseline monitoring focuses on areas where the ground water is most vulnerable (fig. 2).

The GPSC selected 18 pesticides and 2 degradation products as the focal pesticides to be analyzed for as part of the SMP (table 1). The analytical method used to detect the focal pesticides also can detect about 100 other pesticides and degradation products. Any additional pesticides that were detected are listed in table 1 as non-focal pesticides. 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 these counties:

- 1995–1996: Goshen;
- 1997: Park;
- 1997–1998: Washakie;
- 1998–1999: Fremont, Lincoln, and Laramie;
- 1999–2000: Big Horn and Sheridan;
- 2000–2001: Platte, Johnson, and Crook;
- 2001–2002: Natrona, Sweetwater, and Teton;
- 2002–2003: Uinta;
- 2003–2004: Albany, Converse, and Hot Springs;
- 2004–2005: Carbon, Campbell, and Sublette;
- 2005–2006: Niobrara and Weston.

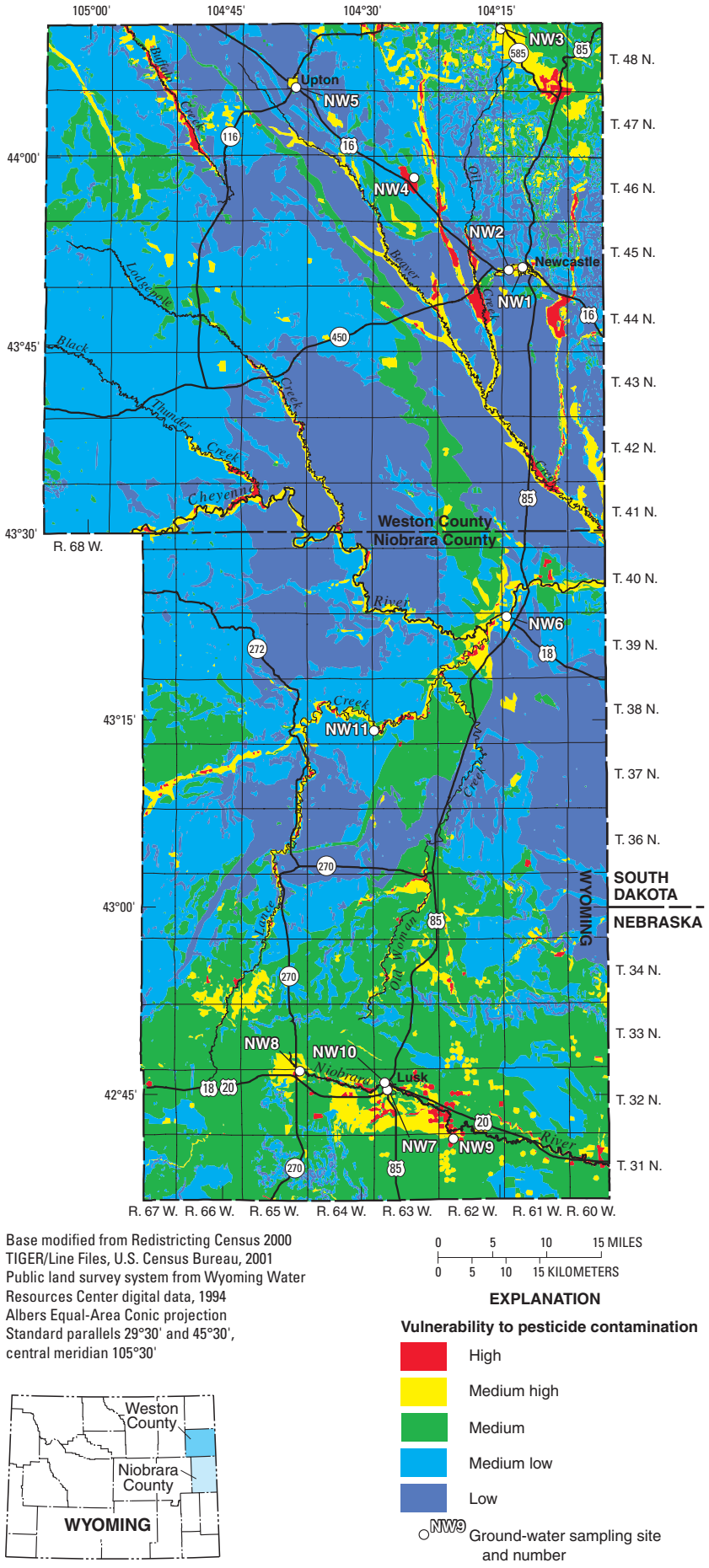

Figure 2. Vulnerability of ground water in Niobrara and Weston Counties, Wyoming, to pesticide contamination (from Hamerlinck and Arneson, 1998).

Ground-Water Monitoring in Niobrara and Weston Counties

Ground water in Niobrara County was ranked twenty-third and ground water in Weston County was ranked thirteenth most vulnerable to pesticide contamination in Wyoming (Wyoming Groundwater and Pesticide Strategy Committee, 1999). Because the land area in Niobrara and Weston Counties deemed vulnerable to ground-water pesticide contamination constituted a small fraction of the total land area, the GPSC combined the two counties into a single study. This facilitated location of suitable sampling sites, and was considered a reasonable compromise because of the similar geologic settings and land uses in the two counties. The vulnerability map by Hamerlinck and Arneson (1998) identifies unconsolidated Quaternary alluvial and terrace deposits in the counties and older consolidated units that underlie urban areas as the most vulnerable to pesticide contamination (shown as red or yellow on fig. 2).

Eleven wells were selected in Niobrara and Weston Counties (fig. 3) for baseline monitoring. All wells were located in areas that had high or medium high vulnerability to pesticide contamination (fig. 2). All wells were sampled twice, once in September 2005 and once in April 2006. Six of the 19 focal pesticides with available analyses and 3 non-focal pesticides were detected in the wells sampled (table 1). Pesticides were detected in 6 of the 11 wells sampled in Niobrara and Weston Counties (fig. 3); concentrations of each detected pesticide were equal to or less than 1/150 of the applicable drinking-water standard (U.S. Environmental Protection Agency, 2004) (table 1).

The most commonly detected pesticide (4 of 21 samples) in Niobrara and Weston Counties was prometon. Prometon, the active ingredient in the general-use pesticide Pramitol, typically is detected in urban areas (Barbash and others, 1999). Prometon was the most commonly detected pesticide in Albany, Campbell, Carbon, Converse, Crook, Johnson, Natrona, Sheridan, Sublette, Teton, and Uinta Counties.

Data Distribution and Availability

Sampling results have been provided to local groups interested in pesticides in ground water in Niobrara and Weston Counties. The information can be used by citizens and local governments to help understand current (2005–2006) conditions. Analytical results of sampling in Niobrara and Weston Counties can be found in Blajszczak and others (2006) and U.S. Geological Survey (2007). All water-quality data for Wyoming can be found at *http://waterdata.usgs.gov/wy/nwis/qwdata*. Analytical results and Fact Sheets for all counties are available from the U.S. Geological Survey,

Wyoming Water Science Center by phone, email, or the Internet at *http://wy.water.usgs.gov/projects/pesticides/*.

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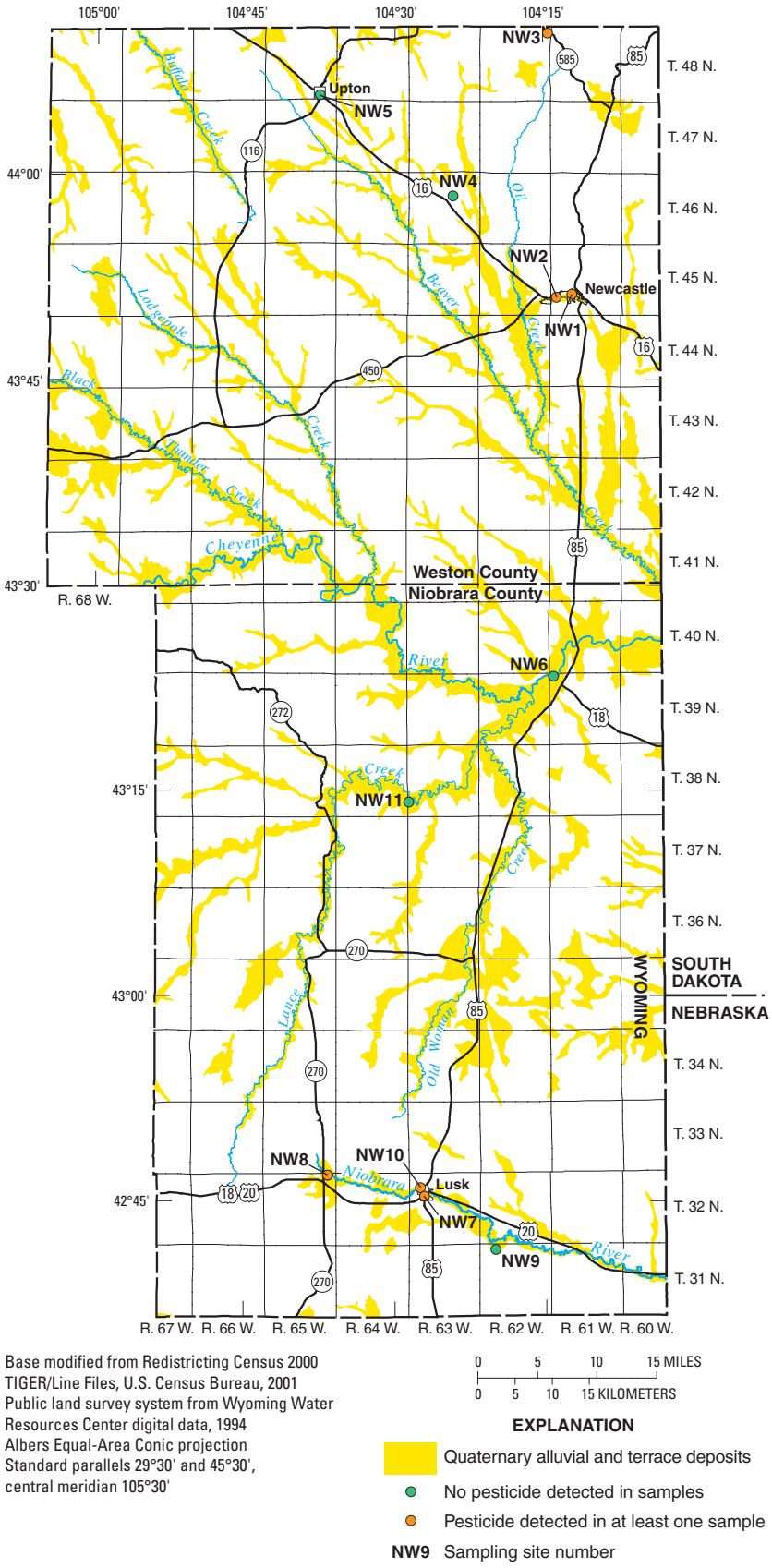

Figure 3. Location of wells sampled in Niobrara and Weston Counties, Wyoming, and notation of pesticide detection in samples from each well.

This Fact Sheet 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.