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Monitoring for Pesticides in Ground Water in Nevada, 2001

Introduction

About 1 billion pounds of pesticides are used per year in agricultural and urban areas throughout the United States to control weed encroachment, plant disease, and insect predation (U.S. Geological Survey, 1999). Frequency of pesticide detections in ground water has increased over the last 20 years (U.S. Environmental Protection Agency, 1992). In 1985, the U.S. Environmental Protection Agency (USEPA) estimated the detection of at least 17 agricultural pesticides in the ground water of 23 states. By 2000, the U.S. Geological Survey (USGS) reported at least one pesticide was found in almost every water and fish sample collected in streams and in more than one-half of shallow wells sample in agricultural and urban areas (U.S. Geological Survey, 2000). To protect ground water from pesticide contamination, USEPA, through the Federal Insecticide Fungicide and Rodenticide Act (FIFRA), requires all states to institute a ground-water protection program. This fact sheet describes current (2001) pesticide monitoring of ground water in Nevada by the Nevada Department of Agriculture (NDOA) and supersedes Adams and others (1997).

Pesticides enter ground water directly and indirectly (fig. 1). Direct entry may result from pesticide spills near poorly sealed wells and from pesticide application through improperly designed or malfunctioning chemigation (chemical and irrigation delivery) systems, typically those systems without backflow protection. Indirect entry may result from percolation of lawn and agricultural irrigation water, urban runoff, and municipal wastewater effluent containing pesticides through soil, drainage ditches, and streambeds.

The NDOA, in cooperation with USEPA, currently (2001) is developing a management plan to protect Nevada's ground-water resources from pesticide contamination. An essential element of the NDOA plan is the network of ground-water sampling sites (fig. 2) that will help detect contamination in its early stages. Ground water is monitored in areas where pesticides potentially may cause adverse effects to human health or the environment. NDOA uses this information to develop programs for managing pesticide use and for minimizing pesticide contamination.

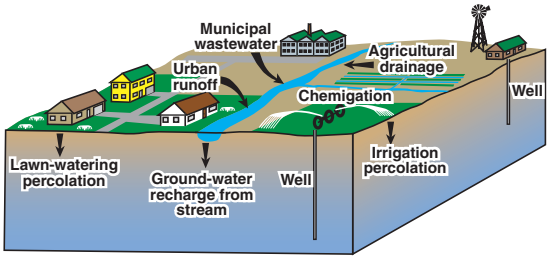

Figure 1. Schematic illustrating routes of pesticides into ground water.

The NDOA began monitoring ground water in 1993 in Mason Valley. This site is 1 of 20 geographic areas in the monitoring network (fig. 2, table 1). Initially, water from generally deep, irrigation, domestic, and municipal wells was sampled. No pesticides were detected in water samples from the NDOA network of supply wells, which were not sampled by NDOA after 1997. Recently, however, the USGS National Water-Quality Assessment (NAWQA) Program reported the detection of pesticides in shallow ground water (less than 100 feet below land surface) from 1993 through 1995 within the urban areas of Reno-Sparks and Las Vegas, and in the agricultural areas of Carson Valley and Carson Desert (Bevans and others, 1998; Lico, 1998). This information led NDOA and USGS, in a cooperative effort, to modify the design of the pesticide monitoring network.

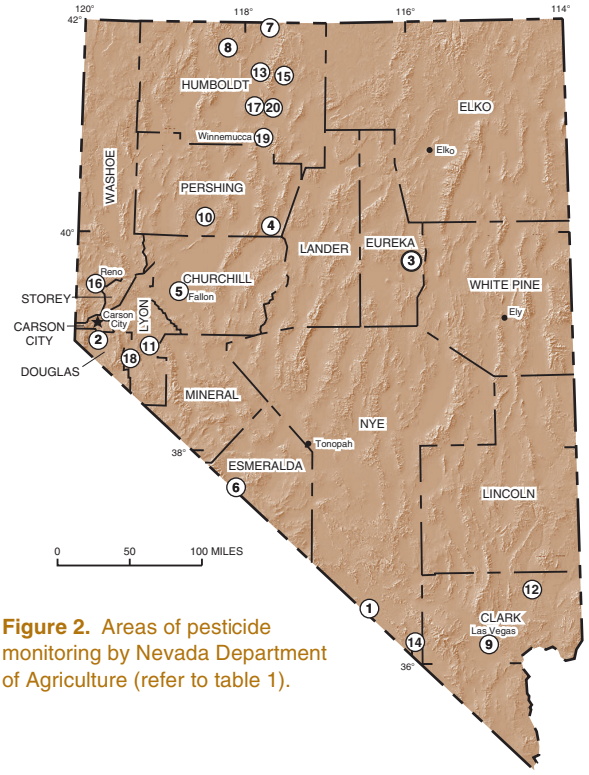

Figure 2. Areas of pesticide monitoring by Nevada Department of Agriculture (refer to table 1).

Table 1. Areas of pesticide monitoring by Nevada Department of Agriculture and principal land use in Nevada

Area no. (fig. 2)	Geographic area (County)	Hydrographic area[1]	Actual and intended sample year	Principal land use
1	Amargosa Valley (Nye)	Amargosa Desert	1995, 2001	Forage, grains
2	Carson Valley (Douglas)	Carson Valley	2002	Forage, urban
3	Diamond Valley (Eureka)	Diamond Valley	1998	Forage, grains
4	Dixie Valley (Churchill)	Dixie Valley	1997	Forage, grains
5	Fallon (Churchill)	Carson Desert	1999	Forage, grains
6	Fish Lake Valley (Esmeralda)	Fish Lake Valley	1996	Alfalfa, grains
7	Fort McDermitt Indian Reservation (Humboldt)	Quinn River Valley, McDermitt Subarea	1995	Potatoes, forage
8	Kings River Ranch (Humboldt)	Little Humboldt Valley	1995	Potatoes, forage
9	Las Vegas (Clark)	Las Vegas Valley	1998–2001	Urban, forage
10	Lovelock (Pershing)	Lovelock Valley	1997	Alfalfa seed, forage
11	Mason Valley (Lyon)	Mason Valley	1993	Onions, garlic
12	Moapa (Clark)	Lower Meadow Valley Wash	1999–2001	Forage, grains
13	Orovada[2] (Humboldt)	Quinn River Valley, Orovada Subarea	1994, 1997–2001	Alfalfa seed, potatoes
14	Pahrump (Nye)	Pahrump Valley	2001	Forage, grains
15	Paradise Valley (Humboldt)	Paradise Valley	1995	Potatoes, forage
16	Reno (Washoe)	Truckee Meadows	2000–2001	Urban, forage
17	Silver State Valley (Humboldt)	Silver State Valley	1994	Potatoes, forage
18	Smith Valley (Lyon)	Smith Valley	2002	Onions, garlic
19	Winnemucca (Humboldt)	Winnemucca Segment	1995	Potatoes, forage
20	Winnemucca Farms (Humboldt)	Paradise Valley	1994–1995	Potatoes, forage

[1] Formal hydrographic areas in Nevada (Rush, 1968; Cardinalli and others, 1968).
[2] In 1997, three shallow ground-water monitoring wells were installed by the USGS.

In most geographic areas, about 20 wells in the upper 10 to 20 feet of the water table are sampled in a designated year (table 1). The water from these wells is sampled semiannually, in spring before irrigation and pesticide application and in the fall after the growing season. The objectives of sampling water are to assess the occurrence of pesticides within recharge areas of shallow ground water that underlie residential, commercial, and agricultural settings and to protect the deep, potable ground water. Each ground-water sample is analyzed for 47 pesticides (table 2).

To date (2001), 5 pesticides have been detected from the monitoring network (table 2). A summary of pesticide detections in seven of the geographic areas sampled since 1997 is listed in table 3. Monitoring results show (1) that the use of more sensitive analytical methods and sampling of shallow ground water after 1997 resulted in the detection of more pesticides, (2) that only the concentration of atrazine exceeded the USEPA Maximum Contaminant Level (MCL) of 3.0 µg/L for public drinking water at only one shallow monitoring site in the Orovada area, (3) concentrations of 26 pesticide detections generally are <1 µg/L, and only 1 of the 5 pesticides detected has an MCL. This may be of concern, and (4) pesticides are more likely to be detected in the fall after the summer growing season. Monitoring for pesticides in shallow ground water, using more sensitive analytical methods, can provide early warning of potential contamination of deeper water supplies. Monitoring also can permit identification of potential sources of pesticides and possible routes for their transport (fig. 1). This information can be used to establish effective programs for protecting Nevada's ground-water resources.

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Table 2. Pesticide compounds analyzed in ground-water samples by the Nevada Department of Agriculture

[Abbreviation: µg/L, micrograms per liter. Symbol: (*), pesticides detected in ground-water samples]

Pesticide	Estimated detection limit (µg/L)	Maximum contaminant level[1] (µg/L)	Pesticide	Estimated detection limit (µg/L)	Maximum contaminant level[1] (µg/L)
2,4,5-T	1.5		Diuron (*)	0.07	
2,4,5-TP	1.5		Disulfoton	2.50	
2,4-D	1.5	70	Hexazinone	.25	
2,4-DB	1.5		Malathion	.04	
3-Hydroxycarbofuran	2.0		MCPA	1.3	
Acifluorfen	1.5		MCPB	1.2	
Alachlor	.02		MCPP	1.3	
Aldicarb	1.0		Methidathion	.07	
Aldicarb Sulfone	2.0	7	Methiocarb	4.0	
Aldicarb Sulfoxide	2.0	7	Methomyl	.5	
Atrazine (*)	.07	3	Methyl Parathion	.03	
Bentazon (*)	1.5		Metolachlor (*)	.03	
Bromacil (*)	.13		Metribuzin	.03	
Bromoxynil	1.0		Oxamyl	2.0	200
Carbaryl	2.0		Parathion	.04	
Carbofuran	1.5	40	Pendimethalin	.03	
Chlorpropham	.08		Picloram	.5	500
Chlorpyrifos	.03		Prometon	.03	under review
Cyanazine	.20		Pronamide	.03	
Dacthal (DCPA)	.02		Propoxur	1.0	
Diazinon	.05		Simazine	.10	4
Dicamba	1.3		Tebuthiuron	.03	
Dimethoate	.04		Trifluralin	.01	
Dinoseb	2.0				

[1] U.S. Environmental Protection Agency, 2000.

Table 3. Summary of pesticide detections in geographic areas sampled since 1997

[Symbol: ≥, greater than or equal to]

Area number (fig. 2)	Geographic area (County)	Year sampled	Spring		Fall	
			Number of wells sampled	Number of wells sampled with ≥1 pesticide detection	Number of wells sampled	Number of wells sampled with ≥1 pesticide detection
3	Diamond Valley (Eureka)	1998	15	0	15	0
5	Fallon (Churchill)	1999	22	0	22	0
9	Las Vegas (Clark)	1999	19	0	19	5
		2000	10	0	10	0
10	Lovelock (Pershing)	1997	21	0	14	0
12	Moapa (Clark)	1999	2	0	2	1
		2000	2	0	2	0
13	Orovada (Humboldt)	1997	3	2	3	3
		1998	3	3	3	3
		1999	3	3	3	3
		2000	3	3	3	3
16	Reno (Washoe)	2000	26	0	26	0

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