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U.S. Geological Survey

Monitoring for Pesticides in Ground Water in Nevada

Many pesticides designed to control weed encroachment, plant disease, and insect predation are used in agricultural and urban areas in the United States. Contamination of ground water by pesticides 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 1988, pesticides identified in ground water had increased to 46 in 26 states. To protect ground water from pesticide contamination, USEPA, through the Federal Fungicide Insecticide and Rodenticide Act (FIFRA), requires all states to institute a ground-water protection program.

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

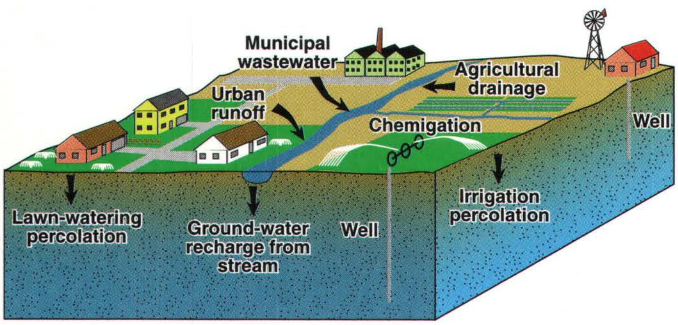

Figure 1. Schematic illustrating routes of pesticides into ground water.

The Nevada Division of Agriculture (NDOA), in cooperation with USEPA, currently (1997) is finalizing a management plan to protect Nevada's ground-water resources from pesticide contamination. An essential element of the NDOA plan is the establishment and operation of a network of ground-water sampling sites 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 minimizing pesticide contamination.

The NDOA began monitoring ground water in 1993 with sampling in Mason Valley. Currently, a network of 20 geographic areas is being planned (fig. 2). Approximately 12 generally deep wells that provide water for irrigation, domestic, or municipal use are monitored in each geographic area for a designated year (table 1). The water from these wells is sampled semiannually, usually in the spring and fall. Each water sample is analyzed for 37 pesticide compounds (table 2). As of spring 1997, no pesticides were detected in samples from the NDOA network of water supply wells.

Recently, scientists of the U.S. Geological Survey (USGS) National Water-Quality Assessment (NAWQA) Program reported the detection of pesticides in shallow ground water (less than 100 feet below land surface) sampled during the period 1993-95 within the urban areas of Reno-Sparks (Neal and Schuster, 1996) and Las Vegas (Covay and Bevans, 1997), and in the agricultural areas of Carson Valley and Carson Desert (Kilroy and Watkins, 1997). This information led NDOA and USGS, in a cooperative effort, to install three monitoring wells in 1997 designed to sample shallow ground water for pesticides in the Orovada area. The pesticide bentazon was present in the water sampled from one of these wells. The concentration of bentazon was approximately 3.0 micrograms per liter, well below the established USEPA health advisory limit of 20 micrograms per liter (U.S. Environmental Protection Agency, 1995).

To date, the monitoring results have shown (1) that concentrations of pesticides detected in Nevada ground water are below those established by the USEPA for safe drinking water, and (2) that pesticides are more likely to be found in the shallower ground water than in water from the deeper supply wells. The monitoring of pesticides in shallow ground water can provide an early warning as to 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.

The detection of bentazon in the Orovada area monitor well by the NDOA and other pesticide detections in shallow wells by the USGS NAWQA Program has prompted the NDOA and USGS to coordinate their future monitoring activities. These agencies will focus their efforts in areas where ground-water resources are most vulnerable to pesticide contamination. The clearer focus and more efficient use of available resources resulting from this coordination will improve the effectiveness of both programs.

Developing a newly-installed pesticide monitoring well near Orovada, Nevada. (Photograph by Jon Carpenter, NDOA, Winnemucca, Nev.)

Table 1. Areas of pesticide monitoring by Nevada Division of Agriculture and irrigated land use in Nevada

Area no. (fig. 2)	Geographic area (County)	Hydrographic area[1]	Actual or intended sample year	Principal land use
1	Amargosa Valley (Nye)	Amargosa Desert	1995, 2000	Forage, grains.
2	Carson Valley (Douglas)	Carson Valley	2002	Forage, urban.
3	Diamond Valley (Eureka)	Diamond Valley	1998	Forage, grains.
4	Dixie Valley (Pershing)	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, 2000	Urban, forage.
10	Lovelock (Pershing)	Lovelock Valley	1997	Alfalfa seed, forage.
11	Mason Valley (Lyon)	Mason Valley	1993	Onions, garlic.
12	Moapa (Clark)	(2)	2000	Forage, grains.
13	Orovada[3] (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	1999, 2001	Urban, forage.
17	Silver State Valley (Humboldt)	Silver State Valley	1994	Potatoes, forage.
18	Smith Valley (Lyon)	Smith Valley	1993	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]Hydrographic area not yet selected.
[3]In 1997, three shallow ground-water monitoring wells were installed by the USGS.

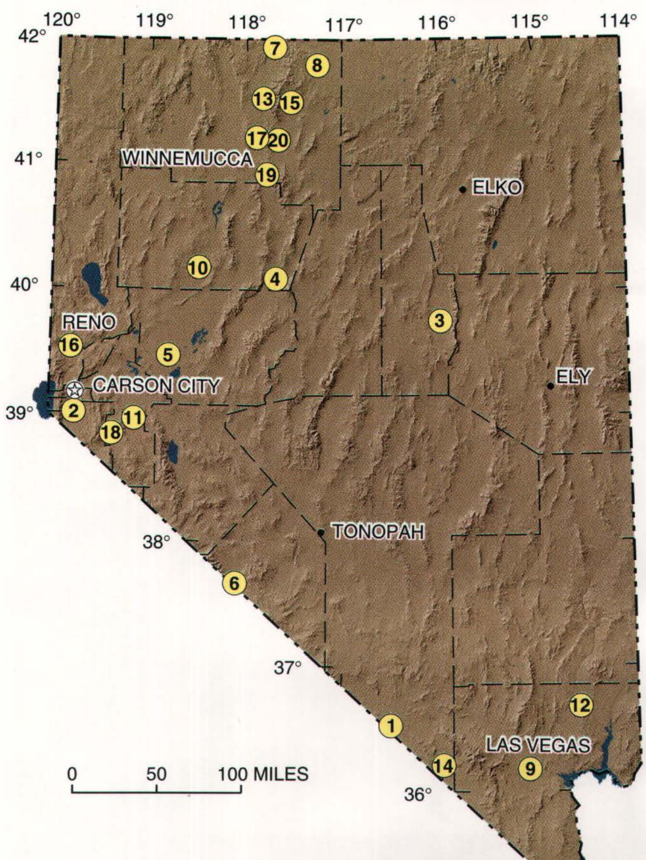

Figure 2. Areas of pesticide monitoring by Nevada Division of Agriculture (refer to table 1).

Table 2. Pesticide compounds for which the Nevada Division of Agriculture analyzes ground-water samples

2,4,5-T	Bromoxynil	MCPP
2,4,5-TP	Carbaryl	Methidathion
2,4-D	Carbofuran	Methiocarb
2,4-DB	Chlorpropham	Methomyl
3-Hydroxycarbofuran	Cyanazine	Metolachlor
Acifluorfen	Dacthal	Oxamyl
Alachlor	Dicamba	Parathion
Aldicarb	Dimethoate	Picloram
Aldicarb Sulfone	Dinoseb	Pronamide
Aldicarb Sulfoxide	Diuron	Propoxur
Atrazine	MCPA	Simazine
Bentazon	MCPB	Tebuthiuron
Bromacil		

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