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EPA

Pesticides In Drinking-Water Wells

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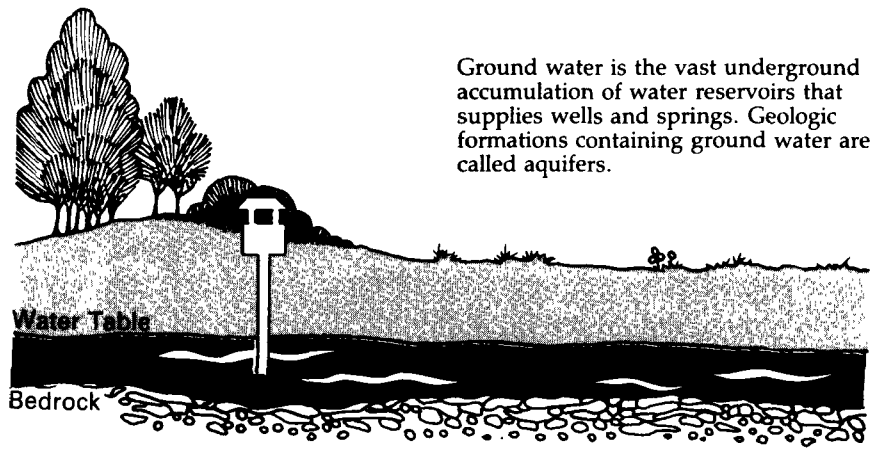
Pesticides In Drinking-Water Wells

This booklet is intended for people who drink water that comes from a well and who are concerned that pesticides may be present in their drinking water. The booklet provides a step-by-step explanation of how pesticides can enter drinking-water wells, the types of health concerns that pesticides can pose, advice on testing your water supplies, and actions that can be taken if contamination is found. Sources of further information and assistance are listed at the back of the booklet.

Nearly half of all Americans get their drinking water from private or community wells that tap ground water. Our dependence on ground water to meet drinking water needs is growing. Withdrawal of ground water is increasing at twice the rate of surface water, and this trend is expected to continue. In some rural areas, ground water accounts for up to 95 percent of the water used for domestic purposes.

Until the late 1970s, it was generally believed that ground water was fairly well protected from pesticide contamination by layers of topsoil, subsoil, rock, and clay. Nevertheless, pesticides *can* enter ground water. When that happens, there may be a potential risk to the health of those who drink and use that water.

In response to this potential threat, the U.S. Environmental Protection Agency (EPA) has undertaken a number of activities. The pesticides EDB and DBCP have been banned based on health concerns and evidence that they leach into ground water; regulatory measures are under development for Aldicarb; and in 1988, EPA proposed a strategy for "Agricultural Chemicals in Ground Water." Numerous drinking water standards and guidelines are being established for pesticides. In addition, in a major effort to determine the extent of the problem of pesticides in drinking water wells, EPA has undertaken a National Pesticide Survey of drinking water wells.



Ground water is the vast underground accumulation of water reservoirs that supplies wells and springs. Geologic formations containing ground water are called aquifers.

The National Pesticide Survey

The National Pesticide Survey was the first study of its kind to be conducted on a national scale. Between 1988 and 1990, 1,350 wells located in all 50 states were sampled for over 100 pesticides as well as nitrates and nitrites.

Results of the survey will indicate to what extent private and community wells across the nation are contaminated with pesticides. Survey data will also yield information on the characteristics of the wells tested, the hydrogeological vulnerability of areas surrounding each well, and patterns of pesticide and fertilizer usage in nearby areas.

This information is critical for improving our understanding of how pesticide use [illegible]

What Are Pesticides? How Are They Regulated?

A pesticide is a chemical substance used to kill or control a pest. "Pest" is a simple catchall term that includes undesired insects, weeds, rodents, fungi, bacteria, and other organisms. Thus, the term "pesticides" includes insecticides, herbicides, nematicides, acaracides, rodenticides, and fungicides.

Pesticides are regulated by the federal government as well as by the states. At the federal level, pesticides are regulated by EPA under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Under FIFRA, EPA registers thousands of pesticide products for a multitude of uses in and around homes and buildings, on trees and shrubs, on golf courses, and for agricultural pest control. No pesticide may be legally sold or used in the United States unless its label bears an EPA registration number and establishment number.

If EPA approves the use of a pesticide, the approval extends only to specific uses. The pesticide's label explains where and how the pesticide may be used. A number of pesticides are registered and labeled as "restricted use" pesticides. Only certified applicators may use these materials.

Pesticides are subject to extensive scientific testing before being registered for the first time to ensure that, when used according to label directions, they will not present unreasonable risks to human health or the environment. EPA reserves the right to require additional data at any time if new information raises questions about the pesticide's health or environmental effects. FIFRA also requires the re-registration of pesticides first registered before today's health and environmental tests were required and before pesticides were known to leach into ground water. Using current scientific standards, EPA is re-examining health and environmental safety information for the approximately 600 major active ingredients contained in some 25,000 registered pesticide products.

Discoveries of Pesticides in Ground Water

The first major discovery of pesticides in ground water occurred in 1979 when Dibromochloropropane (DBCP) was detected in minute quantities in about 2500 wells in California. DBCP ground-water contamination was soon found in four other states as well. Another pesticide, Aldicarb, was found in wells on Long Island, New York, and subsequently in 12 other states.

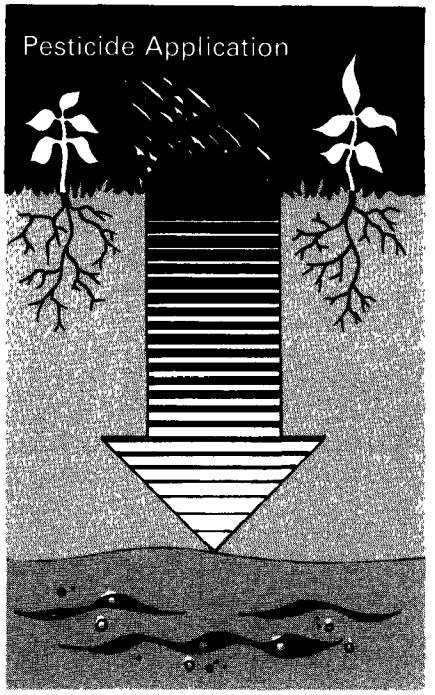
In Florida, more than 1000 wells have been shut down as drinking water sources because of contamination by Ethylene Dibromide (EDB). And in the San Joaquin Valley in California, DBCP may be present in approximately one-quarter of the usable ground water.

A number of states, including California, Florida, Maryland, Minnesota, Iowa, New York, Washington, and Wisconsin, have undertaken studies of pesticides in ground water. In 1985 EPA estimated that at least 17 pesticides have been detected in the ground water of 23 states as a result of agricultural practices. In 1988, EPA reported that normal agricultural use had apparently led to residues of 46 different pesticides in the ground water of 26 states.

How Do Pesticides Get Into Drinking-Water Wells?

Pesticides can enter ground water both directly and indirectly. Direct contamination may occur from pesticide spills around a poorly sealed well, back-siphoning during spray tank filling or chemigation (application of pesticides through irrigation systems), or improper storage and disposal of pesticides or pesticide containers. Indirect contamination can occur when pesticides move down through the soil into the ground water. This may occur in pesticide mixing areas or disposal areas, or as a result of normal application.

The extent to which ground-water contamination can occur as a result of normal crop application depends on a variety of factors: the type of pesticide used, how the pesticide is applied (application method, frequency, and quantity), the characteristics of the soil, and the geology of the area. These factors, working singly or in combination, will determine how quickly the pesticide will move through the soil and how fast it will break down. The best way to determine whether pesticides have entered a water supply is to take samples of the water and have them tested in a laboratory.



Do Pesticides In Drinking Water Pose A Health Concern?

Pesticides can be harmful to you if you are exposed to a sufficient amount. Most people are exposed to some pesticide residues in food products. In addition, people who use and handle pesticides may be exposed to them through breathing in pesticide fumes or through skin contact.

Pesticide levels in drinking water normally result in a much lower exposure than exposure through food or through handling pesticide products. There are three ways in which you can be exposed to pesticides in drinking water:

- by ingestion—either by drinking the water directly or eating foods cooked with the water;
- by breathing in pesticide fumes in the shower or when cooking or washing; and
- by absorbing the pesticides through the skin during showering, swimming, or washing.

The degree to which pesticides may affect the human body depends on:

1. The toxicity of the pesticide—Pesticides can cause a range of possible harmful effects, extending from a mild headache to skin rashes to long-term effects on internal organs, cancer, and death. Pesticides diluted in water are much less dangerous than the pure compound; however, even minute quantities of some chemicals in the water may be cause for concern.

2. A person's exposure to the pesticide—Exposures are based upon the amount of the pesticide in the water, the amount of water to which a person is exposed, the weight of the person, and the length of time the person is in contact with this water.

3. The health status of the individual—People with health problems, older people, infants and children, and pregnant women may be more susceptible to pesticide hazards than the general population.

What this means is that pesticides may or may not pose different types of health risks, depending on the circumstances. Different pesticides have different effects on humans. Moreover, exposure to a small amount of a pesticide over a long period of time can have a different effect than a one-time exposure to a large amount of a pesticide. Further more, certain exposures of pesticides in drinking water may be too high for children but acceptable for adults. These different situations call for different risk assessments and different types of remedies.

Because there are so many factors involved in considering the risks posed by each pesticide, EPA has developed technical guidance documents that provide detailed assessments for particular pesticides.

EPA's Health Advisory Guidance

EPA has developed guidance documents called Health Advisories to assist federal, state, and local officials in responding to the contamination of drinking water by pesticides and other chemicals. The Health Advisory documents contain information on health risks and treatment technologies, and are updated by EPA's Office of Drinking Water as new information becomes available.

The Health Advisory documents specify Health Advisory levels, which represent the concentrations of a contaminant in water that may safely be consumed over a specific time period. EPA sets Health Advisory levels for short-term exposures such as one day and ten days, longer-term exposures of greater than ten days up to several years, and lifetime exposures. These Health Advisory levels are based on health effects (other than cancer) that were found in animals given high doses of the pesticides in laboratory studies.

For pesticides believed to cause cancer in humans, EPA does not calculate a Lifetime Health Advisory level. Instead, EPA calculates the increased risks of cancer that are associated with different concentrations and exposures to the pesticide. The risks that are typically presented in a Health Advisory document range from an increased risk of 1 additional cancer case in a population of 10,000 people exposed to the pesticide, to the risk of 1 additional cancer case in a population of 1 million people exposed. For more information on Health Advisories, contact the Safe Drinking Water Hotline at 1-800-426-4791.

Health Advisory Summaries

EPA has prepared summaries of Health Advisories for the pesticides listed below as well as for nitrates/nitrites. The one-page summaries are intended to provide clear and understandable guidance to the public on possible health effects of these chemicals and actions that may be taken to ensure a safe drinking water supply. To obtain copies of the summaries, call EPA's Safe Drinking Water Hotline at 1-800-426-4791.

Acifluorfen	Chlordane	Diuron	Oxamyl
Alachlor	Chlorothalonil	Endrin	Pentachlorophenol
Aldicarb &	Cyanazine	Ethylene Dibromide	Picloram
Aldicarb sulfone &	Dacthal (DCPA)	Ethylene thiourea	Prometon
Aldicarb sulfoxide	Dalapon	Fenamiphos	Pronamide
Ametryn	2,4-D	Fluometuron	Propachlor
Atrazine	DBCP	Heptachlor &	Propazine
Baygon	Diazinon	Heptachlor epoxide	Propham
Bentazon	Dicamba	Hexachlorobenzene	Simazine
Bromacil	1,2-Dichloropropane	Hexazinone	2,4,5-T
Butylate	1,3-Dichloropropene	Methomyl	2,4,5-TP (Silvex)
Carbaryl	Dieldrin	Methoxychlor	Tebuthiuron
Carbofuran	Dinoseb	Metolachlor	Terbacil
Carboxin	Diphenamid	Metribuzin	Terbutos
Chloramben	Disulfoton	Nitrate/Nitrite	Trifluralin

"Is My Well Water Safe To Drink?"

Usually—yes! Sometimes, however, there is no simple, clear-cut answer. Detection of a small amount of a pesticide in your water sample may serve as a warning or cautionary signal, like a yellow traffic light.

For example, if water samples from your well consistently show 5 micrograms of Atrazine per liter,* and the Lifetime Health Advisory for Atrazine is 3 micrograms per liter, this would not necessarily mean that any harm would occur, because Health Advisories have a built-in margin of safety. Your risk of adverse health effects would depend on your health, how long you will be exposed to the water, and whether any additional contaminants might be present. Exposure to several pesticides or other hazardous chemicals together may multiply the effects of any single chemical.

In such a situation, EPA would recommend that you consider taking action to assure a safer water supply. A first step would be to contact your state or county officials for advice. The Health Advisories would serve as guidelines to help both you and the experts you consult determine how to respond in your individual situation.

* Micrograms per liter are the units of measurement for contaminants in water, equivalent to parts per billion.

Testing And Retesting

Testing drinking water for pesticides is more complex than routine tests for minerals or bacteria. Pesticide testing requires more specialized equipment and training, since pesticides generally occur only at very low levels in ground water. If you are concerned about pesticide contamination of your well, first contact your state or county officials and find out whether contamination problems have been reported by other residents in the area. Also find out which pesticides and fertilizers are commonly used nearby. If contamination has been confirmed in your area, you should have your well tested.

For advice on testing services, contact your state or county officials, state university laboratories, or your EPA Regional Office (listed at the back of this booklet). Be sure to obtain the services of a certified testing service or laboratory. Know the costs beforehand! Costs for water analysis for pesticides vary from one commercial laboratory to the next. For analysis of a single water sample for one or two pesticides, a laboratory may charge between $100 and $150. The cost per sample is usually somewhat less if several water samples are analyzed at the same time. The testing cost for nitrates is about $30.

Many commercial laboratories offer a standard screening test for a number of pesticides and related compounds regulated under the Clean Water Act; before proceeding, you should check with

your state or county officials as to whether it is appropriate to test your water for these chemicals.*

If your well has been tested and pesticides have been found, EPA recommends that you have the well retested. This is because changes in rainfall, in pesticide use, or in water withdrawals from your well or wells nearby can cause wide variations in the levels of any pesticides found in your well at a specific time. Retesting may provide you with a better overall picture of your water quality.

Upon retesting, if a pesticide is detected in your well water at or below EPA's Health Advisory level, you should continue to have your well checked periodically. Ask your state or county health officials for advice on how often retesting should be done. If a pesticide is present above the Health Advisory level, you should consult your state or county health officials for advice on action to limit your exposure to the pesticide.

Finally, if you have reason to believe that your neighbors share a ground-water source containing pesticides, they should be informed of the potential risks and encouraged to have their wells tested.

*Commercial water testing laboratories may not be able to repeat exactly the procedures used to analyze water samples for the National Pesticide Survey. EPA developed these procedures specifically for the survey in order to test for a large number of pesticides simultaneously. However, most laboratories should be able to retest your water for any specific pesticides that may have been found in your well water.

There is no economical way to clean up contaminated water while it is in the ground. Instead, your options for taking action will likely be to treat the water, dig a new or deeper well, or switch to an alternative water supply.

Your choice among these options should be based on an expert evaluation of the source of the problem and a realistic assessment of the costs involved in each option. You may be able to connect with a public water supply. In some cases, digging a new or deeper well may be a reasonable solution. In other parts of the country, this may be infeasible and/or extremely costly. EPA suggests that you proceed only with the advice of impartial experts, such as your state or county health officials.

Treating The Water

It may be possible to treat your drinking water to reduce the pesticides and nitrates present. However, not all available treatment techniques will be effective in reducing particular pesticides. EPA's Health Advisory Summaries identify treatment methods that may be effective for each individual pesticide.

The most common types of home treatment devices currently on the market are briefly described in the box on the next page. Prices shown are for 1988, and may vary by geographic region. The treatment systems require periodic

Home Water Treatment Methods to Reduce Pesticides & Nitrates

Activated carbon filters ("adsorption"): Carbon filters are widely used to remove a wide variety of synthetic organic chemicals, including some pesticides, from water. As contaminated water flows through the unit, the contaminants adhere to the carbon particles in the filter and remain behind. One drawback to this method is that it is hard to know when the carbon has become saturated with contaminants, so it is important to replace the carbon routinely.

Activated carbon filters come in a variety of sizes and designs, with costs ranging from $30 to $300 (including installation) for a single tap, and $600 to $1,000 for a whole house. The filters use either granular carbon, powdered carbon, or carbon blocks. Carbon filters require no mechanical or electrical controls and are installed in-line under pressure.

Reverse osmosis: In reverse osmosis units, water is forced through a series of filters and membranes that screen out contaminants. Contaminants are flushed down the drain along with 70 to 90 percent of the water entering the unit. The remaining 10 to 30 percent of the water entering the unit comes out as treated water. Unit costs range from $600 to $800. The units consume a large amount of water but do not require electricity.

Distillation and **anion exchange** are useful treatment methods for removing nitrates and a variety of other salt-type impurities. These methods are not, however, suitable for most pesticides. In distillation units, the water is boiled and then condenses in a separate chamber, leaving behind the contaminants. Distillation units range from $300 to $1,500, require a good deal of maintenance, and sometimes consume large amounts of electricity. Anion exchange units draw contaminants out of the water by means of resins that act almost like magnets. Unit costs range from $400 to $1,600. It is important to select the proper anion exchange unit that can remove the particular contaminants in your water.

monitoring and maintenance to ensure the unit's efficiency. Annual operating costs for a household can range from $30 to $350. When looking to purchase or lease home water treatment equipment, research the products available. Check performance capabilities, warranty, maintenance provisions, and general operation. Deal with a professional and be an educated consumer!

Some community water systems also use treatment methods, including reverse osmosis, ion exchange, oxidation, and air stripping, to treat contaminated water. More commonly, if there is contamination, community water systems will close down the contaminated well, or blend the water with water from other wells until acceptable water quality is reached, or use conventional treatment methods involving coagulation, sedimentation, and filtration to remove particulates and other contaminants.

Digging A New Well

Digging a new or deeper well may make sense if you are able to draw water from a deeper, clean aquifer. Unfortunately it often is difficult to know the quality of the ground water in different aquifers without drilling or extensive testing.

It is highly recommended that expert advice be sought before you drill! Your county extension agent, or officials from your state geological or water survey or environmental agency can advise you on whether the pesticides in your water are widely used in the county and are likely to be contaminating the aquifer. Local well drillers can advise you on the feasibility of installing a new or deeper well.

The cost of a new well will depend on the depth of the well, the materials used to construct the well, and the installation method. An estimated cost of a new well is between $3.50-$4.50 per inch diameter per foot of depth, plus casing and pump costs. (This estimate is based on a well up to 8 inches in diameter and up to 300 feet deep; costs will be higher if these dimensions are exceeded.) Try to get more than one estimate before proceeding.

Alternative Water Sources

What else can you do? Two other possibilities are purchasing bottled water and hooking up to a public water supply. Sometimes bottled water is a useful temporary alternative until a new permanent water supply can be secured. The cost of bottled water in 1988 was about $7 to $15 per week for a family of four, assuming each person used 2 liters per day for drinking water only. The cost to hook up to a public water supply will depend on the distance to a water main, the housing density in the area, and water payments. Households connected to public water systems may need to pay a service charge for their water.

Eliminating Direct Entry Of Pesticides Through The Well

It is possible that if pesticides are contaminating your well water, they are entering the ground water through the well itself rather than through the soil. If the well is old or poorly cemented or if there are visible cracks in the casing, you may wish to obtain expert advice on whether improvements to the well are possible. Simple methods of capping the well or sealing it at the surface could prove effective in eliminating further contamination.

In any case, if you use well water to mix large amounts of pesticides, no mixing activities should be done near the well, since a spill might lead to direct contamination of the well. If you or others living near you use pesticides extensively, you should consider attending training courses in pesticide use given by your state or county agricultural department.

Where Can I Get More Information?

Following is a sampling of publications and a partial list of organizations that may help you obtain more information. Please note that these lists are not comprehensive and are not necessarily endorsed by EPA.

Publications

"A Drop to Drink." Bruce Webendorfer. *Country Journal.* September 1988.

"Chemical Risk: A Primer." Information Pamphlet. American Chemical Society Department of Government Relations and Science Policy, 1155 16th Street NW, Washington, DC 20036. 1984.

"Citizen"s Guide to Pesticides" and "Citizen's Guide to Drinking Water." U.S. Environmental Protection Agency, 401 M Street SW, Washington, DC 20460. Free.

"Drinking Water: A Community Action Guide." Concern, Inc. 1794 Columbia Rd. NW, Washington, DC 20009. 1988. $3.00

"Groundwater & Environmental Pollution Self-Help Checklist for Farmsteads and Farm Fields" and "Protecting our Groundwater, a Grower's Guide," available from your state or county Farm Bureau office.

"Guidance Document on the Management of Pesticides in Groundwater." Office of Drinking Water, U.S. EPA. 401 M Street SW, Washington, DC 20460. Draft, September 1988. Free.

"Is the Water Safe to Drink?" Consumers Union. 256 Washington Street, Mt. Vernon, NY 10553. 1987. $16.00.

"Pesticides and Groundwater: A Health Concern for the Midwest." Freshwater Foundation. 2500 Shadywood Road, Box 90, Navarre, MN 55392. 1987.

"Pesticides in Groundwater: Background Document." U.S. EPA. 401 M St. SW, Washington, DC 20460. 1986. Free.

"Protecting Groundwater: A Guide for the Pesticide User." Slide Set Storyboard and Manual for Instructors. Keith S. Porter and Michael W. Stimmann. 468 Hollister Hall, Cornell University, Ithaca NY 14853. Sponsored by USDA and U.S. EPA. May 1988. $75.00.

"Safety on Tap: A Citizen's Drinking Water Handbook." League of Women Voters Eduction Fund. 1730 M Street NW, Washington, DC 20036. 1987. $7.95.

"Testing for Toxics: A Guide to Investigating Drinking Water Quality." R. Wilson. U.S. Public Interest Research Group. 215 Pennsylvania Ave. SE, Washington, DC 20003. 1986. $5.00

Organizations

American Public Health Association, 1015 15th Street NW, Washington, DC (202) 789-5600.

American Water Works Assocation, 6666 West Quincy Avenue, Denver, CO 80235 (303) 794-7711.

League of Women Voters, 1730 M Street NW, Washington, DC (202) 429-1965, and local chapters.

National Agricultural Chemicals Association, 1155 15th Street NW, Washington, DC (202) 296-1585.

National Coalition Against the Misuse of Pesticides, 530 7th Street SE, Washington, DC (202) 543-5450.

Natural Resources Defense Council, 122 East 42nd Street NY, NY 10168 (212) 949-0049.

National Rural Water Association, P.O. Box 1428, Duncan, OK 73534 (405) 252-0629.

National Water Well Association, 6375 Riverside Drive, Dublin, OH 43017 (614) 761-1711.

Water Quality Association, 4151 Naperville Road, Lisle, IL 60532 (312) 369-1600.

Contacts

State or County Health Department
State Department of Agriculture
State Pollution Control or Environmental Protection Agency
County Extension Office
Soil Conservation Service District Office
EPA Regional Office

For further information on treatment technologies, drinking water quality, and EPA's Health Advisories, call toll-free, Monday thru Friday, 8:30 A.M. to 4:30 P.M. E.S.T:

EPA's Safe Drinking Water Hotline
1-800-426-4791

(in Washington, D.C., call 382-5533).

Information on the health effects of pesticides and pesticide poisonings is available toll-free, 24 hours a day, from:

National Pesticide Telecommunications Network
1-800-858-7378

EPA Regional Offices and States Covered

EPA Region 1
JFK Federal Building
Boston, MA 02203
(617) 565-3424
Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, Vermont

EPA Region 2
26 Federal Plaza
New York, NY 10278
(212) 264-2515
New Jersey, New York, Puerto Rico, Virgin Islands

EPA Region 3
841 Chestnut Street
Philadelphia, PA 19107
(215) 597-9370
Delaware, Maryland, Pennsylvania, Virginia, West Virginia, District of Columbia

EPA Region 4
345 Courtland Street, N.E.
Atlanta, GA 30365
(404) 347-3004
Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee

EPA Region 5
230 South Dearborn Street
Chicago, IL 60604
(312) 353-2072
Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin

EPA Region 6
1445 Ross Avenue
Dallas, TX 75202
(214) 655-2200
Arkansas, Louisiana, New Mexico, Oklahoma, Texas

EPA Region 7
726 Minnesota Avenue
Kansas City, KS 66101
(913) 551-7003
Iowa, Kansas, Missouri, Nebraska

EPA Region 8
One Denver Place
999 18th Street, Suite 1300
Denver, CO 80202-2413
(303) 293-1692
Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming

EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105
FTS 8-848-1305
DDD (415) 744-1305
Arizona, California, Hawaii, Nevada, American Samoa, Guam, Trust Territories of the Pacific

EPA Region 10
1200 Sixth Avenue
Seattle, WA 98101
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