WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Washington State Pesticide Monitoring Program

Pesticides in Washington State's Ground Water A Summary Report, 1988 - 1995

Pesticides in Ground Water Report No. 9

April 1996

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by
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Environmental Investigations and Laboratory Services Program
Olympia, Washington 98504-7710

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Abstract

The Washington State Pesticide Monitoring Program, initiated in 1988, has sampled ground water at 243 sites in 11 study areas. Sites ranged from a field drain at a depth of 5 feet to a 200 foot well.

A total of 145 different pesticides have been tested, although not all were tested at each site. Twenty-one of the 145 pesticides were detected in ground water. Of the 23,370 individual pesticide analyses, 168 were positive detections. One or more of these detections occurred at 102 of the 243 sites (42%). The average depth of wells with detected pesticides was 38 feet. The five pesticides detected most often were dacthal (DCPA) detected at 16% of sites; 1,2-dichloropropane (DCP) detected at 13% of sites; ethylene dibromide (EDB) detected at 11% of sites; atrazine detected at 7% of sites; and simazine detected at 2% of sites. Three pesticides -- DCP, EDB, and 1,2-dibromo-3-chloropropane (DBCP - one detection) -- were detected at concentrations exceeding human health criteria. Agricultural use of DCP and DBCP was canceled in 1977, and use of EDB was canceled in 1984.

The data do not suggest that pesticides in ground water pose a significant environmental or public health threat in Washington. At the same time, the limited sampling does not prove that pesticides do not pose a threat, or that problems will not develop in the future. To ensure that pesticides do not become a problem, Ecology should implement a systematic ground-water monitoring program including pesticide sampling.

Acknowledgements

I thank the many people who contributed to this ongoing study, especially the well owners whose cooperation was essential.

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Outside comments were provided by Joseph Jones of the United States Geological Survey, and by Steve Foss and Lee Faulkner of the Washington State Department of Agriculture.

Introduction

Pesticides, especially herbicides, insecticides, and fungicides, are used extensively in Washington. Along with the benefits pesticides provide, there are unintended risks to the environment and human health. Pesticides are registered and regulated by the Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide, and Rodenticide Act. In evaluating a pesticide's risks, EPA considers both its inherent toxicity and potential routes of human exposure to the compound. EPA's intent is to ensure that pesticides do not pose an unreasonable risk to human health.

Following World War II, pesticide use on field and tree crops in Washington increased dramatically. At that time their effects on the State's ground-water quality was largely unknown. In January 1984, ethylene dibromide (EDB), a soil fumigant used to control nematodes, was found in a private well in Skagit County. EDB was subsequently found in domestic wells in Skagit, Whatcom, and Thurston counties. Thirteen of the wells had levels of EDB above the health advisory of 0.05 µg/L. In 1987, the Washington State Legislature requested an investigation by the Department of Ecology to determine whether pesticides are reaching ground water.

In response, Ecology implemented the Washington State Agricultural Chemicals Pilot Study. This study investigated ground water at three sites and published the initial results in 1990 (Erickson and Norton, 1990) . Sites were near:

- Lynden in Whatcom County
- Sunnyside in Yakima County
- Pasco in Franklin County

That project evolved into an ongoing program of sampling ground water for pesticides. To date, eight additional areas have been sampled (Figure 1).

- East Naches Aquifer near Gleed was sampled in 1990 (Erickson, 1992)
- Quincy Surficial Aquifer was sampled in 1991 (Larson and Erickson, 1993)
- Ahtanum and Moxee Surficial Aquifers were sampled in 1992 (Larson, 1993)
- East Chehalis Surficial Aquifer was sampled in 1993 (Larson, 1994a)
- Woodland Surficial Aquifer was sampled in 1993 (Larson, 1994b)
- Walla Walla Surficial Aquifer was sampled in 1994 (Larson, 1995)
- Skagit Delta Surficial Aquifer was sampled in 1994 (Larson, 1996)

Each study represents a different crop type, climatic condition, or aquifer. We are currently focused on agricultural areas overlying near surface, unconfined aquifers. In all areas, residential development was interspersed with agriculture.

Data collected during the individual studies are stored in the Ecology Environmental Investigations and Laboratory Services Program (EILS) pesticide database (Larson and Davis, 1993). The database currently contains data from 243 ground-water sites, and includes 23,370 individual ground-water pesticide analyses.

This report summarizes the ground-water data collected under the Washington State Pesticide Monitoring Program.

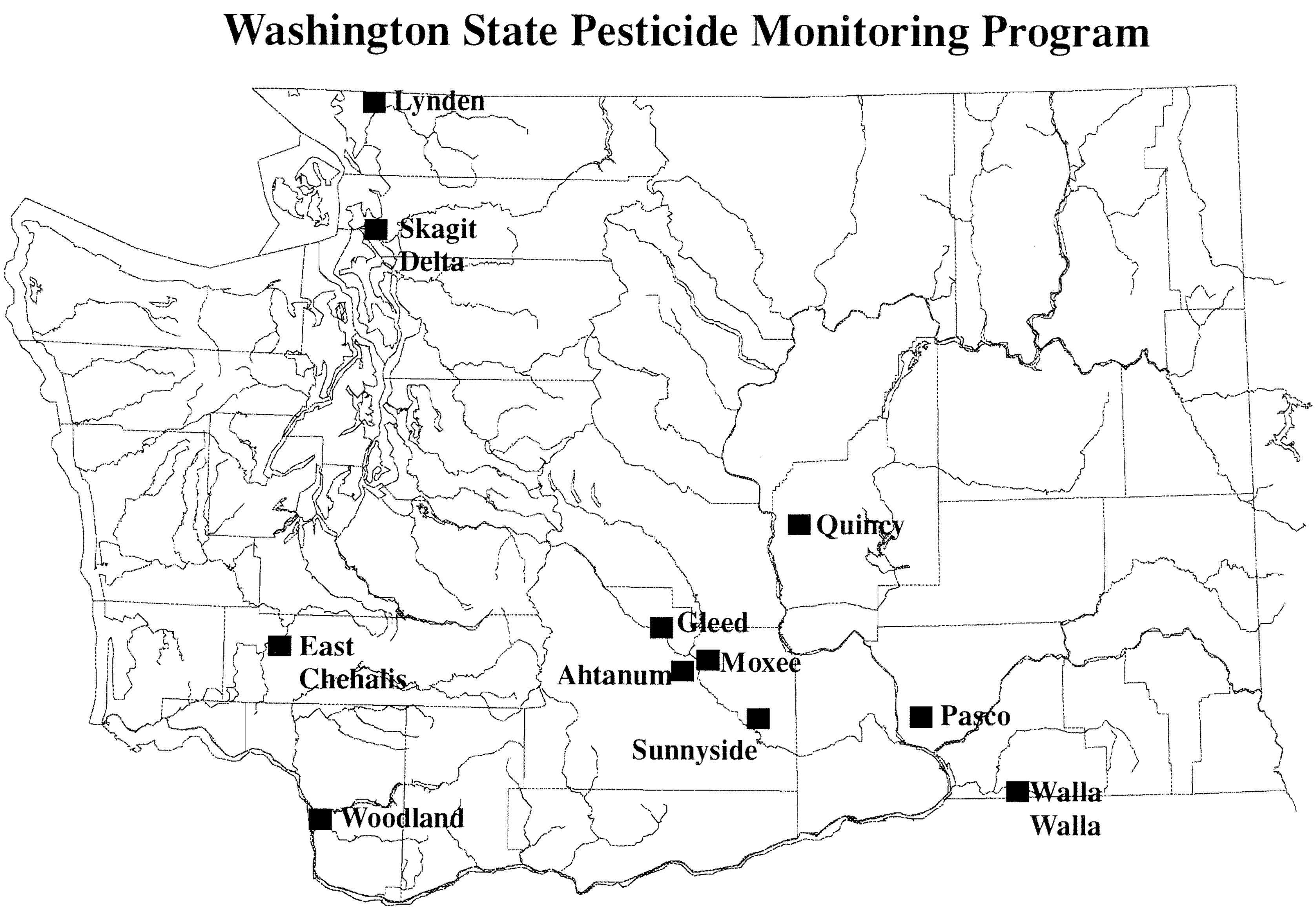

Figure 1. Location of Ground Water study areas.

Pesticide Use

There are about 35,500 commercial farms in Washington State (Washington Agricultural Statistics Service [WASS], 1993). Farming involves 16 million acres of land with an average farm size of 432 acres. In 1993, a little over one-quarter of the acreage (4,389,000 acres) was planted in field crops; wheat, corn, beans, potatoes, hops, hay, etc. Row-crop vegetables (asparagus, carrots, cucumbers, onions, peas, fresh corn, etc.) were harvested from 175,700 acres. Farm production during 1992 was valued at $4.4 billion (WASS, 1992). Apples were the leading money producer at $709 million. Milk, cattle, wheat, and potatoes rounded out the second through fifth rankings.

Although annual use of pesticides has declined slightly since 1982, modern farming still relies heavily on pesticides. During 1992, approximately $178 million was invested in the application of pesticides. Table 1, extracted from the 1991-92, 1992-93, and the 1993-94 Agricultural Statistics reports (WASS, 1992; 1993; 1994), presents the acres planted in a few common crops and the percent of this area receiving pesticide applications. For major crops such as those above, it is common for 80 to 100 percent of the area to be treated with herbicides.

Additional data on the quantities of individual pesticides used and the counties where they are applied are not readily available. A 1985 survey collected estimates by county extension agents on pesticides most likely in use within a county, but not in what quantity (EPA, 1986). Starting in 1991, WASS began publishing estimates of pesticide use on selected crops. Table 2 presents total estimated application amounts of the most common pesticides used on asparagus, apples, fall potatoes, and winter wheat (the crops selected by WASS for their 1992, 1993 and 1994 estimates). Not all pesticides used on these crops are included.

Table 1. Estimated pesticide use on selected crops in 1991 - 93.*				
Crop	Acreage	Percent area applied (%)		
		Herbicide	Insecticide	Fungicide
Fruit Crop				
Apples	157,000	54	99	65
Cherries	14,000	43	93	77
Grapes	29,200	62	29	29
Peaches	2,800	24	82	64
Pears	25,200	54	98	82
Prunes/Plums	2,200	52	95	10
Raspberries	5,000	91	93	95
Strawberries	1,600	71	74	90
Vegetables				
Asparagus	28,500	96	77	38
Carrots	7,600	97	31	41
Cucumbers	-	71	16	54
Green Peas	54,500	100	68	-
Onions	9,300	54	87	44
Snap Beans	-	100	-	94
Sweet Corn	62,600	86	75	-
Field Crop				
1991 Fall Potatoes	144,000	81	94	69
1992 Fall Potatoes	125,000	82	90	86
1993 Fall Potatoes	150,000	93	99	80
Winter Wheat				
1991	700,000	92	6	4
1992	2,000,000	93	-	3
1993	2,500,000	91	-	4

* Washington Agricultural Statistics reports for 1991-92, 1992-93., and 1993-94.
\- not reported.

Table 2. Quantity of pesticide applied to four crops.*

Pesticide	% Area applied	Total annual use (Pounds)
Asparagus - 28,500 acres planted in 1992		
Herbicides		
2,4-D	31	7,400
Dicamba	11	1,000
Diuron	46	19,700
Glyphosate	39	9,100
Linuron	14	3,700
Metribuzin	45	16,800
Simazine	14	8,100
Trifluralin	37	10,000
Insecticides		
Carbaryl	32	13,000
Disulfoton	63	22,200
Fungicides		
Mancozeb	31	16,700

Pesticide	% Area applied	Total annual use (Pounds)
Fall Potatoes - 125,000 acres planted in 1992.		
Herbicides		
EPTC	27	102,000
Metolachlor	6	15,000
Metribuzin	69	38,000
Pendimethalin	27	27,000
Trifluralin	6	4,000
Insecticides		
Azinphos	14	7,000
Carbofuran	8	6,000
Diazinon	11	49,000
Dimethoate	4	3,000
Disulfoton	28	96,000
Esfenvalerate	9	1,000
Ethoprop	10	113,000
Methamidophos	73	156,000
Permethrin	25	4,000
Phorate	38	138,000
Propargite	20	51,000
Fungicides		
Chlorothalonil	37	84,000
Iprodione	37	44,000
Mancozeb	49	113,000
Maneb	19	57,000
Metalaxyl	42	11,000
Metiram	5	18,000
Triphenyltin-hydrox.	10	3,000

Pesticide	% Area applied	Total annual use (Pounds)
Apples - 157,000 acres producing in 1991		
Herbicides		
2,4-D	21	29,200
Diuron	10	9,500
Glyphosate	34	49,700
Norflurazon	8	10,300
Orysalin	5	11,000
Paraquat	22	21,800
Simazine	23	32,800
Terbacil	7	3,700
Insecticides		
Azinphos	90	345,000
Carbaryl	63	143,600
Chlorpyrifos	65	234,600
Diazinon	2	7,400
Dimethoate	5	7,100
Endosulfan	33	98,800
Ethion	2	5,000
Formetanate	6	7,700
Methidathion	3	3,400
Oxamyl	21	14,700
Parathion	60	168,800
Phosmet	9	77,800
Phosphamidon	72	152,500
Propargite	7	25,900
Fungicides		
Captan	6	26,300
Dodine	5	16,000
Fenarimol	26	3,600
Myclobutanil	31	9,500
Triadimefon	22	5,600
Ziram	24	170,100

Pesticide	% Area applied	Total annual use (Pounds)
Winter Wheat - 2,000,000 acres harvested in 1992.		
Herbicides		
2,4-D	42	452,000
Bromoxynil	28	132,000
Chlorsulfuron	26	6,000
Dicamba	8	11,000
MCPA	19	106,000
Metribuzin	12	38,000
Metsulfuron	20	1,000
Thifensulfuron	32	7,000
Tribenuron	34	4,000

*based on Washington Agricultural Statistics reports for 1991-92, 1992-93, and 1993-94.

Pesticides Investigated

In Washington, we have looked for 145 pesticides in ground water (Table 3). This list includes several toxic metabolites formed when a pesticide breaks down.

The initial pilot study tested for 46 pesticides. Most of these were derived from the EPA list of pesticides most likely to leach to ground water, i.e. a "leacher" (Table 4 - Cohen, 1985). Thirty-five of the 36 EPA leachers are included in the pesticides tested. The number of pesticides tested has increased as additional pesticides were added to existing test methods.

Ground water was tested for pesticides at 243 sites in eleven study areas (Figure 1). While most sampling locations consisted of private domestic or irrigation wells, a few are monitoring wells, and two are field drains. The average depth of the wells was 50 feet, ranging from five feet to 200 feet. No individual site was tested for all 145 pesticides, although some sites were tested for as many as 130. The list of pesticides tested for varied slightly from study to study, based on land use and likelihood the pesticide would be found.

Most samples were analyzed at the EPA/Ecology Manchester Laboratory, although some were analyzed by contract labs. Field and laboratory methods, as well as quality assurance, are discussed in the individual study reports (see references).

Table 3. Pesticides tested in Washington's ground water.

1,2-Dibromo-3-Chloropropane (Dbcp)	1,2-Dichloropropane	2,3,4,5-Tetrachlorophenol
2,4,5-T	2,4,5-Tb	2,4,5-Tp (Silvex)
2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-D
2,4-Db	3,5-Dichlorobenzoic Acid	4-Nitrophenol
5-Hydroxydicamba	Abate (Temephos)	Acifluorfen (Blazer)
Alachlor	Aldicarb	Aldicarb Sulfone
Aldicarb Sulfoxide	Aldrin	Ametryn
Atraton (Atron, Atratone)	Atrazine	Azinphos Ethyl
Azinphos Methyl (Guthion)	Baygon (Propoxur)	Benefin (Benfluralin)
Bentazon	Bolstar (Sulprofos)	Bromacil
Bromoxynil	Butachlor	Butifos (Def)
Butylate	Carbaryl	Carbofuran
Carbophenothion	Carboxin	Chloramben
Chlorothalonil (Daconil)	Chlorpropham (CIPC)	Chlorpyriphos Chlorpyrifos)
Cis-1,3-Dichloropropene	Coumaphos	Cyanazine
Cycloate	Dacthal (DCPA)	Dalapon (Dpa)
Ddt, 2,4'-	Demeton-O	Demeton-S
Di-allate(Avadex)	Diazinon	Dicamba I
Dicamba II	Dichlobenil	Dichloroprop
Dichlorvos (Ddvp)	Diclofop-Methyl	Dieldrin
Diethyl Fumarate	Dimethoate	Dinoseb
Dioxathion	Diphenamid	Disulfoton (Di-Syston)
Disulfoton Sulfone	Disulfoton Sulfoxide	Diuron
EDB (Ethylene Dibromide)	Epn	Eptam (EPTC)
Ethalfluralin (Sonalan)	Ethion	Ethoprop (Ss) Issu
Fenamiphos	Fenarimol	Fenitrothion
Fensulfothion	Fenthion	Fenvalerate
Fluridone	Fonofos	Hexazinone
Imidan	Ioxynil	m & p-Xylene
Malathion	Mcpa	Mcpp
Merphos I	Metalaxyl	Methiocarb
Methomyl	Methoxychlor	Methyl Chlorpyrifos
Methyl Paraoxon	Methyl Parathion	Metolachlor
Metribuzin	Mevinphos	Mgk 264
Molinate (Ordram)	Monocrotophos	Napropamide (Devrinol)
Norflurazon	Oxamyl (Vydate)	Oxyfluorfen (Goal)
Parathion	Pebulate	Pendimethalin (Prowl)
Pentachlorophenol	Permethrin (cis and trans)	Phenothrin
Phorate	Phosphamidan	Picloram
Profluralin	Prometon (Pramitol 5p)	Prometryn (Caparol, Primatol Q)
Pronamide (Kerb)	Propachlor (Ramrod)	Propargite
Propazine	Propetamphos	Propham
Resmethrin	Ronilan	Ronnel
Simazine	Simetryn	Sulfotepp
Tebuthiuron	Terbacil	Terbutryn (Igran)
Tetrachlorvinphos (Gardona)	Tetraethyl Pyrophosphate	Trans-1,3-Dichloropropene
Treflan (Trifluraline)	Triadimefon	Triallate
Trichlopyr (Garlon)	Tricyclazole	Vernolate
Xylenes, Total		

Table 4. Pesticides listed by the EPA as leachers.

Alachlor	Diphenamide
Aldicarb	Disulfoton
Ametryne	Diuron
Atrazine	Fenamiphos
Baygon	Hexazinone
Bentazon	Maleichydrazide
Bromacil	Methomyl
Butylate	Metolachlor
Carbofuran	Metribuzin
Carboxin	Oxamyl
Chloramben	Picloram
Cyanazine	Prometon
Cycloate	Pronamide
Dacthal	Propazine
Dalapon	Propham
Dicamba	Simazine
Dichloropropane	Tebuthiuron
Dinoseb	Terbacil

Source: Cohen, 1985.

Which Pesticides Were Found?

Twenty-one of the 145 pesticides were detected in Washington's ground water (Table 5). Of the 23,370 pesticide analyses, 168 were positive detections. One or more of these detections occurred at 102 of the 243 sites (42%). Eleven leacher pesticides were among the 21 detected pesticides; the remaining 10 pesticides detected in ground water were not on EPA's list. The average depth of wells (includes field drains) with detected pesticides was 38 feet, with a minimum depth of 5 feet and a maximum of 110 feet. These well depths are slightly shallower than the 58 feet average for wells without pesticides.

In the study wells, several pesticides were detected most often. As a percentage of sites where the pesticide was sampled:

- **dacthal (DCPA)** was detected in 39 wells or 16 percent of sites,
- **1,2-dichloropropane** was detected in 31 wells or 13 percent of sites,
- **EDB** was detected in 23 wells or 11 percent of sites,
- **atrazine** was detected in 17 wells or 7 percent of sites,
- **simazine** was detected in 8 wells or 3 percent of sites, and
- three others were detected in greater than 2 percent of the wells.

Dacthal is a pre-emergence herbicide used to control various annual grasses in turf, ornamentals, and food crops. It is not considered mobile in soil, but its acid metabolites (degradation products) migrate readily. All metabolites of dacthal are included in the laboratory analysis and usually reported as DCPA.

1,2-dichloropropane is a soil fumigant that was removed from the market in 1977. However, it is still found in some newer soil fumigants, particularly 1,3-dichloropropene. It is also used as a metal degreaser and solvent, and in the manufacture of some inorganic and organic chemicals. Residual 1,2-dichloropropane from pre-1977 soil fumigation is believed to be the major source of contamination in study wells.

Agricultural use of EDB (ethylene dibromide), a pesticide used for soil, grain, and fruit fumigation, was canceled by the EPA in two separate actions (1983 and 1984). Before its cancellation, EDB was extensively applied to strawberry fields in Washington.

Atrazine and simazine are selective herbicides commonly used on a variety of crops from corn to Christmas trees.

Neither **dacthal** or **atrazine** is included in Table 2. These chemicals apparently are not used on the four crops presented. Most of the herbicides reported in Table 2 have been tested for but not detected in ground water. **Simazine** with eight detections was the most commonly detected herbicide listed in Table 2. It was found in three wells in Walla Walla County, one well in Cowlitz County, three wells in Yakima County, and one well in Lewis County.

Commonly used insecticides were rarely detected. Of the insecticides reported in Table 2, only **oxamyl** and **carbofuran** have been detected in ground water, and then only in one well each. **Oxamyl** was detected in one well in Walla Walla County and **carbofuran** was detected in one well in Whatcom County. One reason insecticides were rarely detected in ground water may be because they are usually applied to the above-ground vegetation and not directly on the soil. Also applications are scheduled during dry periods when rain will not wash the insecticide off the plants.

Only a few of the fungicides reported in Table 2 have been tested in ground water; none have been found.

Table 5. Pesticides detected in Washington's ground water.

Pesticide	Number of Sites Tested	Number of Detections	Percent Detections (%)	Maximum Concentration (ug/L)	Quantification Limit (ug/L)	MCL or LHAL (ug/L)
Dacthal (DCPA)	242	39	16	9.9	0.01	3500
1,2-Dichloropropane	243	31	13	24	0.10	5
EDB (Ethylene Dibromide)	216	23	11	4.3	0.01	0.05
Atrazine	243	17	7	0.42	0.01	3
Simazine	243	8	3	0.08	0.04	4
Pentachlorophenol	242	8	3	0.07	0.02	1
Bromacil	243	6	2	14.9	0.50	90
Xylenes	133	6	5	0.90	0.20	10,000
Prometon (Pramitol 5p)	243	4	1.6	6	0.30	100
Trans-1,3-Dichloropropene	162	3	2	0.11	0.10	nl
4-Nitrophenol	242	3	1	1.50	0.13	60
Diuron	211	2	0.9	0.36	0.12	10
Picloram	242	2	0.8	0.07	0.04	500
Tebuthiuron	243	2	0.8	1.9	0.08	500
Methiocarb	65	1	1.5	1.05	0.50	nl
Dichlobenil	106	1	0.9	*0.01	0.10	nl
1,2-Dibromo-3-Chloro-propane (Dbcp)	216	1	0.5	0.36	0.01	0.2
Dicamba	242	1	0.5	*0.025	0.038	200
3,5-Dichlorobenzoic	242	1	0.5	*0.035	0.037	nl
Carbofuran	226	1	0.5	2.4	0.5	40
Oxamyl (Vydate)	225	1	0.5	3.8	0.5	200

nl = not listed
MCL = Maximum Contaminant Level
LHAL = Lifetime Health Advisory Level
* Values less than Quantification Limit are Laboratory estimates

Data Limitations

The data do not present a balanced representation of all the state's ground water. Limitations include:

- There are an estimated 2,000,000 wells in Washington (personal communication, Linton Wildrick, Water Resources Program, Ecology). If we assume that wells are evenly distributed over the ground waters of interest and that each well is representative of the aquifer in its area, then we have sampled less than 0.01 percent of the state's ground water.

- Sampling for pesticides in ground water has not been uniform throughout the state. Pesticide sampling has been greater where pesticide use is believed to be heavy. Many of the study wells were specifically selected in areas where pesticide contamination was known or suspected. Aquifers where pesticide contamination was not expected were not sampled.

Water Quality Implications

For most pesticides detected the EPA has proposed human health criteria, specifically Maximum Contaminant Levels (MCLs) or lifetime drinking water health advisory levels (LHALs - EPA, 1986). MCLs are enforceable public drinking water standards and define maximum permissible concentrations of contaminants in water in any public water system. MCLs are established by considering health effects, treatment technology, national costs, and limitations of laboratory methods. LHALs are not enforceable and are calculated based on toxicity information. They are not calculated for contaminants that are known or suspected carcinogens.

The EPA has not proposed an MCL for **dacthal** (DCPA) in drinking water. They have classified dacthal as a Group D chemical - Not Classified. This means there are inadequate animal data and no human data to classify dacthal as a cancer-causing agent. DCPA and its metabolites appear to have low acute and chronic toxicity. EPA has proposed a lifetime health advisory level of 3500 µg/L. Below this level, non-carcinogenic adverse health impacts to consumers are not expected. The average detected dacthal concentration was 1.3 µg/L and the maximum was 9.9 µg/L, **far below established guidelines**.

Animal studies have indicated that **EDB** is quickly absorbed into the body when inhaled or ingested. Harmful effects to the liver, kidneys and testes, as well as fetotoxicity, genetic mutations, and chromosomal damage, have been reported in experimental animals. EDB has also been shown to cause cancer in rats and mice. The EPA has classified EDB as a Group B chemical - **Probable Human Carcinogen,** and has set the MCL in drinking water at 0.05 µg/L. The average concentration of EDB, where detected, was 0.51 µg/L and the maximum concentration was 4.3 µg/L, **both greater than the MCL**. Use of EDB has been canceled since 1984.

The EPA has proposed that **1,2-dichloropropane** (DCP) be classified as a Group B2 chemical - **Probable Human Carcinogen**. This means there is sufficient evidence from animal studies to show that it causes cancer in animals, but there is inadequate or no human data to indicate that it causes cancer in humans. The EPA has set the MCL for DCP in drinking water at 5.0 µg/L. The average concentration of DCP, where detected, was 2.21 µg/L and the maximum concentration was 24 µg/L. **Five study sites had 1,2-dichloropropane concentrations greater than the MCL**. Use of DCP has been canceled since 1977, although it is still present at low levels in the soil fumigant 1,3-dichloropropene.

In addition to EDB and 1,2-dichloropropane, one other pesticide detection exceeded health-related concentrations. **1,2-dibromo-3-chloropropane (DBCP)** was detected in a single well at a concentration of 0.36 μg/L (found in both the initial and the verification sample). The EPA has set the MCL for this soil fumigant at 0.2 μg/L. All use of DBCP in the continental United States has been canceled since 1977. However, DBCP is highly persistent and mobile in soils.

Atrazine is classified as a Group C chemical - **Possible Human Carcinogen**. There is limited evidence of carcinogenicity in animals, but an absence of human data. The MCL for atrazine is 3.0 μg/L. The maximum concentration detected (0.42 μg/L) was only 14 percent of the MCL.

Simazine is not classified as a carcinogen and the MCL has been set at 4.0 μg/L. The maximum concentration detected (0.06 μg/L) was only 2 percent of the MCL.

Summary and Recommendations

- Ecology has not sampled ground water for the majority of pesticides registered for use in Washington at more than a small fraction of the number of wells in the state.

- Although our sample size is small, most of the pesticides tested for have not been detected in ground water.

- A few pesticides make up the majority of our ground water detections: dacthal, 1,2-dichloropropane, EDB, atrazine, and simazine.

- Three pesticides (EDB, DCP, DBCP) were detected at concentrations exceeding human health criteria; however, these pesticides have been banned for 8 to 18 years.

- The pesticides detected in ground water are not necessarily those applied in the greatest quantity.

Are pesticides reaching ground water? Yes. At least one pesticide was found in 42 percent of the study wells. However, the sites were not randomly selected, were located in areas of suspected high pesticide use, and are not necessarily representative of the state's overall ground-water quality.

Ground-water data presented here are inadequate to address environmental and public health concerns for Washington State as a whole. Ground water has not been sampled for the majority of pesticides registered for use in Washington at more than a token number of sites. Although most pesticides have not been detected in ground water, the sample size is very small compared to the number of wells.

However, we can evaluate from these data whether to change the priority of pesticide monitoring and whether it is prudent to increase or decrease the level of effort. The data do not suggest that pesticides in ground water pose a significant environmental or public health threat in Washington. A recent Department of Health study (DOH, 1995) concluded from a statewide sampling of 1,326 public water supply wells that "pesticide contamination of Washington's drinking water presents a low public health risk." Significantly expanding the investigation of pesticides in ground water would take money away from other, higher priority needs.

At the same time, the present level of monitoring does not prove that pesticides **do not** pose a threat in ground water, or that problems will not develop in the future. For this reason it is not prudent to stop monitoring for pesticides. Rather, pesticide monitoring should be made a part of an overall systematic ground-water monitoring program. I concur with Stratton (1992) who concludes that "Current monitoring efforts do not supply either the level of data or the consistency of data to establish background water quality, evaluate changes in ambient quality, or identify problems needing attention."

To ensure that pesticides do not become a threat, Ecology should implement the Ground Water Quality Monitoring Strategy (Carey, 1987). Carey proposed an ongoing ground water monitoring program based on the assumption that "ground water problems are most effectively addressed if discovered early." Pesticide sampling would be integrated into this program.

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