Results of the WDATCP groundwater monitoring for pesticides. [DNR-002] 1988

Postle, Jeffrey K.; Brey, Kevin M.

Madison, Wisconsin: Wisconsin Department of Natural Resources, 1988

Wisconsin Groundwater Management Practice Monitoring Project No. 2

GROUNDWATER
Wisconsin's buried treasure

Wisconsin Department of Natural Resources

RESULTS OF THE WDATCP GROUNDWATER MONITORING FOR PESTICIDES

Jeffrey K. Postle and Keven M. Brey[1]/

Purpose of the Study

The objective of this study is to determine the extent of groundwater contamination resulting from pesticide use in highly and moderately susceptible areas of the state. In this study highly susceptible areas are defined as having sandy soils, less than 25 ft. to groundwater, and irrigation. Areas of moderate susceptibility are defined as having loamy soils and 15 to 50 ft. to groundwater with or without irrigation. The pesticides of interest are atrazine, alachlor, aldicarb, metolachlor, metribuzin, carbofuran, and several other compounds that have chemical characteristics and use patterns which make them relatively susceptible to leaching.

Part of the motivation for this study, which utilizes monitoring wells, was the belief that the investigation of pesticides in groundwater should be expanded beyond the limited zones of groundwater accessible by drinking water wells. This is consistent with the Wisconsin Groundwater Law, which directs agencies to look at all points of standards applications when assessing groundwater contamination.

The monitoring results from this study are compared to any standards that have been established in s. NR 140, Wis. Admin. Code. A determination can then be made whether regulatory actions are needed to prevent these pesticides from entering groundwater above an official groundwater standard. Under ch. 160, Stats., the Department of Agriculture, Trade and Consumer Protection (DATCP) must adopt preventive rules, within its jurisdiction, to limit the presence of pesticide substances in groundwater. In order to fulfill this directive, DATCP must know the nature and extent of the problem to be addressed.

Materials and Methods

This study focuses on several pesticides determined to have a high potential to contaminate groundwater in Wisconsin based on use patterns and environmental fate characteristics. The monitoring sites are located in areas of high and medium susceptibility throughout the state with site selection based on the following criteria: soil texture, depth to groundwater, appropriate pesticide use history, irrigation practices, and landowner cooperation. It was felt that initiating this study in worst case areas would be the most effective way to proceed as it would provide the best opportunity to identify potential problems. As problems have been identified in some of these worst case areas, additional monitoring has been initiated in progressively less susceptible areas to determine which environmental conditions may be conducive to pesticide leaching.

---

[1]/Groundwater Specialist/Soil Scientist and Project Associate, Agricultural Resource Management Division, Wisconsin Department of Agriculture, Trade and Consumer Protection

Once a monitoring site has been located, the direction of groundwater flow is determined by installing three temporary water table observation wells in a triangular pattern. Depth to water table measurements and leveling of the measuring points are then used to determine the slope of the water table, and groundwater flow direction is taken to be perpendicular to the water table contours. These determinations are checked with the flow direction indicated on groundwater elevation maps where available.

A nest of three wells is then installed just beyond the downgradient end of the field of pesticide application. The wells generally have five foot screens and are installed to sample the following increments below the water table: 0-3 ft., 3-8 ft., and 8-13 ft. This system provides the greatest chance of detecting contamination due to use on the adjacent field, if it is occurring. An example of such a system is shown in Figure 1.

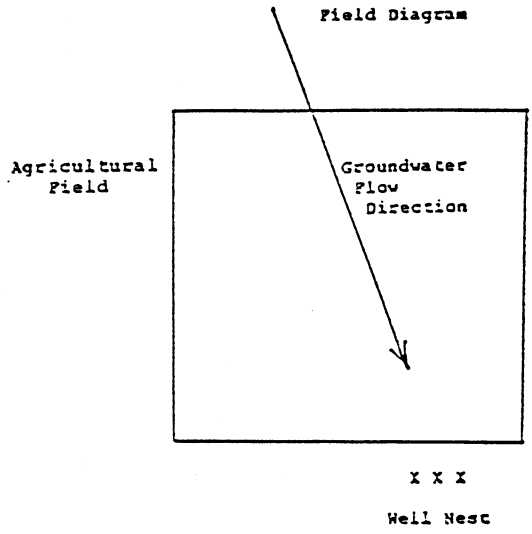
The monitoring wells are installed using the Wisconsin Geological and Natural History Survey drill rig. In most cases the solid stem auger is used. Before drilling, a small hole is hand dug at the bore hole site to avoid contamination with surface soil material during drilling. The bore hole is drilled to the desired depth below the water table, and after removal of the augers, the well pipe and screen are installed into the hole. An up and down pounding of the well is used to achieve the desired depth if bore hole collapse has occurred below the water table. Soil samples for particle size analysis are taken at 5 ft. increments during drilling. After installation, the wells are devel oped by surging with a surge rod and pumping with a portable gas-powered pump until clear water is obtained.

All monitoring wells are constructed to protect the integrity of the groundwater and the samples being collected. The well casing consists of schedule 40 PVC pipe with flush-threaded joints. Well screens are schedule 40 PVC with .006 or .01 inch slot size. In most cases the medium to coarse sand extracted from the borehole is used for a filter and extended 2 to 3 feet above the top of the well screen. If finer materials are encountered during drilling, imported silica sand is used. The annular space is sealed with bentonite clay. A locking protective metal casing is installed over each well and anchored with a cement plug.

The monitoring wells are sampled with a Keck electric submersible pump. A pump blank is taken by pumping Madison tap water through the pump and hose into the sample bottle.

If known, the wells are sampled in order of lowest to highest concentration of pesticide. A new pair of plastic gloves is used during the sample collection procedure at each well. The well is purged of at least three well volumes and then a sample is transferred to the sample bottle. The full sample bottles are placed in an insulated mailer and kept chilled with 2 bottles of ice. The groundwater samples are not filtered in the field or the lab prior to analysis.

Figure 1 - Field Diagram and Well Nest Configuration



Well Nest Configuration

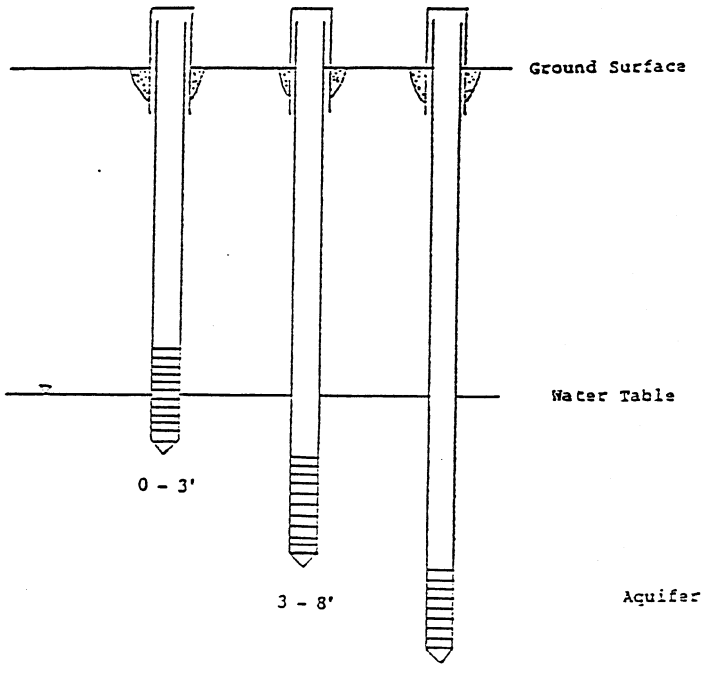


Table 1
Results of the DATCP Groundwater Monitoring for Aldicarb through December 1988

Site Location	Depth* to Groundwater (ft)	Aldicarb Application Date	Sample Depth* Below Water Table (ft)	Aldicarb 8/85	9/85	10/85	12/85	3,4/86	6/86	9/86	11,12/86	4,5/87	7,8/87	10,11/88	1,2,3/88	4,5/88	6,7, 8/88	9,10, 11/88	12/88 1,2/89
				ug/l															
Adams County 1	20	1984	0-4	—	62	110	—	17	10	5.6	67	17	—	17	—	8.90	6.04	3.21	
			5.5-7.5	—	1.0	3.6	—	6.0	5.6	8.3	6.8	2.7	—	4.4	—	2.40	4.52	2.58	
Juneau County 1	7	1984	0-2	ND	1.0	ND	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
			2-7	20	28	27	—	2.4	5.5	ND	ND	ND	ND	ND	1.62	ND	ND	ND	
			7-12	3.0	1.0	8.0	—	5.3	7.4	ND	3.7	1.0	3.2	ND	1.32	0.816	ND	ND	
Juneau County 2	8	1985	0-2	—	ND	—	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	—	—	
			2-7	ND	ND	—	ND	ND	ND	8.3	1.3	1.7	2.9	ND	ND	ND	ND	—	
			7-12	ND	ND	—	ND	ND	ND	ND	ND	2.8	3.2	3.3	3.00	0.614	0.977	—	
Waupaca County	7.5	1984	0-2.5	—	6.1	2.3	—	1.3	ND	ND	ND	—	ND	—	—	—	ND	—	
			2-7	7.8	5.8	4.2	—	2.2	ND	ND	ND	—	ND	—	—	—	ND	—	
			7-12	—	5.8	8.8	—	7.0	3.5	2.3	1.6	—	ND	—	—	—	ND	—	
Waushara County 1	23	84/82	0-5	5.4	10	10	—	6.8	2.1	ND	ND	—	ND	—	—	—	—	—	
			5-7.5	11	9.9	4.6	—	9.3	2.8	2.0	2.6	—	ND	—	—	—	ND	—	
			8-10.5	1.8	1.8	1.9	—	4.3	5.0	4.6	7.2	—	ND	—	—	—	ND	—	
Grant County 1	8	1985	0-3				6.6	5.2	30	12	1.4	ND	ND	ND	ND	ND	ND	—	—
			3-8				6.1	12	12	15	6.8	1.8	ND	ND	1.46	4.21	0.856	3.37	3.11
			8-12.5				5.5	14	6.6	2.6	3.2	3.3	2.5	ND	1.55	2.78	1.85	8.95	10.3
Iowa County 1	12	1984	0-2.7						2.0	ND	1.5	ND	ND	ND	ND	ND	—	—	
			2.7-7.7						1.3	ND	ND	ND	ND	ND	ND	ND	—	—	
			7-12						1.9	ND	ND	ND	ND	ND	ND	ND	—	—	
Iowa County 2	9.5	1984	0-2.7						ND	ND	ND	ND	ND	ND	ND	ND	—	—	
			2.7-7.7						ND	ND	ND	ND	ND	ND	ND	ND	—	—	
			8-13						ND	2.9	4.5	ND	ND	ND	ND	ND	—	—	
Langlade County 1	8	1986	0-4								1.8	ND	ND	ND	ND	ND	—	—	
			4-9								5.9	1.8	1.3	1.0	ND	ND	—	—	
			9-14								1.5	ND	ND	ND	ND	ND	—	—	
Langlade County 2	13	1986	0-3								5.2	2.8	4.2	1.0	—	ND	—	—	
			3-8								3.9	ND	ND	ND	ND	ND	—	—	
			8-13								ND	ND	ND	ND	ND	ND	—	—	
Langlade County 3	31	1986	0-3								ND	ND	—	—	—	—	—	—	
			3-8								ND	ND	—	—	—	ND	—	—	
			8-13								ND	ND	—	—	—	ND	—	—	
Adams County 2	12	1986	0-3.2										66	21	8.39	1.90	ND	ND	
			3.2-8.2										26	24	11.4	7.46	7.70	3.89	
			8.2-13.2										1.3	3.1	3.71	3.28	2.47	6.18	

* Depth on the date of well installation
ND=non detect
__=no sample

Results and Discussion

Aldicarb (Temik)

Aldicarb is a selective systemic insecticide that is used to control sucking or chewing insects and soil nematodes. In Wisconsin the only field use of aldicarb is for potato production. In 1986 approximately 25% of the acreage planted to potatoes had aldicarb products applied. Groundwater contamination by aldicarb residues has occurred in Wisconsin under normal use practices. Aldicarb has the potential to leach to groundwater due in part to a relatively high water solubility (6,000 mg/l) and a relatively low soil adsorption coefficient (Kd) range of 0.015 to 1.55. The half life for degradation of all toxic residues of aldicarb in the root zone is approximately 70 days for sandy soils typical of potato production areas in central Wisconsin (Cohen et al., 1984). The half life is shorter in the heavier soils and higher organic matter soils of the seed potato production areas in Wisconsin.

Twelve agricultural fields in the Central Sands area and along the lower Wisconsin River have been monitored for aldicarb residues. Results of the monitoring are shown in Table 1. Eleven of 12 sites have had aldicarb residues in the groundwater equaling or exceeding the Preventive Action Limit of 2 ppb. Five of the sites have had aldicarb residues exceeding the Enforcement Standard of 10 ppb. One possible explanation for the high concentration of Adams County 1 is the presence of an extensive clay layer of approximately seven feet below the water table. This layer may have prevented normal vertical migration and dispersion of aldicarb residues.

Alachlor (Lasso)

Alachlor is a popular herbicide in Wisconsin that is used to control annual grasses and some types of broadleaf weeds in corn and soybeans. In 1985, alachlor was used on approximately 40% of all corn acreage and 47% of all soybean acreage in Wisconsin (Wisconsin Agricultural Statistics Service, 1986).

It appears that alachlor can be transported to groundwater in susceptible situations. It has a water solubility of 242 mg/l, a soil adsorption coefficient (Kd) range of 0.6-8.1 (with most values below 4), and a soil half life in the range of 15-70 days (Cohen et al., 1984). The primary loss mechanism from soil appears to be microbial degradation.

Alachlor has been monitored in the groundwater at twenty agricultural fields in Wisconsin with sites located in the Central Sands area and the sandy outwash soils along the lower Wisconsin River. The results of this monitoring are shown in Table 2. With the exception of the unusually high levels at the field in Dane County, the alachlor residues in the groundwater samples have been in the range of less than 1 to 7.7 ppb. It is also interesting to note that all the alachlor detects have occurred along the Wisconsin River with no findings to date in the Central Sands area.

Table 2
Results of the DATCP Groundwater Monitoring for Alachlor through August 1988

Site Location	Depth* to Ground-water (ft)	Sample Depth* Below Water Table (ft)	Alachlor (Lasso) 12/85	3/86	6/86	9/86	11,12/86	4,5/87	7,8,9/87	10,11/87	1,2,3/88	4,5/88	6,7,8/88
			ug/l										
Dane	8	0-2.5	ND	ND	ND	ND	0.80	0.685	ND	ND	ND	ND	—
County 1		3.0-8.0	1.2	31.2	1.89	40.7	16.2	28.5	2.4	3.2	0.961	ND	5.71
		8.0-13.0	113	21.5	100.4	67.5	53.0	10.8	69	20	3.03	6.85	6.78
Richland	9	0-3.5	ND	ND	ND	ND	—	ND	~0.20	ND	ND	ND	ND
County 1		3.0-8.0	ND	ND	ND	ND	—	ND	ND	ND	ND	ND	ND
		6.5-11.5	ND	ND	ND	ND	—	ND	ND	ND	ND	ND	ND
Sauk	9	0-4.0	0.1	ND	ND	ND	—	ND	ND	ND	ND	ND	ND
County 1		2.5-7.5	0.1	ND	ND	ND	—	ND	ND	ND	ND	ND	ND
		6.5-11.5	ND	ND	ND	ND	—	ND	ND	ND	ND	ND	ND
Iowa	12	0-2.7			ND	0.9	7.7	4.9	7.1	0.871	ND	0.556	0.399
County 1		2.0-7.0			ND	ND	ND	ND	1.0	ND	ND	ND	ND
		7.0-12.0			ND	ND	ND	ND	~0.20	ND	ND	ND	ND
Iowa	10	0-2.7			ND	ND	ND	ND	—	ND	ND	ND	—
County 2		2.7-7.7			ND	1.0	2.7	2.0	0.58	ND	ND	ND	ND
		8.0-13.0			1.0	ND	ND	0.80	0.31	0.175	ND	ND	ND
Grant	18	0-2.2											ND
County 2		2.1-7.1											.432
		7.3-12.3											ND

ADDITIONAL SITES INCLUDING PORTAGE COUNTY 1, 2 AND 3, ADAMS COUNTY 3 AND 4, SAUK COUNTY 2, 3, 4 AND 5, GREEN COUNTY 1 AND 2, ROCK COUNTY 1, LACROSSE COUNTY 1, GRANT COUNTY 1, IOWA COUNTY 3 AND CHIPPEWA COUNTY 1 HAVE NOT HAD DETECTS OF ALACHLOR

* Depth on the date of well installation
ND=Non detect
~ = confirmed detect below the level of quantitation
— = no sample

The levels of alachlor found in the groundwater at the field in Dane County are much higher than expected for normal agricultural use. It is possible that a spill or back-siphoning incident has occurred, but no evidence of this has been established. Further investigation at this site is being conducted to determine the extent of the plume and to identify its source. It is important for regulatory purposes to determine whether this contamination resulted from normal agricultural use or some point source. Data collected from additional monitoring wells installed at the site indicate that the contamination plume is limited to a small part of the field and probably did not result from a normal agricultural application.

On November 1, 1988, the Wisconsin Department of Natural Resources (DNR) adopted a groundwater enforcement standard for alachlor of 0.5 ppb. Of the twenty sites currently being monitored for alachlor, three have exceeded the 0.5 ppb level. Regulations may be necessary in limited areas to reduce the potential for alachlor leaching and comply with the Groundwater Law.

Atrazine

Atrazine is a triazine herbicide used extensively for weed control in corn. In 1985, atrazine was applied to approximately 77% of the acreage planted to corn, making it the most commonly used corn herbicide in Wisconsin (Wisconsin Agricultural Statistics Service, 1986).

Due to its persistence, mobility, and extensive use, atrazine has the potential to contaminate groundwater in susceptible areas of Wisconsin. It has a water solubility of 33 mg/l, a soil adsorption coefficient (Kd) range of 1-8, and a soil half life in the range of 4-57 weeks (Cohen et al., 1984). Atrazine has been found to persist in agricultural soils into the growing season following the year of application.

Atrazine has been monitored in the groundwater at 28 agricultural fields in Wisconsin, with most sites located in the sandy outwash soils along the lower Wisconsin River and in the Central Sands area. The results of this monitoring are shown in Table 3. Atrazine has been found in the groundwater at 15 of 28 sites in the range of less than 1 to 33 ppb. As with alachlor, most of the atrazine detects have occurred along the Wisconsin River.

On November 1, 1988, the DNR adopted a groundwater Enforcement Standard for atrazine of 3.5 ppb. Of the 28 sites currently being monitored for atrazine, five have exceeded the 3.5 ppb level. Adoption of this standard will likely necessitate regulatory action in susceptible areas of Wisconsin to comply with the Groundwater Law.

Metolachlor (Dual)

Metolachlor is a selective herbicide used for weed control in several crops including corn, soybeans, and potatoes. In 1985, metolachlor was used on approximately 17% of the corn acreage, 18% of the soybean acreage, and 40% of the potato acreage in Wisconsin (Wisconsin Agricultural Statistics Service, 1986).

Table 3
Results of the DATCP Groundwater Monitoring for Atrazine through August 1988

Site Location	Depth* to Ground-water (ft)	Sample Depth* Below Water Table (ft)	Atrazine 12/85	3/86	6/86	9/86	11,12/86	4,5/87	7,8,9/87	10,11/87	1,2,3/88	4,5,/88	6,7,8/88
			ug/l										
Dane County 1	8	0-2.5	ND	ND	ND	0.40	0.80	0.435	ND	ND	ND	ND	
		3-8	0.6	19.3	1.34	10.1	3.70	4.90	1.6	5.3	2.16	4.48	5.33
		8-13	16.6	27.9	30.13	19.8	20.0	5.53	12	13	3.88	8.15	9.99
Grant County 1	8	0-3	0.88	0.51	0.91	0.70	0.50	ND	~0.20	0.223	ND	0.348	0.434
		3-8	0.63	4.1	0.93	0.63	0.40	ND	ND	0.180	ND	0.513	0.398
		8-12.5	1.16	5.1	1.05	0.82	0.60	0.40	~0.25	0.363	ND	0.389	0.389
Richland County 1	9	0-3.5	ND	0.4	ND	ND	—	0.115	ND	~0.15	ND	ND	ND
		3-8	ND	0.4	ND	ND	—	0.100	ND	~0.15	ND	ND	ND
		6.5-11.5	2.3	8.0	1.11	1.03	—	0.675	0.47	1.1	0.485	0.716	ND
Sauk County 1	9	0-4	ND	ND	ND	ND	—	0.169	~0.30	0.48	ND	ND	ND
		2.5-7.5	ND	0.3	ND	ND	—	0.115	~0.30	~0.25	ND	ND	ND
		6.5-11.5	ND	0.3	ND	ND	—	0.210	~0.20	~0.30	0.166	0.372	ND
Iowa County 1	12	0-2.7			5.9	8.1	19	15	33	8.54	3.86	6.63	
		2-7			4.2	4.0	5.6	6.1	9.5	4.85	4.88	3.36	
		7-12			2.2	2.7	3.4	5.1	12	11.50	7.99	12.10	
Iowa County 2	10	0-2.7			ND	2.8	1.5	1.7		1.25	0.797	0.262	
		2.7-7.7			5.2	6.5	10	15	8.8	6.49	5.74	6.19	
		8-13			3.2	0.4	0.80	11	5.6	4.20	7.99	3.81	
Juneau County 1	7	0-2			ND	ND	ND	ND	ND	~0.15	0.480	ND	
		2-7			ND	ND	ND	ND	ND	~0.15	0.409	0.515	
		7-12			ND	ND	ND	ND	ND	ND	ND	ND	
Juneau County 2	8	0-2				ND	ND	ND	ND	ND	ND	ND	
		2-7				ND	ND	ND	ND	~0.10	ND	ND	
		7-12				ND	ND	ND	ND	ND	ND	ND	
Adams County 2	12	0-3.2							ND	ND	ND	ND	ND
		3.2-8.2							ND	ND	ND	ND	ND
		8.2-13.2							ND	0.43	ND	0.170	0.454
Adams County 3	9	0-3.3							ND	ND	ND	ND	ND
		3.1-8.1							ND	0.111	ND	ND	ND
		8.1-13.1							~0.30	0.111	ND	ND	ND
Adams County 4	19	0-3							ND	ND	ND	ND	ND
		3.2-8.2							ND	ND	ND	ND	ND
		8.4-13.4							~0.30	0.125	0.329	0.332	ND
Iowa County 3	9	0-4.4								ND	0.228	ND	ND
		4-9								0.54	0.257	0.369	ND
		9-14								0.72	0.552	0.674	ND
Sauk County 2	13	0-4.7								~0.15	0.14	ND	ND
		4.7-9.2								~0.10	ND	ND	ND
		9.4-14.4								ND	ND	ND	ND
Sauk County 3	11	0-3.8								0.66	ND	ND	0.304
		3.7-8.7								~0.35	ND	0.365	0.375
		9.9-14.9								~0.35	ND	0.250	0.246
Sauk County 4	10	0-4.3								~0.15	ND	0.176	0.157
		4.4-9.4								0.45	ND	0.447	0.363
		9.5-14.5								0.46	ND	0.299	0.375
Sauk County 5	7	0-2.9											ND
		2.7-7.7											0.762
		7.7-12.7											1.03
Sauk County 6	10	0-2.7											0.359
		2.5-7.5											1.43
		7.6-12.6											1.27
Grant County 2	18	0-2.2											.200
		2.1-7.1											2.57
		7.3-12.3											.668

ADDITIONAL SITES INCLUDING PORTAGE COUNTY 1 AND 2, BARRON COUNTY 1,2 AND 3, GREEN COUNTY 1 AND 2, LACROSSE COUNTY 1, WAUSHARA COUNTY 3, CHIPPEWA COUNTY 1, AND ROCK COUNTY 1 HAVE NOT HAD DETECTS OF ATRAZINE

* = Depth on the date of well installation
ND = non detect
~ = confirmed detect below the level of quantitation
__ = no sample

It appears that metolachlor can leach to groundwater in certain environmental settings. It has a water solubility of 530 mg/l, a soil adsorption coefficient (Kd) value below 3, and a soil half life in the range of 2-8 weeks (Cohen and Pomerantz, 1984).

Metolachlor has been monitored at 18 sites in Wisconsin, with most sites along the lower Wisconsin River and in the Central Sands area. Table 4 shows that metolachlor has been found at five of 18 sites in the range of 0.08-15.1 ppb. The enforcement standard for metolachlor is 15 ppb with a preventive action limit of 1.5 ppb. Most of the detects fall in the range between these two levels. All findings of metolachlor to date have been along the Wisconsin River.

Metribuzin (Sencor)

Metribuzin is a triazine herbicide used to control a number of grass and broadleaf weeds in a variety of agricultural crops including soybeans and potatoes. Metribuzin is used on approximately 78% of the potato acreage and 32% of the soybean acreage in Wisconsin (Wisconsin Agricultural Statistics Service, 1986).

Metribuzin has environmental fate characteristics that make it relatively mobile in coarse-textured soils. It has a water solubility of 1200 ppm, a soil adsorption (Kd) of <1, and a soil half life in the range of 6-36 weeks (Cohen and Pomerantz, 1984).

Metribuzin has been monitored at 16 sites in Wisconsin, with most sites along the lower Wisconsin River and in the Central Sands area. Table 5 shows that it has been detected at nine of twelve sites in the range of 0.08-6.8 ppb. There is no existing or proposed enforcement standard for metribuzin in Wisconsin, but it has an unofficial health advisory level of 25 ppb. All the detects are below this level.

Other Compounds

Other compounds for which a limited amount of data have been collected include cyanazine (Bladex), linuron (Lorox), carbofuran (Furadan), picloram (Tordon), 2,4-D, dinitro (Dinoseb), and terbufos (Counter). These results are shown in Table 6 which summarizes the results of the entire study to date.

Table 4
Results of the DATCP Groundwater Monitoring for Metolachlor through August 1988

Site Location	Depth* to Ground-water (ft)	Sample Depth* Below Water Table (ft)	Metolachlor (Dual) 6/86	9/86	11,12/86	4,5/87	7,8,9/87	10,11/87	1,2,3/88	4,5/88	6,7,8/88
			ug/l								
Dane County	8	0-2.5	ND	ND	ND	ND	ND	ND	ND	ND	—
		3.0-8.0	ND	ND	ND	ND	~0.40	2.8	3.09	15.1	4.05
		8.0-13.0	ND	ND	ND	ND	ND	~0.45	0.827	1.03	.406
Grant County	8	0-3.0	1.09	11	1.6	1.0	8.3	6.17	4.99	3.90	1.94
		3.0-8.0	1.18	3.1	ND	ND	2.2	2.69	2.84	0.977	1.25
		8.0-12.5	0.98	0.08	ND	ND	ND	2.87	2.74	0.752	1.08
Iowa County 1	12	0-2.7	4.3	2.0	9.1	6.6	11	11.2	2.32	8.49	15.7
		2.0-7.0	4.1	3.8	1.8	0.65	2.1	3.12	0.603	3.51	11.5
		7.0-12.0	12	11	5.6	4.6	1.8	1.92	1.29	0.793	0.985
Iowa County 2	10	0-2.7	ND	ND	ND	ND	—	ND	ND	ND	—
		2.7-7.7	ND	ND	ND	ND	ND	ND	ND	ND	3.99
		8.0-13.0	ND	ND	ND	~0.19	0.60	0.506	ND	0.861	1.10
Juneau County 1	7	0-2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
		2.0-7.0	ND	ND	ND	ND	ND	~0.45	0.282	0.372	0.286
		7.0-12.0	ND	ND	ND	ND	ND	ND	ND	ND	ND

ADDITIONAL SITES INCLUDING ADAMS COUNTY 2, 3, AND 4, PORTAGE COUNTY 2, WAUSHARA COUNTY 2, JUNEAU COUNTY 2, BARRON COUNTY 3, SAUK COUNTY 5 AND 6, GRANT COUNTY 2, ROCK COUNTY 1, AND GREEN COUNTY 1 AND 2 HAVE NOT HAD DETECTS OF METOLACHLOR

* Depth on the date of well installation
ND = non detect
~ = confirmed detect below the level of quantitation
— = no sample

Table 5
Results of the DATCP Groundwater Monitoring for Metribuzin through August 1988

Site Location	Depth* to Ground-water (ft)	Sample Depth* Below Water Table (ft)	Metribuzin (Sencor) 6/86	9/86	11/86	12/86	4,5/87	7,8/87	10,11/87	1,2,3/88	4,5/88	6,7,8/88
			ug/l									
Iowa County 1	12	0-2.7	1.4	ND	_	ND	~0.14	0.23	0.129	0.150	0.679	0.222
		2.0-7.0	1.1	ND	_	ND	0.40	~0.10	0.124	0.114	0.580	1.23
		7.0-12.0	3.1	6.8	_	3.1	2.6	0.71	0.410	0.198	0.129	0.805
Iowa County 2	10	0-2.7	ND	ND	_	ND	_	_	ND	ND	ND	--
		2.7-7.7	ND	ND	_	ND	_	ND	ND	ND	0.220	4.83
		8.0-13.0	ND	ND	_	ND	_	ND	0.033	ND	0.165	0.361
Juneau County 1	7	0-2.0	ND	ND	ND	_	ND	ND	ND	ND	ND	
		2.0-7.0	0.7	ND	ND	_	0.46	0.40	0.67	0.115	0.205	
		7.0-12.0	0.8	ND	1.2	_	0.45	0.37	0.42	0.338	0.143	
Juneau County 2	8	0-2.0		ND	ND	_	ND	ND	ND	ND	ND	
		2.0-7.0		1.6	2.2	_	1.4	0.94	~0.10	0.064	0.276	
		7.0-12.0		ND	ND	_	1.6	1.8	1.9	0.468	1.20	
Grant County	8	0-3.0				ND	~0.13	0.66	0.879	0.741	0.138	0.387
		3.0-8.0				3.2	1.9	0.98	1.88	2.57	2.11	1.62
		8.0-13.0				1.4	1.6	3.0	1.94	1.91	1.54	3.49
Portage County 1	7	0-2.9					ND	ND	0.041	_	ND	ND
		2.9-7.9					ND	ND	ND	0.53	ND	0.362
		8.0-13.0					0.38	0.403	0.177	ND	0.0658	ND
Portage County 2	9	0-3.1					0.58	0.986	0.225	0.213	ND	ND
		3.0-8.0					1.12	0.825	1.36	1.06	0.532	0.841
		7.9-12.9					ND	ND	0.055	0.080	0.0758	0.275
Portage County 3	6	0-2.4					ND	ND	0.660	_	0.645	0.721
		3.0-8.0					ND	0.082	1.21	_	0.184	1.06
		7.8-12.8					ND	0.235	0.164	_	ND	ND
Waushara County 2	5	0-3.8						ND	ND	ND	ND	ND
		4.0-9.0						ND	ND	0.350	0.453	0.784
		9.1-14.1						~0.17	0.057	0.119	0.933	0.191
Waushara County 3	7	0-3.1						2.1	0.649	_	0.366	0.157
		3.1-8.1						1.3	0.257	_	0.394	0.331
		8.3-13.3						ND	ND	_	ND	0.121
Adams County 2	12	0-3.2						0.21	~0.10	ND	ND	ND
		3.2-3.2						0.34	1.7	1.81	0.337	1.47
		8.2-13.2						0.22	0.90	1.41	ND	0.890

ADDITIONAL SITES INCLUDING BARRON COUNTY 2 AND 3, LANGLADE COUNTY 3 AND ADAMS COUNTY 4 HAVE NOT HAD DETECTS OF METRIBUZIN

* Depth on the date of well installation
ND=non detect
~=Confirmed detect below the level of quantitation
_=no sample

Table 6

Summary of the Wisconsin DATCP Groundwater Monitoring Project for Pesticides through August 1988

Chemical Name	Total Sites	Sites With Detects	Detect Range	Mean Detect*	Mean High Detect**	Existing or Proposed Standard
			ug/l			
Alachlor	20	6	0.1-113	0.87#	2.23#	0.5
Aldicarb	12	11	1.0-110	6.09	25.4	10.0
Atrazine	28	18	0.1-33	1.24#	4.14#	3.5
Metolachlor	17	5	0.08-15.7	2.56	9.25	15.0
Metribuzin	16	12	0.03-6.8	0.74	2.21	—
Picloram	3	3	0.125-49	7.75	27.4	—
Linuron	7	1	1.3-2.7	1.9	1.9	—
2-4,D	3	0	ND	ND	ND	—
Carbofuran	5	0	ND	ND	ND	50.0
Terbofos	2	0	ND	ND	ND	—
Cyanazine	5	0	ND	ND	ND	10.0
Dinoseb	3	0	ND	ND	ND	—
Butylate	2	0	ND	ND	ND	—
EPTC	2	0	ND	ND	ND	—

* Mean of individual site means
** Mean of individual site highs
# Does not include Dane County results
ND = non detect

References

Cohen, S. Z., S. M. Creegor, R. F. Carsel, and C. G. Enfield, 1984. Potential Pesticide of Groundwater from Agricultural Uses. In Kreuger, R. F. and J. N. Seiber, eds. Treatment and Disposal of Pesticide Wastes. ACS Symposium Series #259. American Chemical Society, Washington D.C.

Cohen, S. Z. and Irv Pomerantz, 1984. List of Potential Groundwater Contaminants. USEPA Memorandum.

Dean, J. D., P P. Jowise, and A. S. Donigian, Jr. (1984). Leaching Evaluation of Agricultural Chemicals (LEACH) Handbook. EPA-600/3-84-068.

Jury, W. A., W. F. Spencer, and W. J. Farmer, 1984b. Behavior Assessment Model for Trace Organics in Soil: III. Application of Screening Model. J. Environ. Qual. 13:573-579.

Wisconsin Agricultural Statistics Service, 1986. Wisconsin 1985 Pesticide use. Madison, WI: Wisconsin Department of Agriculture, Trade and Consumer Protection.

JKP/88/001/T5
11/17/88

050834- Results of the WDATCP Groundwater Monitoring for Pesticides