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RESEARCH BRIEF

Clean Wisconsin Environmental Health Initiative

Common Pesticides Used in Wisconsin & Potential Health Impacts

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SUMMARY – Pesticides are widely used in Wisconsin to control weeds and pests that threaten crop yields. While they play an important role in agriculture, their use comes with health, environmental, and ecological consequences. Once in the environment, pesticides and their breakdown products can persist for years, spreading beyond their intended targets through runoff and drift. This can harm non-target organisms such as pollinators and can affect human health well beyond the fields where the pesticides were originally applied.

Potential human health risks from exposure include reproductive harm, neurological and developmental impacts, adverse birth outcomes, and increased cancer risk. People are exposed to pesticides in a variety of ways, including direct contact and inhalation while applying pesticides, pesticide residues on food like fruits and vegetables, drinking water contamination, inhalation of pesticides in airborne drift from nearby fields being sprayed, incidental ingestion of contaminated dust or soil, and contact with pesticides on recently sprayed areas like lawns and parks.

While all routes of exposure should be addressed, the focus of this brief is on pesticide drinking water contamination in Wisconsin. As an agricultural state, pesticide contamination of drinking water is recognized as an significant risk. Private wells are of particular concern because they are typically shallower than public wells and not subject to regular testing, making them especially vulnerable to pesticide contamination. More than 30% of Wisconsin residents—many in rural, agricultural areas—rely on private wells for drinking water.

In this brief, we summarize health risks associated with pesticide exposure and look at pesticide drinking water contamination in Wisconsin to understand how frequently pesticides are found in drinking water and what pesticides are most often found. This brief focuses on non-neonicotinoid pesticides to complement our prior brief on neonicotinoid pesticides.

Key takeaways:

- Environmental exposure to pesticides has been linked to a variety of adverse health effects, including damage to the nervous, endocrine (hormone), and reproductive systems, adverse birth outcomes like miscarriage, low birthweight or birth defects, and increased cancer risk.
- The most common non-neonicotinoid pesticides found in Wisconsin drinking water are atrazine, alachlor, acetochlor, metolachlor, and their breakdown products formed when exposed to the environment.
- A quarter of public water systems and more than 40% of private wells in Wisconsin contain non-neonicotinoid pesticides.
    - Contamination rates of private wells exceed 60% in agricultural areas.

- Pesticides are typically found at concentrations well below health-based water quality standards.
    - However, water quality standards do not account for mixtures of pesticides, and as many as 19 different pesticides have been found in a single drinking water well in Wisconsin.
    - Standards also do not account for inactive ingredients in pesticides, which help with application, preservation, and uptake of the active ingredient. These inactive ingredients can be toxic on their own or increase the toxicity of the pesticide's active ingredient.
- Further research is needed to fully assess the health risks of pesticide exposure, particularly combinations of pesticides and other agricultural contaminants like nitrate, and to ensure that current regulatory concentration levels are adequately protective.

Definitions

Acetochlor: an herbicide used for pre-emergent control of weeds in corn.

Alachlor: an herbicide used on corn and soybeans in the past; its usage has been largely replaced by metolachlor and acetochlor.

Atrazine: an herbicide used to control broadleaf and grassy weeds around corn and other crops in Wisconsin.

Groundwater Enforcement Standard (ES): a water quality standard established by the Wisconsin Department of Natural Resources based on recommendations from the Wisconsin Department of Health Services. When groundwater levels exceed ES levels, the state groundwater protection rule requires intervention to address the contamination.

Groundwater Preventative Action Limit (PAL): a groundwater contamination concentration established by the Wisconsin Department of Natural Resources designed to be a warning to initiate interventions to address contamination before it becomes a serious health concern. It is set to 10% of the Enforcement Standard (ES) for cancer-causing contaminants and to 20% of the ES for other contaminants.

Maximum Contaminant Level (MCL): a water quality standard established by the United States Environmental Protection Agency to protect public health and well-being that public water systems must meet.

Metolachlor: an herbicide used on corn and soybeans, as well as vegetable crops such as peas, snap beans, and potatoes.

Pesticide: a substance used to kill, repel, or control plant, animal, fungal, bacterial or other organisms considered to be pests. These include herbicides (controlling undesirable vegetation), insecticides (controlling insects), fungicides (controlling fungi), antimicrobials (controlling bacteria)

Pesticide metabolite or breakdown products: chemical molecules formed when the original pesticide molecule is broken down by plants, animals or environmental factors like water, soil and sunlight.

Private drinking well: a drinking water source not part of a public water system, typically serving a single home.

Public water system: a system providing water for human consumption to at least 15 connections or regularly serving an average of 25 people each day for at least 60 days each year.

- **Community public water systems:** public water systems serving people where they live
    - **Municipal community systems:** public water systems owned by a municipality (city, village, etc.)
    - **Other-than-municipal community systems:** community public water systems privately-owned and serving residences in mobile home parks, apartments, and housing subdivisions.
- **Non-Community public water systems:** public water systems serving people at work, school or dining or entertainment establishments.
    - **Non-transient, non-community systems:** non-community public water systems serving the same people day after day (e.g., workplaces, schools, daycares)
    - **Transient non-community systems:** non-community public water systems not serving the same population consistently (e.g., bars, restaurants, motels, campgrounds, gas stations).

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Introduction

Pesticides are widely used in Wisconsin to control weeds and pests that threaten crop yields. These include herbicides (controlling undesirable vegetation), insecticides (controlling insects), fungicides (controlling fungi), antimicrobials (controlling bacteria), and other biocides.

Properly used, pesticides play an important role in increasing crop yields and reducing food spoilage. However, while they play a vital role in agriculture, their use comes with health, environmental, and ecological consequences. Once in the environment, pesticides and their breakdown products can persist for years, spreading beyond their intended targets through runoff and drift. This can harm non-target organisms such as pollinators and can affect the health of humans far from the original application area.

Normal applications, spills, misuse, or improper storage and disposal can all result in contamination of groundwater resources. In Wisconsin, where private wells supply drinking water for 25 to 30% of residents, this is a particularly pressing issue (Wisconsin DHS 2025a, Wisconsin DNR 2025). In a previous brief we examined neonicotinoid pesticides specifically. In this brief, we explore the health concerns associated with common non-neonicotinoid agricultural pesticides and what is known about their occurrence in drinking water in Wisconsin.

Environmental Exposures to Pesticides

For the general population, the main pesticide exposure routes are eating food products with pesticide residues (e.g., fruits and vegetables), drinking contaminated water, and direct contact with household products (such as insect repellents, pet products to kill fleas and ticks, and lawn and garden weed killers) or recently sprayed surfaces like lawns (USEPA 2025a).

Those working in pesticide production, handling, or application may experience higher exposure rates through inhalation or skin contact. Those living in agricultural communities are also exposed from inhalation of pesticides in airborne drift from fields being sprayed. Incidental ingestion of soils and dust containing pesticides is another source of exposure, particularly for young children.

While exposure to pesticides from all routes need to be addressed, this brief is focused on drinking water contamination in the state.

Human Health Concerns

Environmental exposure to pesticides has been linked to a variety of adverse health effects, including damage to the nervous, endocrine (hormone), and reproductive systems, adverse birth outcomes like miscarriage, low birthweight or birth defects, and increased cancer risk (Tudi et al. 2022, Ahmad et al. 2024, Zhou et al. 2025). The specific health effects of a given pesticide depend on the type of pesticide and its mode of action (i.e., how it affects its target organism) and how it acts in the human body. For example, organophosphate insecticides attacks target insects by inhibiting the enzyme acetylcholinesterase, an enzyme necessary for the normal function of the nervous system (Zhou et al. 2025). Thus, when humans are exposed to organophosphates, there can be nervous system impacts. Alternatively, some pesticides can mimic the hormone estrogen, disrupting normal hormone function in women (Bretveld et al. 2006).

Despite the potential health effects of pesticide exposure, only a small fraction of pesticides used in the state have a water quality standard. There are thousands of pesticides registered for use in the state (Wisconsin DATCP 2025a), including 500 agricultural pesticides (Wisconsin Groundwater Coordinating Council 2025). Only 42 have a groundwater enforcement standard and 22 have a drinking water standard (Table A1). Another 50 pesticides have health advisory standards established by the DHS or EPA (Table A1). The United States Environmental Protection Agency (EPA) has also established non-regulatory human health benchmarks for 430 pesticides. (US EPA 2025b). These benchmarks can be used to identify when pesticides without a drinking water standard may be posing a health risk.

Notably, little research has been done on the health effects of combinations of pesticides, but some studies have suggested possible synergistic effects, where the cumulative impact of multiple pesticides is greater than the individual effects (e.g., Porter et al. 1999, Hayes et al. 2006, Hernández et al. 2017, Coalova et al. 2025). For example, a literature review found 17 examples of synergistic interactions between pesticide mixtures, primarily among insecticides (Rizzati et al. 2016). In a study on honeybees, atrazine and alachlor mixtures with chlorpyrifos increased toxicity to honeybees by 3-fold (atrazine + chlorpyrifos) and 2-fold (alachlor + chlorpyrifos), respectively (Fellows et al 2022). Although this study was not conducted in humans, it illustrates the increased risk from exposure to multiple pesticides.

Finally, it should be recognized that unintended ecosystem effects of pesticide use can also indirectly harm human health. For example, metolachlor has been found to have the potential to promote harmful cyanobacterial blooms through stimulation of cyanobacteria growth and the inhibition of chytrid parasites that control bloom growth (Martinez-Ruiz et al. 2024). In turn, exposure to toxins from harmful algal blooms can irritate the skin, cause gastrointestinal illness, and harm the liver, kidney and nervous system.

While more research is necessary to fully understand the full scope of the risks posed by pesticide exposure, what is currently known from animal studies and the limited human studies is concerning enough to warrant more attention and take precautionary approaches. Growing evidence of human health effects from pesticide exposure highlights the need for stronger regulations, further research, and better monitoring to protect the health of communities in Wisconsin.

Given the hundreds to thousands of pesticides registered for use in Wisconsin, it is beyond the scope of this brief to detail the health effects of exposure to all pesticides used in the state. Thus, in the remainder of this section we focus on the health effects of the four pesticides most commonly found in drinking water in Wisconsin (acetochlor, alachlor, atrazine and metolachlor), as well as recent information on the association between increased cancer risk and overall pesticide usage.

Human Health Concerns: Atrazine

Atrazine is a known endocrine-disrupting chemical, particularly in relation to reproductive health. A recent meta-analysis found that atrazine exposure causes hormonal disruptions that can compromise testicular functionality, damage sperm production and development, and increase the risk of male infertility (Guimarães-Ervilha et al. 2025).

Atrazine exposure has also been associated with adverse birth outcomes (USEPA 2018). A study looking at community water systems in Ohio from

2006-2008 found an association between higher atrazine levels in drinking water and increased risk of low-birth weight births. Importantly, only 4% of samples from the water systems tested in this study exceeded the maximum contaminant level (MCL) of 3 ppb, suggesting that the MCL level may not be sufficiently protective against adverse birth effects (Almberg et al. 2018).

Similarly, simultaneous exposure to nitrate and atrazine has been associated with higher rates of birth defects (Rhoades et al. 2025). Atrazine is often used in tandem with nitrogen-based fertilizers, resulting in high rates of co-occurrence in groundwater. In Nebraska, elevated nitrogen concentrations often co-occurred in drinking water wells that tested positive for atrazine (Gosselin et al. 1997). Additional research found that exposure to both contaminants in drinking water tripled the risk of developing non-Hodgkin lymphoma compared to nitrate alone (Rhoades et al. 2013).

Atrazine exposure has also been linked to pediatric cancer. In Nebraska, elevated atrazine concentrations in both ground and surface water were found to have significant associations with pediatric cancer (Puvvula et al. 2021). Another Nebraska study found that counties with higher groundwater atrazine concentrations had a higher incidence of pediatric cancers (Ouattara et al. 2022).

A study in Wisconsin did not find any association between atrazine levels in well water and breast cancer, although it could not rule out the possibility of risk for women exposed to concentrations above the drinking water standard of 3 ppb (McElroy et al. 2007).

Wisconsin's groundwater standard for atrazine is based on protecting against its potential to harm the liver, kidney, and heart (Wisconsin DHS 2025b).

Human Health Concerns: Alachlor

Alachlor is classified by the EPA as a possible human carcinogen. Animal studies link alachlor exposure to increased risk of nasal cavity, thyroid, and stomach cancers (Genter et al. 2003). The Agricultural Health Study, a large study of pesticide applicators and their spouses, observed a strong positive association of alachlor use and laryngeal cancer in humans, and a weaker association with myeloid leukemia, a bone marrow and blood cancer (Lerro et al. 2018).

Wisconsin's groundwater standard is based on effects on the kidneys, spleen, blood, and reproduction (Wisconsin DHS 2025b).

Human Health Concerns: Acetochlor

Acetochlor is also classified as a possible human carcinogen by the EPA, based on evidence showing benign lung tumors and histiocytic sarcomas in mice. Human information is limited, although analyses of the Agricultural Health Study found an increased risk of lung cancer among licensed acetochlor applicators and a significant increase in colorectal cancer risk among the highest usage group (Lerro et al. 2015). The combined use of acetochlor and atrazine was also associated with an increased risk of lung cancer (Lerro et al. 2015).

While there have been limited human studies, animal studies suggest possible endocrine-disrupting effects of acetochlor exposure. In a study on female rats, neonatal exposure to acetochlor was found to alter pubertal development (Rollerova et al. 2011). Additionally, acetochlor has been found to cause endocrine disruption of the thyroid system in zebrafish (Yang et al. 2015).

Wisconsin's groundwater standard for acetochlor is based on protecting against its potential to damage the nose, lungs, liver, kidneys, brain and reproductive organs (Wisconsin DHS 2025b).

Human Health Concerns: Metolachlor

Metolachlor is classified as a possible human carcinogen by the EPA, based on studies showing increased liver neoplasms in female rats (Silver et al. 2015). Analyses of the Agricultural Health Study found no significant association between metolachlor exposure and risk for any cancer (Silver et al. 2015). There was a positive association found between metolachlor use and the incidence of liver cancer and follicular cell lymphoma, though these findings were based on small sample sizes of exposed cases (Silver et al. 2015). Animal studies found that metolachlor exposure leads to decreased body weight of developing and adult animals and decreased reproductive success at higher doses (Minnesota Department of Health, 2018) Direct exposure can cause skin and eye irritation, and inhalation can result in throat irritation (New Jersey Department of Health, 2016).

Wisconsin's groundwater standard for metolachlor is based on protecting against its potential to harm the liver, decreased body weight and development (Wisconsin DHS 2025b).

Human Health Concerns: Pesticide Exposure and Cancer Risk

Research suggests multiple mechanisms by which pesticides can cause cancer, with the most likely mechanisms being through genotoxicity (causing damage to DNA, leading to mutations) and oxidative stress (Cavalier et al. 2023). Oxidative stress occurs when there are too many highly reactive molecules in our cells (called "free radicals") that can interfere with normal cellular function. Oxidative stress can lead to DNA mutations and other damage, as well as cell proliferation, leading to cancers (Reuter et al. 2010). Other potential ways pesticides could cause cancer include disrupting normal hormone function, causing inflammation and activating substances in the body that would otherwise not be carcinogenic (Cavalier et al. 2023).

Indeed, the International Agency for Research on Cancer analyzed five pesticides and concluded that all were probably or possibly carcinogenic (Guyton et al. 2015). The Agricultural Health Study tracks 30 pesticides, 12 of which have been reported to be linked to a variety of cancers, including prostate, lung, pancreas, and colorectal cancers, as well as multiple myeloma and leukemia (Andreotti et al. 2009, Gerken et al. 2024).

Two recent analyses have examined the relationship between agricultural pesticide exposure and cancer. First, Gerken et al. (2024) conducted a comprehensive national analysis using county-level data on 69 pesticides, cancer incidence, and relevant covariates to assess the effect of pesticide use patterns on cancer rates. Their findings showed that pesticide exposure was associated with increased cases of leukemia, non-Hodgkin lymphoma, bladder, colon, lung, and pancreatic cancer. Importantly, the effect of pesticide exposure on increased cancer risk was found to rival that of smoking. Metolachlor and its metabolites, atrazine, imazethapyr and acetochlor had the largest contributions to increased overall cancer incidence. In Wisconsin, the counties with the most cancer cases attributed to pesticide usage were found in southeastern parts of the state.

Second, a literature review by Cavalier et al. (2022) examined 63 high-quality epidemiological studies on exposure to pesticides and cancer risk published 2017 to 2021. They found that the strongest evidence exists for a causal relationship between pesticide exposure and both acute myeloid leukemia and colorectal cancer. While noting that significant information gaps remain, there is enough existing evidence to justify regulatory action to reduce human exposure to pesticides.

However, it is important to note that much of the evidence linking pesticides to cancer has been in animal models and laboratory studies examining how pesticides interact with cells in ways that could cause cancer (Cavalier et al. 2023). That said, the number of epidemiological studies documenting an association between exposure and cancer cases in observed human populations is increasing, providing more evidence to support the connections suggested in animal and mechanistic studies.

At-risk Populations

Certain populations such as children, agricultural workers, and migrant workers have a higher risk of exposure to pesticides making them more likely to experience negative health impacts. Agricultural workers are especially vulnerable due to their direct contact with pesticides during application and work on treated crops. These workers are also likely to live in close proximity to the treated fields, resulting in increased exposure through air and water contamination.

Additionally, children are more vulnerable to experiencing adverse health effects from pesticide exposure than adults. This is due to higher pound-for-pound consumption of food and drink than adults and underdeveloped immune systems that may not be able to effectively remove pesticide metabolites (Liu & Schelar 2014). Pesticide exposure in children is associated with poor behavioral and neurological outcomes such as delayed mental development and attention-deficit hyperactivity disorder (Liu & Schelar 2014). Children of agricultural workers may be at further increased risk due to the dual factors of increased exposure and vulnerability. A study in central Washington found that median pesticide metabolite concentrations in children of agricultural workers were five times higher than children of nonagricultural workers (Lu et al. 2000).

Migrant workers in Wisconsin face the same exposure risks, along with additional factors that may increase their risk of adverse health effects. Limited healthcare access and language barriers to proper safety and risk management training can increase their risk of exposure and health impacts. Migrant workers may also have economic and legal incentives to refrain from reporting symptoms and unsafe working conditions (Prado et al. 2017).

Pesticides in Wisconsin Drinking Water

Private Wells

Based on stratified sampling by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) designed to be representative of all private wells in the state, an estimated 43% of private wells in Wisconsin contain detectable levels of at least one pesticide or their metabolites (Wisconsin DATCP 2024a). Notably, in areas with more than 15% farmland, the pesticide detection rates in DATCP's sampling are above 60%. The study analyzed water samples for over 100 pesticides or their breakdown products. Across all samples, 21 unique pesticides were detected when grouping together parent pesticides and all of their breakdown products. Atrazine, alachlor, metolachlor, and acetochlor (or their breakdown products) are the most frequently occurring pesticides, all being detected in at least 10% of tested wells (Table 1).

DATCP also conducts targeted sampling, which focuses on wells with a high susceptibility to groundwater contamination by agricultural chemicals. Such areas include those with vulnerable geology (e.g., shallow aquifers or areas with broken karst that provides pathways to deeper aquifers), areas where prior testing shows elevated levels of agricultural chemical contamination, areas with little or no crop rotation so the same pesticides are likely to be consistently used.

Looking at these targeted sampling efforts since 2019, 77-91% of wells, depending on the sampling year, had at least one pesticide or metabolite detected (Wisconsin DATCP 2020,2021,2022,2024b). As with the statewide survey, metolachlor, alachlor, atrazine, and their metabolites were the most frequently detected, although they had higher rates of detection than the statewide sampling (Table 2). As many as 19 different pesticides have been found in a single drinking water well during these targeting sampling efforts.

Table 1. Summary of the most commonly detected non-neonicotinoid pesticides in Wisconsin's DATCP survey of agricultural contaminants in private drinking water wells (n=380) in 2023. Also shown are the range of concentrations found and the state groundwater standards. Pesticides found in concentrations above the preventative action limit are highlighted in orange.

Pesticide	Number of Detections	Detection Rate	Range of Concentrations Detected in Private Drinking Wells (ppb)	NR140 Preventative Action Limit and Enforcement Standard (ppb)
Metolachlor ESA[1]	170	45%	0.1-18.3	260/1,300
Alachlor ESA[2]	97	26%	0.1 -6.9	4/20
De-ethyl atrazine [3]	92	24%	0.1-0.6	0.3/3
Acetochlor ESA[4]	40	11%	0.1-5.3	46/230
Di-amino atrazine[3]	29	8%	0.2-2.3	0.3/3
Atrazine	18	5%	0.1-0.2	0.3/3
Metolachlor OA[1]	16	4%	0.3-13.2	260/1,300
De-isopropyl atrazine[3]	9	2%	0.1-0.4	0.3/3
Bentazon	8	2%	0.1-0.4	60/300
Metribuzin DADK	5	1%	0.1-5.1	14/70
Metolachlor	4	1%	0.1-0.3	10/100

[1] Metolachlor metabolite; [2] Alachlor metabolite; [3] Atrazine metabolite; [4] Acetochlor metabolite

Table 2. Detection rates of the non-neonicotinoid pesticides sampled in Wisconsin DATCP's targeted sampling of private drinking water wells known, or suspected, to be at high risk of agricultural chemical contamination from 2020 to 2024. Shown are pesticides with detection rates exceeding 5%, and those found in concentrations above the preventative action limit are highlighted in orange.

Pesticide	Detection Rate (%)	Maximum concentration detected (ppb)	NR140 Preventative Action Limit and Enforcement Standard (ppb)
Metolachlor ESA[1]	67	26.8	260/1,300
Alachlor ESA[2]	47	6.0	4/20
De-ethyl atrazine[3]	39	0.7	0.3/3
Di-amino atrazine[3]	22	1.5	0.3/3
Acetochlor ESA[4]	21	1.5	46/230
Metolachlor OA[1]	15	21.2	260/1,300
Atrazine	9	0.5	0.3/3
De-isopropyl atrazine[3]	9	0.3	0.3/3
Dimethenamid ESA	7	2.4	--
Metribuzin DADK	7	1.6	14/70

[1] Metolachlor metabolite; [2] Alachlor metabolite; [2] Atrazine metabolite; [4] Acetochlor metabolite

A total of 1,185 unique private drinking wells have tests for pesticides between January 2015, and October 2025 in the Wisconsin Department of Natural Resources' Groundwater Retrieval Network. Of these, 299 (25%) had at least one pesticide detected and 30 (3%) had multiple pesticides. One test was above a health-based standard, which was a test for the triazine screen (atrazine, simazine, and cyanazine).

The only pesticides tested for in this dataset were alachlor OA (1% detection), metolachlor ESA (37% detection), metolachlor OA (7% detection), pyrene (0% detection) and triazine screen (24% detection).

Public Water Systems

Since 2015, 16% of all active public water systems across Wisconsin detected at least one of the 22 pesticides with maximum contaminant levels (MCL) in public water systems established by the EPA under the Safe Drinking Water (Table 3). Atrazine was by far the most commonly detected pesticide. It was detected in 261 systems (14% of all systems), including 128 (23%) municipal community systems, 32 (8%) other-than-municipal community systems, 100 (11%) non-transient, non-community systems, and 1 (5%) transient, non-community system.[1] Additionally, pentachlorophenol was found in in 17 systems, and alachlor and dinoseb were each found in 8 public water systems. A total of 25 systems had detections of multiple pesticides, including 10 municipal systems. No sample exceeded any health-based drinking water standards.

Although there is no MCL for metolachlor, the most commonly detected pesticide in private drinking wells, 164 public water systems have reported tests for this pesticide since 2015. Of the systems that tested for metolachlor, 70 (43%) had detections, including 43 municipal community systems. Even without full testing, this makes it the second most commonly detected pesticide. Similarly, there is no MCL for dicamba, but most of the public water systems that have tested for other pesticides have also tested for dicamba. Of the 1,746 active public water systems that have tested for dicamba since 2015, 36 (2%) have detected it.

Table 3. Number and percent of active public water systems with detections of non-neonicotinoid pesticides with drinking water standards from 2015-2025. System counts refer to the number of systems that have tested for pesticides between 2015-2025.

Pesticide	All public systems (n=1,871)	Municipal Community (n=560)	Other-than-Municipal Community (n=410)	Non-transient, Non-community (n=879)	Transient, Non-community (n=22)
2,4,5-TP (SILVEX)	1 (<1%)	0	0	1 (<1%)	0
2,4-D	6 (<1%)	1 (<1%)	0	5 (<1%)	0
Alachlor	8 (<1%)	4 (<1%)	2 (<1%)	2 (<1%)	0
Atrazine[1]	261 (14%)	128 (23%)	32 (8%)	100 (11%)	1 (5%)
Carbofuran	0	0	0	0	0
Chlordane	0	0	0	0	0
Dalapon	5 (<1%)	1 (<1%)	0	4 (<1%)	0
DBCP[2]	0	0	0	0	0
Dinoseb	8 (<1%)	0	0	8 (1%)	0
Diquat	1 (<1%)	0	1 (<1%)	0	0
Endothall	2 (<1%)	1 (<1%)	0	1 (<1%)	0
Endrin	1 (<1%)	1 (<1%)	0	0	0
Glyphosate	0	0	0	0	0
Heptachlor[3]	3 (<1%)	1 (<1%)	0	2 (<1%)	0
Hexachlorobenzene	2 (<1%)	1 (<1%)	0	1 (<1%)	0
Lindane	0	0	0	0	0
Methoxychlor	3 (<1%)	2 (<1%)	0	1 (<1%)	0
Oxamyl	0	0	0	0	0
Pentachlorophenol	17 (1%)	2 (<1%)	4 (<1%)	11 (1%)	0
Picloram	5 (<1%)	1 (<1%)	2 (<1%)	2 (<1%)	0
Simazine	6 (<1%)	2 (<1%)	0	4 (<1%)	0
Any Pesticide	**299 (16%)**	**134 (24%)**	**37 (9%)**	**127 (14%)**	**1 (5%)**

[1] includes atrazine and three breakdown products (diaminoatrazine, diethylatrazine and deisopropylatrazine)
[2] 1,2-Dibromo-3-chloropropane; only tested in 67 municipal community, 76 other-than-municipal community, 250 non-transient, non-community and 4 transient, non-community water systems.
[3] includes heptachlor and breakdown product heptachlor epoxide

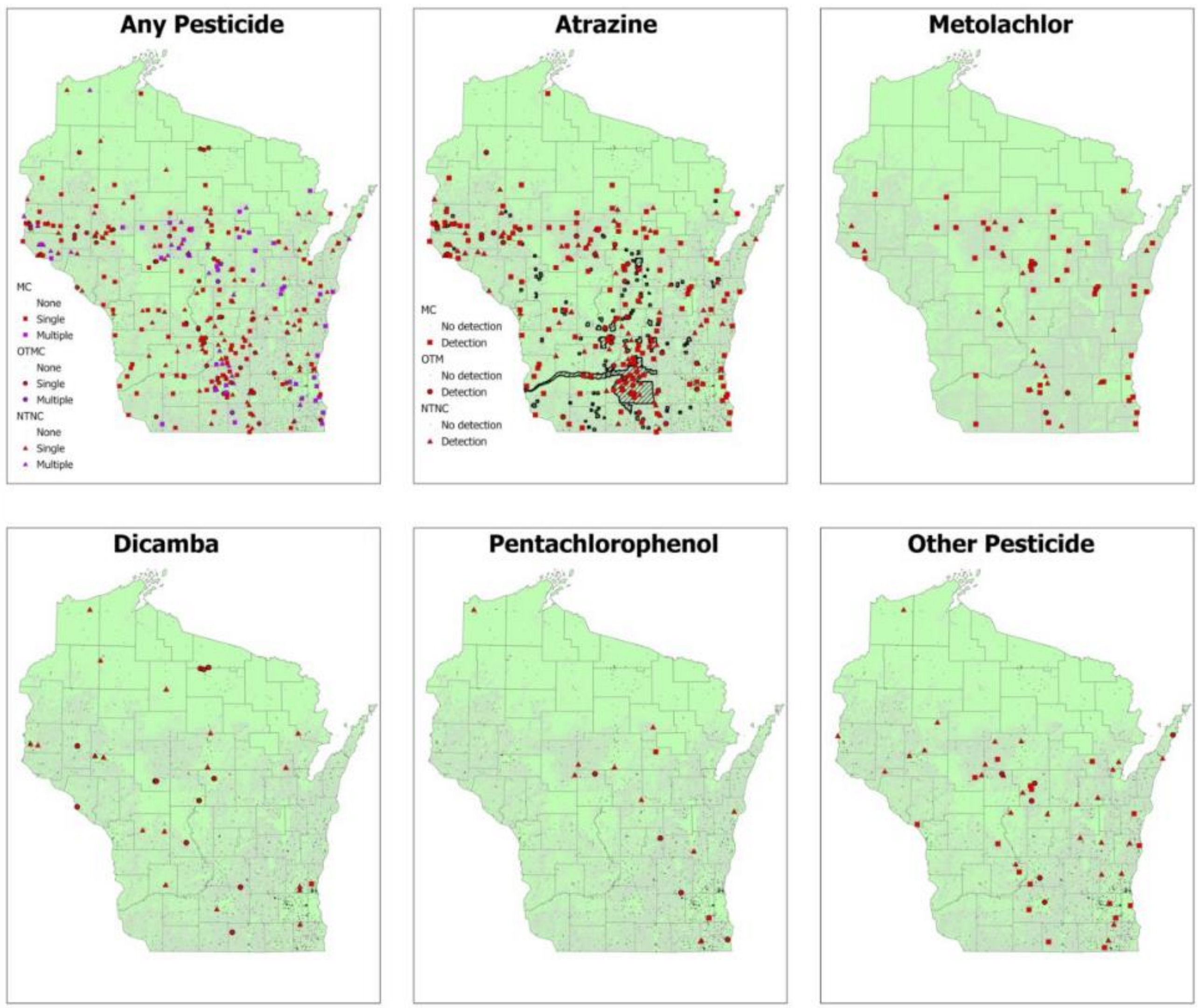

Figure 1. Public water systems with pesticide detections between 2015-2025. The light gray shading indicated agricultural land cover (from WISCLAND2.0 dataset). Different system types are indicated by different shapes MC: municipal community public water system (squares); OTMC: other-than-municipal community public water system (circles) ; NTNC: non-transient, non-community system public water system (triangles). The legend in the atrazine map applies to all of the individual pesticide maps. The dashed areas in the atrazine map indicate atrazine prohibition areas, where its use is restricted due to groundwater contamination.

Pesticide detections in Wisconsin public water systems are primarily concentrated in the south, central, and west central regions of the state. Additionally, there is a high concentration around urban areas such as Dane County. This geographic distribution aligns with agricultural usage patterns, corresponding with corn and soybean production areas.

Atrazine-specific information

Over 11,000 private well tests for atrazine have been submitted to the Center for Watershed Science's database since 2015, with 30% of tests detecting atrazine statewide (Center for Watershed Science 2025). Less than 1% of tests exceed the health-based water quality standard of 3 ppb, although levels as high as 15 ppb have been found. Figure 2 shows county-level results, indicating central and south-central Wisconsin as having the highest rates of atrazine contamination in the state.

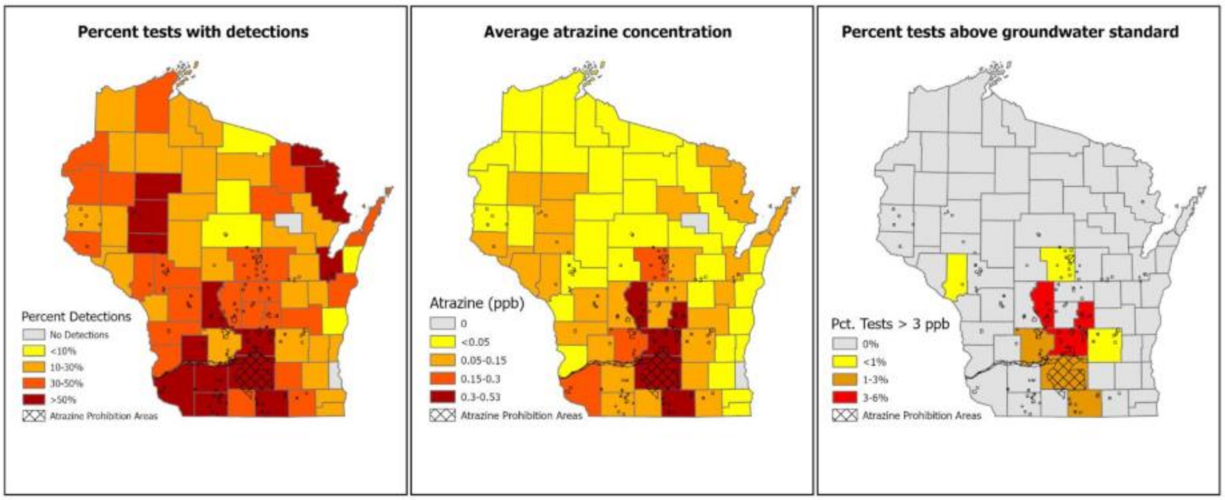

Figure 2. Percent of atrazine detections, the average atrazine concentration and percent of tests above the health-based water quality standard from private well tests since 2015 submitted to the Center for Watershed Science. Also shown are Atrazine Prohibition Areas, where atrazine use is restricted to address groundwater contamination.

In response to widespread detection of atrazine in private drinking wells, Wisconsin restricted the general use of atrazine across the state in 1991 by limiting the maximum application rate and times of the year when it can be applied. (Wisconsin DATCP 2025b). To further protect groundwater and public health, Atrazine Prohibition Areas were established in 2006. These zones prohibit the use of atrazine across 101 designated areas in Wisconsin, covering around 1.2 million acres. (Figure 2; Wisconsin DATCP 2025b). Areas are chosen by several factors, including the frequency of atrazine detections exceeding groundwater standards, uniformity of hydrogeologic characteristics, and other technical or economic factors that are specific to the area.

A recent evaluation of these prohibition areas found that 60% of these prohibition areas appear to be effective, meaning that more than half of the wells in the area that previously exceeded groundwater standards have declining atrazine levels (Wisconsin DATCP 2025). Only 2% of prohibition areas with sufficient data appear to be ineffective, meaning that more than half of the wells in the area that previously exceeded groundwater standards have steady or increasing atrazine levels. The remainder of the areas had insufficient information from which to make an assessment.

These results indicate that the prohibition areas are working to reduce atrazine contamination. To repeal these prohibitions, three criteria must be met: 1) three consecutive tests, taken at least 6 months apart, of wells previously exceeding the atrazine enforcement standard must be less than 50% of the enforcement standard; 2) no tests of other wells in the prohibition area have atrazine concentrations above 50% of the enforcement standard; and 3) DATCP makes a determination that renewed use of atrazine is not likely to cause renewed violations of the enforcement standard. (Wis. Admin. Code s. ATCP 30.375). So far, the first two requirements have been met for 40% of the prohibition areas, but the third requirement has yet to be met for any of the prohibition areas (Wisconsin DATCP 2025b).

Conclusions & Recommendations

Available information indicates that pesticide contamination of drinking water in Wisconsin is somewhat common with about 40% of private wells and 25% of public water systems that serve cities and villages having pesticide detections. However, the concentrations of pesticides in drinking water supplies are typically much lower than health-based water quality standards. This is consistent with a national study of groundwater from public wells conducted by the United States Geological Survey, which found frequent, but low concentration, detections around the country (Bexfield et al. 2021). The most commonly detected pesticides in both public and private wells are atrazine, metolachlor, alachlor, acetochlor, and/or their respective breakdown products.

While pesticide concentrations are typically well below health-based standards, it should be noted that there are important limitations to the water quality standards. First, as discussed earlier in this brief, these standards are based on the pesticide in isolation and do not account for mixtures of pesticides or combinations of pesticides and other agricultural contaminants like nitrates. Such contaminant mixtures have been shown to have increased toxicity compared to a single contaminant in isolation. Nitrate contamination in Wisconsin is widespread, particularly in agricultural areas (Wisconsin Groundwater Coordinating Council 2025), and sampling of private wells have detected up to 19 different pesticides in a single well.

Second, these health-based standards are largely based on testing of the active ingredient in the pesticide only. However, pesticides are formulated with numerous inactive ("inert") ingredients that aid in the preservation, application and uptake at the target organism. These inert components may also be present in drinking water and can be toxic on their own or increase the toxicity of the active ingredient (Cox and Surgan 2006, Defarge et al. 2018, Mesnage and Antoniou 2018). For example, numerous per- and polyfluoroalkyl substances (PFAS) compounds ("forever chemicals") are included as inert pesticide ingredients (Donley et al. 2024).

Finally, as discussed above, only a small fraction of approved pesticides have water quality standards and thus analysis of only those with water quality standards provides an incomplete picture of the public health risk of pesticide drinking water contamination.

Given these limitations, we must continue work to better understand and address pesticide contamination of drinking water in the state. Recommendations to do this include:

- Support additional research on health effects of individual pesticides, as well as around the health risks of pesticide combinations or combinations of pesticides and nitrates relevant to Wisconsin's agricultural use.
  - In particular, much of the current evidence of health effects is based on animal studies so more human evaluations would be helpful.
  - Epidemiological studies investigating the health burden of pesticide exposure in Wisconsin specifically would be valuable to better appreciate the impact of this pollution in the state.

- Establish groundwater and drinking water standards for additional pesticides commonly used or detected in drinking water in Wisconsin (e.g., metolachlor) or that are particularly toxic.
- Re-examine existing groundwater and drinking water quality standards to ensure they reflect the best available information.
- Support Integrated Pest Management, organic and sustainable agriculture techniques to reduce the reliance on pesticides.
- Expand public awareness campaigns about the risks of pesticide exposure
    - In particular, outreach to migrant workers and children is needed, given potential language barriers and limited access to healthcare.
- Provide free or reduced-cost testing kits for rural communities to increase testing of private wells, as well as increased funding to support well owners with contaminated wells.

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Additional Resources

Clean Wisconsin: Clean Water, Clean Air, Clean Energy - Clean Wisconsin

Wisconsin DHS: Pesticides in Private Wells: https://www.dhs.wisconsin.gov/water/pesticides.htm

Wisconsin DNR: pesticides in drinking water: https://dnr.wisconsin.gov/sites/default/files/topic/DrinkingWater/Publications/DG007.pdf

Wisconsin DATCP: Groundwater Reports: https://datcp.wi.gov/Pages/Programs_Services/GroundwaterReports.aspx

United States Geological Survey; Pesticides in Groundwater: https://www.usgs.gov/water-science-school/science/pesticides-groundwater

United States EPA: Drinking Water and Pesticides: https://www.epa.gov/safepestcontrol/drinking-water-and-pesticides

Appendix

Table A.1. Pesticides with groundwater standards (NR140), drinking water standards (US EPA maximum contaminant levels), or health advisory levels from the US EPA or the Wisconsin Department of Health Services, as of October 2025.

Pesticide	Groundwater Standard	Drinking Water Standard	Health Advisory Level[1]	Pesticide	Groundwater Standard	Drinking Water Standard	Health Advisory Level
Acetochlor	X			Endothall		X	X
Acetochlor ESA or OA	X			Endrin	X	X	
Acifluorfen			X	Fenamiphos			X
Alachlor	X	X		Flumetsulam			X
Alachlor ESA	X			Fluometuron			X
Aldicarb	X			Fomesafen			X
Aldicarb Sulfone			X	Fonofos			X
Aldicarb Sulfoxide			X	Glyphosate		X	X
Aldrin			X	Glyphosate AMPA degradate			X
Ametryn			X	Heptachlor	X	X	
Atrazine	X	X		Heptacholor epoxide	X	X	
Bayelton			X	Hexachlorobenzene	X	X	
Baygon			X	Hexazinone			X
Bentazon	X			Imidacloprid			X
Bromacil			X	Isoxaflutole			X
Bromomethane	X			Lindane	X	X	
Butylate	X			Malathion			X
Carbaryl	X			Maleic hydrazide			X
Carbofuran	X	X		MCPA			X
Carboxin			X	Metalaxyl			X
Chloramben	X			Methomyl			X
Chlorantraniliprole			X	Methoxychlor	X	X	
Chlordane	X	X		Methyl parathion			X
Chlorothalonil			X	Metolachlor	X		
Chlorpyrifos	X			Metolachlor ESA or OA	X		
Clomazone			X	Metribuzin	X		
Clothianidin			X	Monuron			X
Cyanazine	X			Norflurazon			X
Cyantraniliprole			X	Oxamyl		X	
Dacthal	X			Paraquat			X
Dalapon		X		Pentachlorophenol	X	X	
Diazinon			X	Picloram	X	X	
1,2-Dibromoethane (EDB)	X			Prometon	X		
1,2-Dibromo-3-chloropropane (DBCP)	X	X		Pronamide			X
Dicamba	X			Propachlor			X
1,2-dichlorobenzene	X			Propazine	X		
1,3-dichloropropene	X			Propham			X
2,4-dichlorophenoxyacetic acid (2,4-D)	X	X		Saflufenacil			X
Dicofol			X	Simazine	X	X	
Dieldrin			X	Sulfentrazone			X
Dimethenamid	X			Tebuthiuron			X
Dimethoate	X			Terbacil			X
Dimethrin			X	Terbufos			X
Dinoseb	X	X		Thiamethoxam			X
Diphenamid			X	Thiencarbazone-methyl			X
Diquat		X		Trichlorophenol			X
Disulfoton			X	2,4,5-TP	X	X	
Diuron			X	Trifluralin	X		
EPTC	X						

[1]Obtained from Wisconsin Department of Natural Resources' Drinking Water & Groundwater Quality Standards/Advisory Levels. Available at: https://dnr.wisconsin.gov/sites/default/files/topic/DrinkingWater/HALtable.pdf