PESTICIDES

IN LAKE MEMPHRAMAGOG'S VERMONT WATERSHED

MORE INDICATIONS FOR A LAKE IN CRISIS?

Sylvia Knight
Earth Community Advocate & Researcher
VT Pesticide and Poison Action Network (VTPAPAN)
VTPFAS/Military Poisons Coalition

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Lake Memphramagog in Crisis

To amplify the Resolution and testimony of DUMP, Inc and the urgency of declaring Lake Memphramagog as a “Lake in Crisis”, VT PAPAN submits this testimony and data regarding pesticides as an additional unmonitored source of threats to Lake Memphramagog.

Thousands of pounds (at least 40,000) of pesticides, some *endocrine-disrupting* compounds, some persistent in the environment, some including PFAS active ingredients, are used in Orleans County, the Vermont watershed of Lake Memphramagog. Corn culture and golf courses see the highest uses. See Chart 1, pages 3-4 below.

Pesticides can and do run off the land in spite of applicators “following the label”. Tile drainage, extreme rain events, overuse, and inadequate buffers contribute to pesticide runoff and contamination of surface waters and groundwater. Very few pesticides used in Vermont have any drinking water or water quality standards.

Endocrine disruptors can cause serious health effects at very low concentrations at critical phases of life, and other effects in different amounts at other phases of life. The regulatory system has not caught up with these complexities. The endocrine system consists of many glands and organs that help regulate energy, metabolism, reproduction, growth and development, response to injury, stress and mood. The gut biome is now considered by many to be part of the endocrine system, and is connected to the brain. We are learning more about how many pesticides once considered of low harm to humans (because they are herbicides) can cause human illness by harming the gut biome. Examples of endocrine disrupting pesticides are acetochlor, atrazine, chlorothalonil, glyphosate, simazine, metolachlor, pentachloronitrobenzene, and 2,4-D.

The Public Health and Resource Management (PHARM) division of VT Agency of Agriculture Food & Markets (VAAFM) oversees pesticides and regulations. The Vermont Rule for Control of Pesticides does not require pesticide reduction or address PFAS in pesticides. https://agriculture.vermont.gov/sites/agriculture/files/doc_library/Vermont Rule for Control of Pesticides in Accordance with 6 V.S.A. Chapter 87 (3.8.23).pdf

Vermont Law: Title 6 Chapter 87 of Vermont Statutes Annotated contains laws pertaining to pesticides. Sections 1103-1104 give authority to the Secretary of Agriculture to restrict uses of pesticides or delete uses from pesticide labels.

6 VSA Subchapter 7A section 4964 states that the Agriculture Innovation Board can recommend practices that reduce the use of and exposure to pesticides, … to protect soil biology, human health and environmental health. It includes *recommending targets to achieve the State goal of overall reduction in use of pesticides.* But these are recommendations, and cannot be enforced. Has this work been done?

The Vermont Farm to Plate Plan for 2030 calls for a 20% reduction in pesticide use by 2030. But who is charged with implementing that reduction?

Chart 1

Pesticides Used in Orleans County, Lake Memphramagog Watershed

(2022 latest data available)
https://agriculture.vermont.gov/sites/agriculture/files/doc_library/2022 County Usage initial 05172024.pdf

* = fluorinated organic compound; PFAS incorporated into chemical formula
# = EPA proposing cancellation
F=fungicide; H=herbicide; I = insecticide; PGR = plant growth regulator

Corn, field and forage:	type	lbs of active ingredient used
Acetochlor	H	18,655.9168
Atrazine	H	3,689.976
Bicyclopyrone	H	54.49284 *
Clopyralid	H	39.75
Dicamba	H	154.4395
Glyphosate	H	1221.925
Mesotrione	H	10,415.75136
Metolachlor	H	3304.21096
Nicosulfuron	H	4.788
Rimsulfuron	H	8.13604
Simazine	H	518.5798
Tembotrione	H	8.5824 *
Thiencarbazone-methyl	H	1.6986
Thifensulfuron	H	1.2524
Forestry		
Glyphosate	H	53.56
Imazapyr	H	1.62
Imidacloprid	I	0.018
Pendimethalin	H	0.228
General Pest Control		
Fluazinam	F	5.3424
Flurprimidol	PGR	9.417
Glyphosate	H	4.1026
Iprodione	I	257.4
Mancozeb	F	12.8
Mesoprop	H	10.7928
Mefentrifluconazole	F	2.754 *
Piperonyl butoxide	I	4.82273851
Propiconazole		35.554
Golf courses		
2,4-D	H	24.3784
Bifenthrin	I	9.60542 *
Chlorantraniliprole	F	3.149

Chlorothalonil	F	879.1125
Dicamba	H	6.37
Diquat	H	0.1686
Dithiopyr	H	1.36
Ethephon	PGR	6.8
Fluazinam	F	5.3424
Flurprimidol	PGR	9.417
Glyphosate	H	4.1026
Iprodione	F	257.4
Mancozeb	F	12.8
Mecoprop	H	610.7928
Mefentrifluconazole	F	2.754 *
Pentachloronitrobenzene	F	20 #
Propiconazole	F	35.554
Pyraclostrobin	F	2.6624
Tebuconazole	F	56.352
Thiophanate-methyl	F	150
Trinexapac-ethyl	PGR	8.9124
Highway & Railway		
Aminocyclopyrachlor	H	24.76
Aminopyralid	H	0.4725
Glyphosate	H	214.47
Indazaflam	H	8.0661
Metsulfuron methyl	H	2.03655
Sulfometuron methyl	H	16.378125 4
Utilities and Wood Treatment		
Aminopyralid	H	0.6
Chlorsulfuron	H	0.39
Glyphosate	H	113.84
Imazapyr	H	5.7
Indazaflam	H	0.8476085
Metsulfuron methyl	H	0.28314
Sulfometuron methyl	H	0.8775
Triclopyr	H	0.95
Approximate total		**40,900 lbs active ingredients**

General Comments

We include pesticides used at very low amounts as well as those used in high amounts to indicate the wide variety of pesticides used. Also, some of these low-volume pesticides are very persistent in the environment and powerful at much smaller amounts.

These data include only the “active” ingredients of pesticide products used in Vermont. Other chemical ingredients are also added to the products but not identified, due to laws on

confidential business information, and not reported but can be as chemically active or as toxic as the “active” ingredient. In addition, adjuvants, or drift retardants, surface spreaders and penetrants (called surfactants) are added, not identified, not reported. *These compounds are likely to include PFAS*, given their properties to control spreading, enable penetration and promote persistence on the target organism. These properties also promote bio-accumulation in organisms.

Acetochlor is a pre-emergent herbicide, used before the crop sprouts from the ground. It can cause cancer, according to the California Office of Environmental Health Hazard Assessment. It is also suspected of damaging fertility or the unborn child, is a respiratory irritant and can cause skin irritation. Acetochlor is toxic to aquatic life with long-lasting effects (National Institutes of Health /PubChem).

Aminopyralid and aminocyclopyrachlor are extremely persistent. If livestock eat grasses treated with these herbicides, the compound remains intact and passes through into their manure, which is then toxic to plants even after processing for compost. Aminopyralid can last in the soil for over 500 days. The half-life for aminocylcopyrachlor was found to be up to 400 days. While they are low in toxicity to mammals, they can damage the gut biome through residues in water or food. For more info see https://www.tandfonline.com/doi/full/10.1080/19490976.2023.2187578

Fungicides tend to cause reproductive harm, such as reducing fertility or harming the unborn child. Fluazinam, iprodione, mancozeb, mefentrifluconazole, chlorantraniliprole, pentachloro-nitrobenzene#, propiconazole, pyraclostrobin, trebuconazole, thiophanate- methyl are all fungicides, used primarily on golf courses. They are generally very toxic to aquatic life with long-term effects. Chlorantraniliprole and chlorothalonil are suspected carcinogens.

Glyphosate contributes phosphorus to water bodies, encouraging cyanobacteria to grow. Noone in Vermont state government has factored this property into the phosphorus TMDL for lakes in Vermont. This herbicide has been marketed as relatively benign for humans, but is now known to be toxic to the gut biome, an essential part of the endocrine system. It is always used with other chemicals which add to its adverse effects on organisms.

Mesotrione (notice large use) is both a pre-emergent and post-emergent herbicide. Both the parent compound and Its two main break-down products or degradates move easily through soil into water. Its two degradates are more toxic to non-target organisms than the parent compound and can cause DNA damage in fish cells at low amounts. For more information see http://creativecommons.org/licenses/by-nc-nd/4.0/

Pentachloronitrobenzene is an organochlorine fungicide registered in 1964. It is persistent, bioaccumulative and toxic, and a persistent organic pollutant. EPA proposed in September 2022 to cancel all uses for this fungicide. But the decision for cancellation is not yet final.

Sulfonylureas include chlorsulfuron, metsulfuron methyl, nicosulfuron, rimsulfuron, and sulfometuron methyl. They are powerful herbicides used at only ounces per gallon of water rather than pints or quarts like other herbicides. They are used with drift retardants because they can damage off-target areas so easily. In the 1990s some EPA scientists were reluctant to register this type of herbicide because they caused so much damage in non-target areas.

Their persistence in soil ranges from weeks to months depending on the soil. These compounds may contribute to Type 2 diabetes after prolonged use.

Triazine herbicides include atrazine and simazine, which, as endocrine disruptors, can cause developmental toxicity and female reproductive toxicity, according to EPA. Atrazine was detected in 2021 at high concentrations at the confluence of four streams with Lake Champlain due to agricultural activity inland: Potash Brook, Englesby Brook, Stevens Brook and Rock River. These herbicides also leach to groundwater. It has also caused gender changes in fish in Missisquoi Bay. The Maximum Contaminant Level set by EPA is 3 parts per billion (ppb).

For further information on these pesticides visit:
Beyond Pesticides: https://www.beyondpesticides.org/resources/pesticide-gateway

National Library of Medicine: PubChem database: https://pubchem.ncbi.nlm.nih.gov
Shows chemical formula; provides health and environmental dangers, links to studies.

For international documents on pesticide use, policy and alternatives visit:
https://pan-international.org/resources/

PFAS active ingredients in bicyclopyrone, tembotrione, mefentrifluconazole, and bifenthrin are fluorinated organic (carbon) compounds as part of the chemical product. They tend to be persistent in the environment, can create break-down products that more toxic than the parent compound. and may adversely affect non-target species. They bioaccumulate in organisms and act as endocrine disruptors. For more information on fluorinated organic compounds, see this research article at http://doi.org/10.1016/j.envpol.2021.118315.

Nathan Donley, Kyla Bennett and others published an article in Public Health Perspectives (https://ehp.niehs.nih.gov/doi/full/10.1289/EHP13954) listing a number of pesticides with EPA-registered PFAS active ingredients that meet the Organisation for Economic Co-operation and Development (OECD) definition of PFAS adopted by Vermont in Act 131, 2024; that is: “a class of fluorinated organic chemicals containing at least one fully fluorinated carbon atom.”

Comparing their list with Vermont’s pesticide use data, we find that at least twenty-four (24) pesticides with PFAS active ingredients have been registered in Vermont, as of 2022. The Legislature is trying reduce PFAS in Vermont. VAAFM appears determined to disperse them widely, without accountability.

See Chart 2 below.

Chart 2: PFAS ACTIVE INGREDIENTS IN VT PESTICIDES

In 2024, a group of scientists reported a list of pesticides with PFAS active ingredients. (N. Donley et al. Forever pesticides. https://doi.org/10.1289/EHP132.)
VTPAPAN compared that list with VAAFM's Pesticide Use data of 2022, last year reported. https://agriculture.vermont.gov/sites/agriculture/files/doc_library/2022%20County%20Usage%20initial%2005172024.pdf

Types: F=fungicide; H=herbicide; I=insecticide; L=lampricide; R=rodenticide.
Counties: AD=Addison; BN=Bennington; CA=Caledonia; CH=Chittenden; ES=Essex; FR=Franklin; GI=Grand Isle; LA=Lamoille;OR=Orange; OL=Orleans; RU=Rutland; WA=Washington; WI=Windham; WN=Windsor.

PFAS ACTIVE INGRED.	TYPE	TOTAL LBS.	USEs	LOCATIONS
Bicyclopyrone	H	**489**	corn, field, forage	CA, CH, ES, FR, GI, LA, OR, OL, RU, WN
Bifenthrin	I	**647**	pest control, golf courses, landscape, mosquitos	Location of major use not identified
Bromethalin	R	0.06	rodent control	small amounts in most counties
Chlorfenapyr	I	48	general pest control	locations not specified
Dithiopyr	H	483	golf courses, lawn care	mostly CH & WN
Ethalfluralin	H	**268**	**FOOD**	OR
Fipronil	I	371	general pest control, mosquitos	Location not identified
Fludioxonil	F	36	Golf courses	Several counties
Fomesafen	H	133	Corn, field, forage **FOOD**	AD,FR OR
Lambda-cyhalothrin	I	**455**	Corn, field,forage **FOOD,** lawn care, golf courses, pest control	AD; FR

(P.2 PFAS in Pesticides)
Types: F=fungicide; H=herbicide; I=insecticide; L=lampricide; R=rodenticide.
Counties: AD=Addison; BN=Bennington; CA=Caledonia; CH=Chittenden; ES=Essex; FR=Franklin; GI=Grand Isle; LA=Lamoille; OR=Orange; OL=Orleans; RU=Rutland; WA=Washington; WI=Windham; WN=Windsor.

PFAS ACTIVE INGRED.	TYPE	TOTAL LBS.	USEs	LOCATIONS
Hydramethylnon	I	0.19	general pest control	Unspecif; also BN, OR
Indoxacarb	I	8.7	general pest control	Unspec; BN,CH,LA, RU, WA, WI, WN
			golfcourse;	AD,WA
			lawn care;	AD, WI
			FOOD	**CH, OR, WI**
Mefentrifluconazole	F	92.5	golf courses	CA,RU,WA,WN
			FOOD	WN
Novaluron	I	9	gen. pest control,	all counties
			golf courses,	AD, WN
			mosquitos	most counties
Noviflumuron	I	0.013	not specified in county data	
Penoxsulam	H	0.8	lawn care	AD,CH,RU, WI, WN
Picoxystrobin	F	156	corn, field, forage	FR, RU
Prodiamine	H	**2010**	golf courses	WA
			lawn care	BN,CH,RU,WN
Prosulfuron	H	26	corn, field, forage	CH
Pyroxasulfone	H	**1005**	corn, field, forage	AD, CH
Tembotrione	H	**494**	corn, field, forage	AD,CA,OR,WN
Tetraconazole	F	42	corn, field, forage	AD
Tetraniliprole	I	10	golf courses	WN
			lawn care	CH, LA
TFM (2020)	L	13,782	lampricide	CH, FR