

Summary Report: Urban Storm Water Runoff Monitoring for Pesticides and Nitrate in Helena and Billings, 2011

Montana Department of Agriculture, Groundwater Protection Program

Project Summary

Pesticides are commonly used in residential and urban settings to control weeds and insects around homes, lawns, parks, golf courses, road sides, and other areas. Fertilizer is also commonly applied to lawns and gardens. During storm or irrigation events, pesticides and fertilizer can be washed off application areas and end up in storm sewers which then discharge into streams or into ponds where the water can percolate down to groundwater. However, there is no known monitoring conducted on storm water in Montana to determine the presence and potential impacts of pesticides and fertilizers in storm water.

In the summer of 2011 the Montana Department of Agriculture (MDA) collected storm water samples from both Helena and Billings to test for pesticides and nitrate. Sixteen samples were collected from four sites during four storm events in Helena. Samples were raw storm water collected from ditches and drain pipes in the Helena storm water drainage system. Seven samples from four sites during two storm events were collected in Billings. The samples were collected from streams and drains which receive storm water discharges.

Samples collected during this project were taken to the MDA Analytical Laboratory Bureau at Montana State University and analyzed for 148 pesticide compounds (herbicides, insecticides, and fungicides) as well as nitrate. A summary of laboratory results are included in Table 1.

Laboratory Results

In total there were 29 different pesticide compounds detected in Helena storm water and 26 pesticide compounds in Billings storm water (Table 1). The detections consisted of a wide range of herbicides, insecticides, and fungicides. The most common groups of pesticides detected in storm water were the phenoxy herbicides (2,4-D, MCPA, and MCPP) and herbicides used as soil sterilants (diuron, glyphosate, prometon, tebuthiuron, and triclopyr) . The phenoxy herbicides are commonly used in residential settings. 2,4-D and MCPA are commonly detected in streams across the state of Montana, however, the concentrations in storm water were generally higher. Soil sterilants are used in non-crop areas where long term vegetation or weed control is desired. Because of their persistence in the environment soil sterilants are also commonly detected in surface waters across the state.

Nitrate was detected in 20 of 23 storm water samples, but all of the concentrations were below what is considered background levels (Table 1). Nitrate has several potential sources including fertilizer, animal waste (i.e., septic effluent, sewage, livestock waste), and natural sources.

Table 1. Summary of Pesticide and Nitrate Detections

Helena Storm Water							
Pesticide Compound	Number of Samples	Number of Detections	Percent of Samples with Detections	Summary of Detections		Human Health Standard for Drinking Water (µg/L)	Lowest Available Aquatic Life Benchmark* (µg/L)
				Median Concentration (µg/L)	Maximum Concentration (µg/L)		
2,4-D (H)	16	16	100	1.35	17	70	13.1
AMPA (D)	12	3	25	1.0	1.4	--	N/A
Atrazine (H)	16	5	31	--	<0.0022	3	1
Azoxystrobin (F)	16	3	19	--	<0.01	1,000	44
Bromacil (H)	16	4	25	0.009	0.03	90	6.8
Carbaryl (I)	16	2	13	--	0.1	700	0.5
Chlorothalini (F)	16	7	44	--	<0.017	15	0.6
Chlorsulfuron (H)	16	6	38	0.014	0.036	1,750	0.055
Chlopyralid (H)	16	4	25	0.057	0.085	3,500	56,500
Diazan (I)	16	2	13	0.014	0.017	0.6	0.11
Dichloprop (H)	16	7	44	0.0059	0.099	--	--
Diuron (H)	16	14	88	0.014	0.92	10	2.4
Fipronil (I)	16	1	6	--	<0.0012	--	0.11
Glyphosate (H)	12	11	92	0.0058	0.01	700	1,800
Hydroxy atrazine (D)	16	3	19	--	<0.004	70	>1,500
Imazapic (H)	16	9	56	0.003	0.0081	4,000	--
Imazapyr (H)	16	15	94	0.019	0.53	21,000	24
Imidacloprid (I)	16	4	25	--	<0.021	400	1.05
Malathion (I)	16	1	6	--	1.1	100	0.035
MCPA (H)	16	16	100	0.12	2.2	4	20
MCPP (H)	16	16	100	0.23	4.6	7	14
Nitrate	16	13	81	0.65 mg/L	1.5 mg/L	10 mg/L	--
Picloram (H)	16	3	19	0.16	0.39	500	550
Prometon (H)	16	16	100	0.0275	0.61	100	98
Propaconazole (F)	16	6	38	--	<0.011	700	21
Simazine (H)	16	4	25	0.006	0.023	4	36
Sulfomuterun (H)	16	2	13	0.103	0.2	2,000	0.48
Tebuconazole (F)	16	3	19	--	0.012	200	12
Tebuthiuron (H)	16	12	75	0.0015	0.0023	500	50
Triclopyr (H)	16	15	94	0.0235	2.1	350	100
Billings Storm Water							
2,4-D (H)	7	7	100	1.1	27	70	13.1
Atrazine (H)	7	5	71	<0.0022	0.086	3	1
Bromacil (H)	7	4	57	0.031	0.26	90	6.8
Carbaryl (I)	7	2	29	--	<0.077	700	0.5
Chlorsulfuron (H)	7	1	14	--	0.0056	1,750	0.0055
Chlopyralid (H)	7	1	14	--	0.8	3,500	56,500
Deethyl atrazine (D)	7	2	29	--	0.015	3	1,000
Dichloprop (H)	7	2	29	--	0.019	--	--
Diuron (H)	7	7	100	0.069	0.22	10	2.4
Hydroxy atrazine (D)	7	3	43	--	0.014	70	>1,500
Imazapic (H)	7	4	57	--	<0.003	4,000	--
Imazapyr (H)	7	7	100	0.022	0.04	21,000	24
Imidacloprid (I)	7	3	43	0.03	0.05	400	1.05
Malathion (I)	7	3	43	0.071	0.16	100	0.035
MCPA (H)	7	7	100	0.065	1.3	4	20
MCPP (H)	7	7	100	0.023	3.9	7	14
Metolachlor ESA (D)	7	3	43	0.01	0.03	100	24,000
Nitrate	7	7	100	1.2 mg/L	1.6 mg/L	10 mg/L	--
Permethrin, cis (I)	7	1	14	--	<0.03	--	--
Permethrin, trans (I)	7	1	14	--	<0.025	--	--
Picloram (H)	7	2	29	0.107	0.14	500	550
Prometon (H)	7	7	100	0.023	0.47	100	98
Propaconazole (F)	7	3	43	--	<0.011	700	21
Simazine (H)	7	1	14	--	0.009	4	36
Sulfomuterun (H)	7	2	29	0.0097	0.011	2,000	0.48
Tebuthiuron (H)	7	6	86	0.0015	0.0024	500	50
Triclopyr (H)	7	7	100	0.0054	3	350	100

H = herbicide, I = insecticide, F = fungicide, D = pesticide degradate
 * Aquatic life benchmarks are available for acute and chronic effects on fish, acute and chronic effects on invertebrates, acute effects on nonvascular plants, and acute effects on vascular plants

Summary

The number of pesticide detections per sample in storm water was very high when compared with other stream samples collected around the state. Helena storm water samples averaged approximately 13 pesticides per sample while Billings' storm water averaged nearly 15 pesticides per sample.

All pesticide concentrations were below human health drinking water standards, however, there were several detections which were greater than 50% of the drinking water standard. MCPA had one detection in Helena >50% of the drinking water standard and MCPP had two detections in Helena and one in Billings >50% of the drinking water standard. Several detections also exceeded or approached an aquatic life benchmark as set forth by the Environmental Protection Agency Office of Pesticides. There were two 2,4-D detections, one in Helena and one in Billings, which exceeded the acute aquatic life benchmark for vascular plants. Malathion exceeded both the acute and chronic benchmark for invertebrates in one sample from Helena and exceeded the chronic benchmark for invertebrates in two samples from Billings. Chlorsulfuron was detected in one sample from Helena at >50% of the acute benchmark for vascular plants.



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