INFORMATION ON PHARMAECEUTICALS, PERSONAL CARE PRODUCTS, ENDOCRINE DISRUPTING COMPOUNDS AND PHTHALATE ESTERS IN OUR WATER

SEAWA Watershed Report 2010-10 ***draft***

SEAWA Web-based State of the Watershed Report

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Summary

INTRODUCTION:

Due to the advancements in the methods used for detecting chemicals in the environment, trace levels of pharmaceuticals have been found in waterways. This is an increasing concern because of the potential to cause undesirable ecological effects. Residues of human and veterinary pharmaceuticals such as antibiotics, estrogens and active ingredients of drugs are introduced into the environment via a number of pathways. [2]

While a few effects are known, there is a still a great deal unknown about the affects of these drugs in our water.

PHARMACEUTICALS AND PERSONAL CARE PRODUCTS

What are they?

Pharmaceuticals and personal care products are human and veterinary drugs, dietary supplements, fragrances, cosmetics, sunscreens and cleaning products.[7]

Are they in our water?

In 2005, Alberta Environment tested the water in treated municipal wastewaters and the rivers that receive wastewater for pharmaceuticals and endocrine disrupting compounds (EDCs). The results for pharmaceuticals were as follows:

a) Acidic Pharmaceuticals in our water

Of the nine acidic drugs analysed (Table 1), only two (clofibric acid and ketoprofen) were not detected at least once in either effluents (treated municipal wastewaters sent out from the waste water treatment plant (WWTP) into a river or sea) or in the river waters. Of the remaining seven, anywhere from four to seven were noted in effluents from the four WWTPs in Edmonton and Calgary, with the exception of diclofenac and naproxen. In the case of smaller municipalities (Lethbridge, Medicine Hat and Red Deer), only gemfibrozil was detected in effluents and at downstream sites.[5]

Table 1: Acidic pharmaceutical concentrations in WWTP effluents and receiving rivers of Alberta (micrograms per liter). ND = Not Detected.[5]

			NORTH SASKATCHEWAN RIVER		BOW RIVER		OLDMAN RIVER	SOUTH SASKATCHEWAN RIVER	RED DEER RIVER
		Compound	Capital Region WWTP 17/12/02	Gold Bar WWTP 17/12/02	Fish Creek WWTP 15/01/03	Bonnybrook WWTP 15/01/03	Lethbridge WWTP 29/01/03	Medicine Hat WWTP 23/01/03	Red Deer WWTP 22/01/03
Acid Pharmaceuticals	Effluent	Bezafibrate	0.117	0.547	0.298	0.144	ND	ND	ND
		Clofibric acid	ND	ND	ND	ND	ND	ND	ND
		Diclofenac	ND	ND	0.429	0.359	ND	ND	ND
		Fenoprofen	0.106	0.355	0.078	ND	ND	ND	ND
		Gemfibrozil	0.619	0.652	0.773	0.799	0.410	0.606	0.813
		Ibuprofen	1.759	1.333	1.149	0.383	ND	ND	ND
		Indomethacin	0.803	ND	0.166	0.105	ND	ND	ND
		Ketoprofen	ND	ND	ND	ND	ND	ND	ND
		Naproxen	ND	ND	2.668	1.785	ND	ND	ND
		Compound	At Fort Saskatchewan Bridge (downstream of effluents) 17/12/02		At Stiers Ranch (downstream of effluents) 19/08/03		SW of Diamond City (downstream of effluent) 29/01/03	Upstream of Medicine Hat (upstream of effluent) 23/01/03	At Red Deer (downstream of effluent 25/08/03
	Receiving River	Bezafibrate	0.029		0.010		ND	ND	ND
		Clofibric acid	ND		ND		ND	ND	ND
		Diclofenac	0.090		0.021		ND	ND	ND
		Fenoprofen	0.026		ND		ND	ND	ND
		Gemfibrozil	0.052		0.023		0.017	0.067	0.004
		Ibuprofen	0.269		0.023		ND	ND	ND
		Indomethacin	0.027		0.020		ND	ND	ND
		Ketoprofen	ND		ND		ND	ND	ND
		Naproxen	0.106		0.059		ND	ND	ND

b) Neutral Pharmaceuticals

Six of the eight tested neutral pharmaceuticals (trimethoprim, pentoxifylline, cyclophosphamide, carbamazepine, caffeine, and cotinine) appeared in nearly all WWTP effluents (Table 2). Of the remaining two, fluoxetine was only detected in the Capital Region and Goldbar WWTP effluents, while norfluoxetine did not appear at all. Pentoxyfylline and cyclophosphamide were found at very low concentrations in most of the WWTPs. Trimethoprim, carbamazepine, caffeine and cotinine were consistently reported for most effluents and rivers. [5]

Table 2: Neutral pharmaceutical concentrations in WWTP effluents and receiving rivers of Alberta (micrograms per liter). ND = Not Detected. [5]

			NORTH SASKATCHEWAN RIVER		BOW RIVER		OLDMAN RIVER	SOUTH SASKATCHEWAN RIVER	RED DEER RIVER
		Compound	Capital Region WWTP 17/12/02	Gold Bar WWTP 17/12/02	Fish Creek WWTP 15/01/03	Bonnybrook WWTP 15/01/03	Lethbridge WWTP 29/01/03	Medicine Hat WWTP 23/01/03	Red Deer WWTP 22/01/03
Acid Pharmaceuticals	Effluent	Fluoxetine	0.031	0.799	ND	ND	ND	ND	ND
		Norfluoxetine	ND	ND	ND	ND	ND	ND	ND
		Trimethoprim	3.528	0.669	0.795	0.907	0.887	0.514	1.404
		Pentoxifylline	0.163	0.098	0.171	0.099	0.023	0.084	0.036
		Cyclophosphamide	ND	0.005	0.048	0.055	0.012	0.012	ND
		Carbamazepine	2.641	1.784	0.702	0.925	2.785	1.123	3.287
		Caffeine	ND	0.129	0.670	0.405	0.074	0.872	0.095
		Cotinine	0.162	0.156	3.476	0.165	0.030	0.141	0.131
		Compound	At Fort Saskatchewan Bridge (downstream of effluents) 17/12/02		At Stiers Ranch (downstream of effluents) 19/08/03		SW of Diamond City (downstream of effluent) 29/01/03	Upstream of Medicine Hat (upstream of effluent) 23/01/03	At Red Deer (downstream of effluent 25/08/03
	Receiving River	Fluoxetine	ND		ND		ND	ND	ND
		Norfluoxetine	ND		ND		ND	ND	ND
		Trimethoprim	0.104		0.018		0.039	0.076	ND
		Pentoxifylline	ND		0.015		ND	ND	ND
		Cyclophosphamide	ND		ND		ND	ND	ND
		Carbamazepine	0.171		0.094		0.139	0.206	0.095
		Caffeine	0.023		0.064		0.072	0.466	0.054
		Cotinine	0.009		0.007		ND	0.189	ND

How do they get in our water?

Some ways are: [7]

- Excretion by humans and domestic animals
- Flushing
- Bathing
- Swimming
- Discharge from municipal sewage systems or private septic systems
- Leaching from landfills
- Runoff from confined animal feeding operations
- Discharge of raw sewage from storm overflow

What is their effect on us?

When it comes to effects of this effluent, there is a great deal of uncertainty. Some scientists believe the levels of pharmaceuticals in the water are so low that there will be no affect. Other scientists are concerned about the effects of long-term and combined exposure to these pharmaceutical products.[8]

However, antibiotic-resistant bacteria are being found in significantly higher numbers in wastewater and treated wastewater compared to the typical resistant population in surface water due to the pharmaceuticals and antibiotics in the wastewater.[1]

ENDOCRINE DISRUPTING COMPOUNDS

What are they?

Endocrine disruptors are chemicals that may interfere with the body's endocrine (glandular) system and produce adverse developmental, reproductive, neurological and immune effects in both humans and wildlife. They include certain pharmaceuticals, dioxin, polychlorinated biphenyls, DDT and other pesticides and plasticizers. They can be found in plastic bottles, metal food cans, detergents, flame retardants, food, toys and cosmetics.[3]

Figure 1: *Bisphenol A in plastics*

Figure 2: *DDT pesticide*

Are they in our water?

The results for Endocrine Disrupting Compounds in the Alberta Environment research were as follows:

Thirteen of 32 EDCs were consistently detected in WWTP effluents (Table 3). Most of these thirteen compounds occurred at low concentrations, with only nonyphenol, cholesterol and fucosterol exceeding 1 microgram per liter.[5]

Table 3: EDC concentrations in WWTP effluents of Alberta (nanogram per liter). ND = Not Detected.[5]

Target Analyte	NORTH SASKATCHEWAN RIVER			BOW RIVER		OLDMAN RIVER	SOUTH SASKATCHEWAN RIVER	RED DEER RIVER
	Capital Region 17/12/02	Capital Region (2) 17/12/02	Gold Bar 17/12/02	Fish Creek 12/6/03	Bonnybrook 15/01/03	Lethbridge 29/01/03	Medicine Hat 23/01/03	Red Deer 22/01/03
	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)
Nonylphenol	ND	178.72	2391.92	ND	1733.51	184.54	2771.77	786.33
Cholesterol	800.59	337.47	290.11	2140.14	413.65	85.34	1570.46	672.45
Fucosterol	681.23	372.73	847.10	1798.32	577.54	53.04	870.11	523.79
Stigmasterol	425.37	96.49	363.02	626.32	177.14	9.74	284.05	180.39
Campesterol	342.01	135.09	233.21	ND	153.24	6.58	764.88	177.24
β-Sitosterol	330.83	226.86	367.39	751.12	202.85	32.33	397.49	209.33
Coprostan-3-one	313.76	88.67	181.15	ND	154.49	27.92	401.98	171.45
Cholestanol	136.59	51.23	121.97	810.53	132.30	6.21	271.65	107.07
Stigmastanol	87.67	20.92	44.29	330.04	29.81	4.83	108.34	35.84
Bisphenol A	6.49	ND	115.93	194.55	83.57	1.29	36.93	26.34
7-Ketocholesterol	83.73	126.29	40.81	130.72	14.82	52.37	74.73	36.21
Desmosterol	ND	102.28	ND	ND	ND	68.49	ND	143.74
Kaempferol	ND	ND	56.43	13.45	ND	ND	40.79	48.29
6-Ketocholestanol	18.00	7.82	ND	20.69	ND	4.57	16.20	9.65
Genistein	ND	ND	9.89	ND	ND	ND	ND	ND
Totarol	ND	ND	ND	ND	ND	ND	3.11	ND
Pinosylvin	ND	ND	ND	ND	ND	ND	1.49	ND
α-Zearalanol	ND	ND	ND	ND	ND	ND	ND	ND
Naringenin	ND	ND	ND	ND	ND	ND	ND	ND
Engosterol	ND	ND	ND	ND	ND	ND	ND	ND
Estrone	3.34	0.26	34.06	ND	2.56	ND	10.27	9.93
(-)-Norgestrel	22.23	ND	ND	ND	ND	ND	ND	ND
17 α-Ethynylestradiol	ND	ND	ND	8.47	ND	ND	ND	ND
Estriol	ND	ND	3.43	ND	3.99	ND	2.51	2.19
17β –Estradiol	ND	ND	2.08	ND	1.48	0.21	2.73	ND
17α-Estradiol	ND	ND	ND	ND	ND	ND	1.79	ND
Equilin	ND	ND	ND	ND	ND	ND	ND	ND
Testosterone	ND	ND	ND	ND	ND	ND	ND	ND
d-Equilenin	ND	ND	ND	ND	ND	ND	ND	ND
Mestranol	ND	ND	ND	ND	ND	ND	ND	ND
19-Norethindrone	ND	ND	ND	ND	ND	ND	ND	ND
β-Estradiol-3-benzoate	ND	ND	ND	ND	ND	ND	ND	ND

Thirteen EDCs consistently appeared at measurable concentrations in most rivers (Table 4). Twelve of these were among the thirteen detected most frequently in effluents.[5]

Table 4: EDC concentrations in receiving rivers of Alberta (nanogram per liter). ND = Not Detected.[5]

Target Analyte	North Saskatchewan River at Ft. Saskatchewan Bridge (downstream of effluents) 17/12/02	Bow River at Stiers Ranch (downstream of effluents) 15/01/03	Oldman River SW of Diamond City (downstream of effluent) 29/01/03	South Saskatchewan River Upstream of Medicine Hat (upstream of effluent) 23/01/03	Red Deer River at Red Deer (downstream of effluent) 22/01/03
	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)
Nonylphenol	ND	292.27	175.62	119.22	36.19
Cholesterol	69.96	285.10	224.87	216.28	64.53
Fucosterol	113.69	135.87	957.40	136.75	ND
Stigmasterol	12.65	ND	252.42	44.61	21.09
Campesterol	12.99	19.98	193.55	36.78	10.59
β-Sitosterol	59.58	73.28	579.52	84.22	52.05
Coprostan-3-one	8.70	17.65	ND	26.08	16.73
Cholestanol	2.47	10.01	12.37	20.55	6.45
Stigmastanol	2.77	8.73	47.83	9.88	4.41
Bisphenol A	ND	1.80	1527.35	ND	42.55
7-Ketocholesterol	5.92	105.98	80.49	45.59	47.44
Desmosterol	11.40	165.23	94.93	61.30	65.60
Kaempferol	ND	2.84	ND	ND	ND
6-Ketocholestanol	0.65	7.39	18.46	7.85	4.85
Genistein	ND	ND	ND	ND	ND
Totarol	ND	ND	ND	ND	ND
Pinosylvin	ND	ND	ND	ND	ND
α-Zearalanol	ND	ND	ND	ND	ND
Naringenin	ND	ND	ND	ND	ND
Engosterol	ND	ND	ND	ND	ND
Estrone	ND	ND	ND	ND	ND
(-)-Norgestrel	ND	ND	ND	ND	ND
17 α-Ethynylestradiol	ND	ND	ND	ND	ND
Estriol	ND	ND	ND	ND	ND
17β –Estradiol	ND	ND	ND	ND	ND
17α-Estradiol	ND	ND	ND	ND	ND
Equilin	ND	ND	ND	ND	ND
Testosterone	ND	ND	ND	ND	ND
d-Equilenin	ND	ND	ND	ND	ND
Mestranol	ND	ND	ND	ND	ND
19-Norethindrone	0.58	ND	ND	ND	0.77
β-Estradiol-3-benzoate	ND	ND	ND	ND	ND

What is their effect on us?

The risks associated with pesticides, a common endocrine disruptor, include: [9]

- increased risk of cancer (e.g. non-Hodgkin's lymphoma, childhood leukemia and breast cancer)
- neurological impairment (e.g. Parkinson's disease, Alzheimer's disease)
- developmental effects (e.g. autism)
- reproductive effects (e.g. sperm abnormalities, birth defects)
- organ damage
- interference with the human hormone system

Sperm levels and spawning patterns in aquatic organisms have been clearly altered in areas heavily polluted with endocrine disruptors.[8]

PHTHALATE ESTERS

What are they?

Phthalate esters are "plasticizers" that increase polymer flexibility in plastics. They are also components of cosmetics, detergents, building products, lubricant oils, pesticides and solvents. Phthalate esters are also characterized as endocrine disruptors although the endocrine disrupting impacts of many are unclear. [4] [5] It is estimated that more than four million tons of phthalates are consumed globally per year. Di-(2-ethylhexyl) phthalate (DEHP) is one of the most commonly used phthalates, particularly in Personal Care Products.[6]

Are they in our water?

With the exception of two blank-corrected values that fell below detection limits, all thirteen target phthalate esters were found at measurable concentrations in effluents from all WWTPs (Table 5).[5]

Table 5: Phthalate ester concentrations in WWTP effluents of Alberta (nanograms per liter). ND = Not Detected.[5]

Target Analyte	NORTH SASKATCHEWAN RIVER			BOW RIVER		OLDMAN RIVER	SOUTH SASKATCHEWAN RIVER	RED DEER RIVER
	Capital Region 17/12/02	Capital Region (2) 17/12/02	Gold Bar 17/12/02	Fish Creek 12/6/03	Bonnybrook 15/01/03	Lethbridge 29/01/03	Medicine Hat 23/01/03	Red Deer 22/01/03
	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)
C6-iso-mix	43.9	24.2	141.9	5.8	ND	1.0	37.0	9.2
C7-iso-mix	194.2	57.9	121.9	88.1	43.8	49.7	110.5	43.9
C8-iso-mix	2666.6	1134.5	4772.6	5211.4	392.0	105.7	3048.1	5508.8
C9-iso-mix	762.4	115.5	1107.9	373.8	30.0	38.2	180.5	147.6
C10-iso-mix	680.1	105.2	1295.8	243.7	35.8	21.8	170.2	64.5
DEHP	2645.9	1128.8	4741.6	5182.1	390.3	105.5	3037.0	5500.5
DBP	1385.4	50.6	57.2	246.8	101.2	16.1	26.9	51.6
DEP	95.1	1.6	14.4	213.4	22.9	8.0	17.7	20.0
DNP	85.0	23.7	46.0	130.1	3.6	3.2	31.5	17.7
DIBP	56.2	54.3	6.4	107.0	10.7	1.7	24.6	7.5
BBP	36.3	15.6	3.5	77.7	8.0	ND	14.3	16.2
DnOP	20.7	5.7	31.1	29.2	1.8	0.3	11.1	8.4
DMP	1.1	0.0	1.0	3.9	1.4	0.3	ND	0.1

Although all of the thirteen phthalate esters examined during this project were detected in most of the receiving rivers, they were generally present at very low concentrations (Table 6).[5]

Table 6: Phthalate ester concentrations in receiving rivers of Alberta (nanograms per liter). ND = Not Detected.[5]

Target Analyte	North Saskatchewan River at Ft. Saskatchewan Bridge (downstream of effluents) 17/12/02	Bow River at Stiers Ranch (downstream of effluents) 15/01/03	Oldman River SW of Diamond City (downstream of effluent) 29/01/03	South Saskatchewan River Upstream of Medicine Hat (upstream of effluent) 23/01/03	Red Deer River at Red Deer (downstream of effluent) 22/01/03
	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)	Blank Corrected Concentration (ng/L)
C6-iso-mix	3.4	27.2	ND	3.9	ND
C7-iso-mix	17.9	158.4	51.8	68.7	53.6
C8-iso-mix	76.4	688.1	2058.7	762.2	1718.5
C9-iso-mix	18.3	176.8	18.2	66.0	245.9
C10-iso-mix	41.9	128.4	26.9	43.1	33.1
DEHP	75.5	684.1	2055.8	758.8	1715.0
DBP	5.8	169.4	41.0	87.8	ND
DEP	18.5	48.5	22.6	2.7	9.2
DNP	3.8	20.0	5.6	12.5	12.5
DIBP	ND	9.0	ND	ND	ND
BBP	1.2	21.7	8.2	6.9	16.1
DnOP	0.8	4.0	2.9	3.4	3.5
DMP	ND	3.2	0.8	0.3	0.2

Only M C8-iso-mix, which was a mixture of MEHP and MnOP, of nine tested mono-phthalate esters was detected in WWTP effluents (Table 7).[5]

Table 7: Mono-phthalate ester concentrations in WWTP effluents and receiving rivers of Alberta (nanograms per liter). ND = Not Detected; NA = Not Analysed.[5]

			NORTH SASKATCHEWAN RIVER		BOW RIVER		OLDMAN RIVER	SOUTH SASKATCHEWAN RIVER	RED DEER RIVER
		Compound	Capital Region WWTP 17/12/02	Gold Bar WWTP 17/12/02	Fish Creek WWTP 12/6/03	Bonnybrook WWTP 15/01/03	Lethbridge WWTP 29/01/03	Medicine Hat WWTP 23/01/03	Red Deer WWTP 22/01/03
Mono-Phthalate Esters	Effluent	MMP	ND	ND	ND	ND	ND	ND	ND
		MEP	ND	ND	ND	ND	ND	ND	ND
		MButP	ND	ND	ND	ND	ND	ND	ND
		M C6-iso-mix	ND	ND	ND	ND	ND	ND	ND
		MBzP	ND	ND	ND	ND	ND	ND	ND
		M C7-iso-mix	ND	ND	ND	ND	ND	ND	ND
		M C8-iso-mix	12.8	8.7	135.8	11.7	7.3	35.8	ND
		M C9-iso-mix	ND	ND	ND	ND	ND	ND	ND
		M C10-iso-mix	ND	ND	ND	ND	ND	ND	ND
		Compound	At Fort Saskatchewan Bridge (downstream of effluents) 17/12/02		At Stiers Ranch (downstream of effluents) 15/01/03		SW of Diamond City (downstream of effluent) 29/01/03	Upstream of Medicine Hat (upstream of effluent) 23/01/03	At Red Deer (downstream of effluent 22/01/03
	Receiving River	MMP	ND		ND		NA	ND	ND
		MEP	ND		ND		NA	ND	ND
		MButP	ND		ND		NA	ND	ND
		M C6-iso-mix	ND		ND		NA	ND	ND
		MBzP	ND		ND		NA	ND	ND
		M C7-iso-mix	ND		ND		NA	ND	ND
		M C8-iso-mix	1.2		5.8		NA	6.7	4.3
		M C9-iso-mix	ND		ND		NA	ND	ND
		M C10-iso-mix	ND		ND		NA	ND	ND

What is their effect on us?

Phthalates are not chemically bound in plastics and therefore can be consumed and readily metabolized to monoesters. Monoesters of phthalates are thought to display the most toxicity. They have estrogenic effects on humans and are also thought to be carcinogenic. Limited studies have been conducted with humans.[6] Toxicological studies have also linked some of these compounds to liver and kidney damage, and to possible testicular or reproductive-tract birth defect problems. [4] (In what concentrations?)

WHAT CAN WE DO?

1) Long-term monitoring of river water upstream and downstream of major urban centres[5]
2) Work on the fate and transport of pharmaceuticals, endocrine disruptors and other organic wastewater contaminants[5]
3) Analyze both WWTP influent and effluent to compare different treatment processes and plants[5]
4) Source control aimed at medical disposal practices[8]
5) Design more environmental friendly chemicals[8]
6) Minimize overuse and misuse of drugs[8]
7) Conduct more research on the effects of pharmaceuticals and other endocrine disruptors

GLOSSARY

Acid Pharmaceuticals

Bezafibrate- lipid regulator *(common trade names: Befizal, Bezalip)*

Clofibric acid- lipid regulator *(common trade names: Active metabolite of Clofibrate, Atromid-S, Claripex, Novofibrate)*

Diclofenac- analgesic/anti-inflammatory *(common trade names: Apo-Dicho, Novo-Difenac, Novo-Difenac-K, Nu-Diclo, PMS-Diclofenac, Voltaren, Voltaren Ophtha, Voltaren Rapide)*

Fenoprofen- analgesic/anti-inflammatory *(common trade names: Fenopron, Nalfon)*

Gemfibrozil- lipid regulator *(common trade names: Lopid, Apo-Gemfibrozil, Gen-Gemfibrozil, Novo-Gemfibrozil, Nu-Gemfibrozil, PMSGemfibrozil, ratio-Gemfibrozil)*

Ibuprofen- analgesic/anti-inflammatory *(common trade names: Advil, Apo-Ibuprofen, Motrin, Novo-Profen, Nu-Ibuprofen)*

Indomethacin- analgesic/anti-inflammatory *(common trade names: Amuno, Apo-Indomethacin, Indocid, Indotec, Novo-Methacin, Nu-Indo, ratio-Indomethacin, Rhodacine)*

Ketoprofen- analgesic/anti-inflammatory *(common trade names: Apo-Keto, Novo-Keto, Nu-Ketoprofen, Orudis SR, Oruvail, Rhodis, Rhovail)*

Naproxen- analgesic/anti-inflammatory *(common trade names: Naprosyn, Apo-Naproxen, ratio- Naproxen, Novo-Naprox, Nu-Naprox, Gen-Naproxen EC, Apo-Naproxen EC, ratio-Naproxen E, ratio-Naproxen SR*

Neutral Pharmaceuticals

Caffeine- stimulant *(common trade name: Cafergot)*

Carbamazepine- Anti-epileptic, anticonvulsant, antidiuretic, antimanic, antineuralgic, antipsychotic *(common trade names: Tegratal, Mazepine , Apo-Carbamazepine, Novo-Carbamaz, Nu-Carbamazepine, PMS-Carbamazepine Chewtabs, PMS-Carbamazepine CR, Taro-Carbamazepine, Tegretol)*

Cotinine- metabolite of nicotine

Cyclophosphamide- immunosuppressive; used in treatment of some cancers *(common trade names: Cytoxan, Procytox)*

Fluoxetine- Psychiatric drug, antidepressant, antiobsessional, antibulimic *(common trade names: Prozac, Apo-Fluoxetine, Dom-Fluoxetine, Fluoxetine, FXT 10, FXT 20, FXT 40, Gen-Fluoxetine, Novo-Fluoxetine, Nu-Fluoxetine, PMS-Fluoxetine, ratio-Fluoxetine)*

Norfluoxetine- primary metabolite of fluoxetine

Pentoxifylline- vasodilator that is used to improve blood flow and treat leg pain associated with poor circulation *(common trade names: Trental, Albert-Pentoxifylline, Apo-Pentoxifylline SR, Nu-Pentoxifylline SR, ratio-Pentoxifylline)*

Trimethoprim- antibiotic for human and veterinary applications *(common trade names: Trental, Albert-Pentoxifylline, Apo-Pentoxifylline SR, Nu-Pentoxifylline SR, ratio-Pentoxifylline)*

Endocrine Disrupting Compounds

Bisphenol A- potent EDC from plastics

Campesterol- major wood derived sterol

Cholestanol (Coprostanol)- cholesterol derivative

Cholesterol- animal derived sterol(polycyclic alcohol)

Coprostan-3-one- fecal neutral sterol

Desmosterol- cholesterol derivative

d-Equilenin- hormone replacement therapy drug

Equilin- hormone replacement therapy drug

Ergosterol- main sterol produced by fungi

17α-Estradiol- female estrogen

17β-Estradiol- female estrogen

β-Estradiol-3-benzoate- veterinary drug

Estriol- female estrogen

Estrone- female estrogen

17α-Ethynylestradiol- synthetic ovulation inhibitor in birth control pills

Fucosterol- sterol found in seaweed

Genistein- secondary metabolite found in soy products and pulp mill effluents

Kaempferol- secondary metabolite found in woody plants

6-Ketocholestanol- cholesterol oxidation product

7-Ketocholesterol- cholesterol oxidation product

Mestranol- synthetic ovulation inhibitor in birth control pills

Naringenin- secondary metabolite found in woody plants

Nonylphenol- potent EDC from surfactants, pesticides and lubricating oil

19-Norethindrone- synthetic ovulation inhibitor in birth control pills

(-)-Norgestrel- synthetic ovulation inhibitor in birth control pills

Pinosylvin- a toxin found in heartwood

β-Sitosterol- major wood derived sterol

Stigmasterol- major wood derived sterol

Testosterone- male steroid hormone

Totarol- organic antibacterial substance found in heartwood

α- Zearalanol- veterinary drug

Phthalate Esters

Butylbenzyl phthalate(BBP)- used to coat electrical wires

Di-n-butyl phthalate(DBP)- found in carpets, paints, insect repellents and hair spray

Di(2-ethylhexyl) phthalate(DEHP)- a commonly used plasticizer

Diethyl phthalate(DEP)- plasticizer in cosmetics, insecticides and aspirin

Diisobutyl phthalate(DIBP)- used as a solvent, in PVC production and in synthetic rubber

Dimethyl phthalate(DMP)- rubber softener in wood stains and varnishes

Di-n-octyl phthalate(DnOP)- a plasticizer and pesticide

Dinonyl phthalate(DNP)- plasticizer that has automobile applications

Mono-phthalate Esters

MBuP – C13-Mono-n-butyl phthalate-ring-1.2-13C-dicarboxyl-13-C2

Monobutyl phthalate(MButP)- dibutyl phthalate metabolite

Monobenzyle phthalate(MBzP)- butylbenzyl phthalate metabolite

MEH – C13-Mono-2-ethylhexyl phthalate-ring-1.2-13C-dicarboxyl-13-C2

Monoethyl phthalate(MEP)- diethyl phthalate metabolite

Monomethyl phthalate(MMP)- dimethyl phthalate metabolite

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The **South East Alberta Watershed Alliance (SEAWA)** was formed in 2007, incorporated as a non-profit society in 2008, and designated as the WPAC (Watershed Policy and Advisory Council) for the South Saskatchewan River sub-basin.

SEAWA Vision: *A healthy watershed that provides balance between social, environmental and economic benefits.*

SEAWA Mission: *South East Alberta Watershed Alliance brings together diverse partners to plan and facilitate the sustainable use of the South Saskatchewan River Watershed for present and future needs.*

SEAWA Members include interested individuals throughout the watershed along with our communities, ranchers, farmers, industries, companies, governments, conservation groups and educational institutions. We are proud to include the following among our founding members:

Government Sector: Alberta Government, City of Medicine Hat, Government of Canada, Cypress County, Palliser Health Region, Town of Redcliff, Town of Bow Island, and Special Areas Board.

Land Resource - Industry and Agriculture Sectors: St Mary River Irrigation District, Murray Lake Ranching, GG Bruins Farms, Short Grass Ranches, Canadian Fertilizers Limited, Redcliff Technology Enterprise Centre, Box Springs Business Park, and Canadian Centre for Unmanned Vehicles.

Academic, Research and Non-Governmental Organizations Sectors: Medicine Hat College, Alberta Research Institute, Red Deer River Watershed Alliance, and Hyperion Research.

Tourism and Conservation Sectors: Grasslands Naturalists, Canadian Badlands, and Medicine Hat Interpretive Program.

SEAWA Web-based State of the Watershed Report is managed by the *SEAWA State of the Watershed Committee (2010 members)*:

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