

Appendix 2. Table 9.1 Summary of Information on Selected Common Pesticides¹

Pesticide Chemical Class	Some Common Examples	Uses	Biological Action	Long Term Effects in Mammals	Level of Concern	Level of Uncertainty	Status in Canada	Other Concerns
Organophosphates	<i>Insecticides:</i> e.g., Chlorpyrifos (also Parathion, Methyl parathion, Malathion, Diazinon, Dichlorvos) <i>Herbicides:</i> e.g., Glyphosate	<ul style="list-style-type: none"> ▪ Insecticides primarily, some herbicides ▪ Both home-use and commercial pesticide applications 	<ul style="list-style-type: none"> ▪ Inhibit cholinesterase enzyme 	<ul style="list-style-type: none"> e.g. Chlorpyrifos ▪ Neurodevelopmental effects in animals ▪ Dose-related reproductive toxicity in animals ▪ Teratogen ▪ Alters protein & DNA synthesis in brain ▪ Latent peripheral neuropathy (humans) ▪ Cognitive, affective & neuropsychologic symptoms (humans) ▪ Suspected assoc'n with birth defects (Chlorpyrifos in humans) 	<ul style="list-style-type: none"> High ▪ Data from acute exposures suggest young more susceptible to ill effects than adults ▪ Substantial toxicologic evidence for neuro-developmental and growth effects in developing animals ▪ Able to cross placenta ▪ Chlorpyrifos measured in homes 8 yrs after use ▪ Residues appear frequently on food items commonly eaten by children 	<ul style="list-style-type: none"> High to Moderate? ▪ Few studies of subtle long term effects from <i>in utero</i> exposure ▪ Uncertainty regarding human immune system suppression 	<ul style="list-style-type: none"> ▪ Most registered ▪ PMRA announced re-evaluation of 26 organophosphate pesticides, June 1999. ▪ Review ongoing and awaiting outcome of studies by U.S. EPA 	<ul style="list-style-type: none"> ▪ Tetrachlorvinphos contaminated with dioxins
Carbamates	e.g., Aldicarb, Basudin, Carbaryl, Propoxur	<ul style="list-style-type: none"> ▪ Insecticides mainly ▪ Both home-use and commercial pesticide applications 	<ul style="list-style-type: none"> ▪ Inhibit cholinesterase enzyme ▪ Anti-cholinesterase effects are <u>reversible</u> 	<ul style="list-style-type: none"> ▪ Similar to above ▪ Prevalence of asthma sig. associated with use of carbamates in farmers (Sask.) ▪ Increased risk of miscarriage where male farmers exposed to certain carbamates (Can.) 	<ul style="list-style-type: none"> High ▪ Data from acute exposures suggest young more susceptible to ill effects than adults ▪ Several individual carbamates relatively toxic to humans ▪ Residues appear frequently on food items commonly eaten by children 	<ul style="list-style-type: none"> High to Moderate? ▪ Uncertainty regarding human immune system suppression 	<ul style="list-style-type: none"> ▪ Most registered ▪ Aldicarb banned in 1964 ▪ No reviews pending 	
Organochlorines	e.g., DDT, aldrin, dieldrin, lindane, chlordane, toxaphene, hexachlorobenzene (HCB), pentachlorophenol (PCP)	<ul style="list-style-type: none"> ▪ Variety of uses ▪ Previously used as: <ul style="list-style-type: none"> ❖ Insecticides, (DDT vs. mosquitoes, Lindane for lice); ❖ Herbicides (dicamba); ❖ Rodenticides; ❖ Fungicides (HCB, PCP), ❖ Wood preservative (PCP), and ❖ Veterinary use 	<ul style="list-style-type: none"> ▪ Interfere with transmission of nerve impulses ▪ Primarily disrupt CNS 	<ul style="list-style-type: none"> ▪ Carcinogens (human data) e.g., brain cancer with use in childhood of Lindane anti-lice treatment ▪ Chromosomal abnormalities (human data) ▪ Suspect teratogens ▪ Fetotoxins ▪ Behaviour changes (human data) ▪ Reproductive effects (human data) 	<ul style="list-style-type: none"> High ▪ Developing animals more sensitive than adults ▪ Exposures to pregnant rodents → effects seen in offspring ▪ Transfer across placenta ▪ Found in mother's milk ▪ Persistent, bioaccumulative and biomagnifying ▪ Potential for serious delayed effects (e.g., endocrine disruption, cancer) ▪ Transgenerational effects 	<ul style="list-style-type: none"> Moderate ▪ Reasonably good data for effects from chronic exposure including human studies ▪ Uncertainty regarding effects as endocrine disruptors and immune system suppressants in humans 	<ul style="list-style-type: none"> ▪ Most banned as primary ingredients in 1970s, '80s ▪ Designated Track 1 substances, targeted for virtual elimination ▪ Lindane, methoxychlor & PCP still registered ▪ PCP under ongoing re-evaluation as a wood preservative (Feb 1994). ▪ Lindane under special review ▪ Tributyl tin (TBT) used on ocean-going vessels to prevent barnacle build up 	<ul style="list-style-type: none"> ▪ Some are contaminants of currently registered pesticides (e.g. DDT & dicofol-containing products; HCB & several registered pesticides – Atrazine, Endosulfan, etc.) ▪ May appear in imported produce and flowers and in domestic meat and dairy items.

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Pyrethrins & Pyrethroids	e.g., Pyrethrin, Cyfluthrin, Permethrin, Cypermethrin	<ul style="list-style-type: none"> Insecticides used for a variety of types such as lice, cockroaches Used in crops such as nut, fruit, various vegetables, mushroom, potato, cereals Used in greenhouses and home gardens for termites 	<ul style="list-style-type: none"> Inhibit sodium & potassium conduction in nerve cells Block transmission of nerve impulses ∴ paralyze the nervous system Permethrin is a stomach and direct contact poison 	<ul style="list-style-type: none"> Suspect mutagens? Suspect teratogens? Suspect carcinogens Immunotoxins Lower hormone release from brain Associated with neurologic and respiratory reactivity Permethrin causes liver enlargement 	Medium to High <ul style="list-style-type: none"> Some may be cumulative Potential endocrine disruptors Toxic to wildlife 	High <ul style="list-style-type: none"> Studies show variable results viz. chronic effects in animals 	<ul style="list-style-type: none"> Most registered in Canada 	
Amides	e.g., DEET (N,N-diethyl- <i>m</i> -toluamide)	<ul style="list-style-type: none"> Insect repellent effective against mosquitoes and biting flies Applied on human skin, clothing, pets, tents, screens, etc. 	<ul style="list-style-type: none"> Not fully understood 	<ul style="list-style-type: none"> Neurotoxin Evidence for dermal and neurobehavioural effects in workers, children Clinical reports of various neurotoxic effects in children such as toxic encephalopathy, seizures 	Medium to high <ul style="list-style-type: none"> Readily absorbed via skin or ingestion Distributed to all organs, including brain Crosses the placenta Excreted mainly in urine but also in milk Commonly used on children Concern that children at greater risk of adverse rxs 	High <ul style="list-style-type: none"> Effects in children known mainly from clinical reports 	<ul style="list-style-type: none"> Ongoing review along with several other personal insect repellents, announced in June 1990 by Health Canada 160 DEET-containing products registered (U.S. has 53 registrants of DEET-containing insect repellents) 	
(Chlor)phenoxy group	e.g., 2,4-D (2,4-dichloro-phenoxyacetic acid)	<ul style="list-style-type: none"> Herbicides Used in agriculture, forest management against broad leaf weeds Found commonly in home garden products 	<ul style="list-style-type: none"> Acts as a synthetic growth hormone (plants) Action not fully understood for animals 	e.g., 2,4-D <ul style="list-style-type: none"> Suspect mutagen Teratogen Delayed fetal development Suspect fetotoxin Immunotoxin Toxic injury to liver, kidney, CNS Reproductive effects in male farm sprayers Carcinogen (assoc'n with Non-Hodgkin's Lymphoma in exposed workers) Higher rates of birth defects in exposed populations 	High <ul style="list-style-type: none"> Widely used Agriculture and Agri-food Canada discovered dioxin contamination in 2,4-D products 	Low to Medium <ul style="list-style-type: none"> Vast amount of study on 2,4-D due to its association as a component of Agent Orange 	<ul style="list-style-type: none"> Usage in Ontario > 140,000 kg annually Ongoing re-evaluation in Canada (announced in October 1980; latest update, November 1994) Restricted use pesticide in the U.S. 	

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Bipyridil	e.g., Diquat, Paraquat	<ul style="list-style-type: none"> Herbicide dessicant 	<ul style="list-style-type: none"> May interfere with cellular respiration & damage cell membranes Non-selective toxicity 	<ul style="list-style-type: none"> Suspect mutagen Suspect teratogen Suspect embryo & fetotoxin Liver damage Cataracts <p>Human</p> <ul style="list-style-type: none"> Damage to gastrointestinal tract, kidneys, liver, heart Reported fatalities from skin absorption Paraquat implicated in Parkinson's disease 	<p>High</p> <ul style="list-style-type: none"> Variety of health effects in humans Potential for long-term, delayed effects 	High	<ul style="list-style-type: none"> Diquat & Paraquat registered in Canada Both slated for review by PMRA 	<p>Paraquat</p> <ul style="list-style-type: none"> Banned in Sweden (1983) Banned in Netherlands (1989)
Triazine	e.g., Atrazine	<ul style="list-style-type: none"> Herbicide Agricultural use – control of broad leaf and grassy weeds in various crops such as corn, Christmas trees 	<ul style="list-style-type: none"> May disturb vitamin metabolism 	<ul style="list-style-type: none"> Immunotoxin Adrenal, liver heart damage Effects on ovary Possible human carcinogen (EPA) Suspect endocrine disruptor 	<p>Medium to high?</p> <ul style="list-style-type: none"> May contaminate groundwater Moderately persistent to persistent Health Canada study found atrazine in well water in PEAS Used in large volumes Contamination with HCB 	Medium	<ul style="list-style-type: none"> Registered in Canada Annual usage 2 million kg (Restricted use in U.S. since 1990) Slated for review by PMRA 	<ul style="list-style-type: none"> Atrazine contaminated with HCB
Fungicides	e.g. Benomyl (class - benzimidazole), [Also ziram (dithiocarbamate), captan (phthalimide), methyl mercury (organic metal), PCP (organochlorine) see above]	<ul style="list-style-type: none"> Variety of classes used against various types of fungus e.g., Benomyl used against fungal diseases in field crops, fruits, nuts, ornamentals, mushrooms, turf 	<ul style="list-style-type: none"> Modes of action vary depending on class of each fungicide e.g., Benomyl interferes with cellular respiration 	<p>e.g., Benomyl</p> <ul style="list-style-type: none"> Skin disorders Listed as teratogen by U.S. EPA Suspect carcinogen Suspect mutagen Liver & testes damage Reduced sperm Blood damage 	<p>Medium to high?</p> <ul style="list-style-type: none"> Moderately persistent Anecdotal reports of association with gross eye defects in children of mother's allegedly exposed to Benomyl during pregnancy 	<p>Medium to High</p> <p>e.g. Benomyl</p> <ul style="list-style-type: none"> Birth defects vary depending on route of exposure in test animals 	<p>Benomyl</p> <ul style="list-style-type: none"> Registered in Canada Slated for review by PMRA Restricted use in U.S. since 1982 	

ⁱ Information compiled from several sources including: Briggs, Shirley, A. and staff of Rachel Carson Council. *Basic Guide to Pesticides: Their Characteristics and Hazards*. (Washington: Taylor & Francis, 1992); CALPIRG & PSR, 1998, *op cit.*, City of Toronto, 1998 *op cit.*; PMRA personal communication April 2000 and internal data file 405acti1.xls; Eskenazi et al. 1999, *op cit.*; EXTTOXNET. Extension Toxicology Network. A pesticide information project of cooperative extension offices of Cornell University, Michigan State University, Oregon State University and University of California at Davis. Pesticide Information Profiles. Available at: <http://pmep.cce.cornell.edu/profiles/extoxnet/>; and World Wildlife Fund, Inuit Circumpolar Conference, Inuit Tapirisat of Canada, 2000, *op cit.*