

City of Calgary Review of Integrated Pest Management Plan (1998)

Submission regarding the evaluation of pesticide toxicity and children's health

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Date: Feb 3, 2016

Attention: Steven Snell, MRes, MCIP, RPP, City of Calgary, Conservation Policy Team Lead

Via: email



First of all, it is so encouraging to hear that the City of Calgary Council has directed Administration to evaluate pesticide toxicity with the goal of eliminating the use of the more toxic pesticides on City-owned land as it has been many years since this was last discussed. Calgary has been criticized in the past for not protecting its citizens from toxic pesticides despite the awareness that these chemicals have long been linked to serious diseases, disorders and other health-related concerns.

Of greatest concern for me is the impact these chemicals have on children's health. I am pleased to submit my position as a concerned citizen, a long-standing health care worker and as an Advisory Board member for the Coalition for a Healthy Calgary. I will speak from the position of having studied the impact of toxic chemicals on our health with a special interest in children's health for more than twenty years.

I have authored a book called "Indoor Air Pollution... The Silent Killer" and developed two courses for Mount Royal University related to chemicals and the impact they have on our health. The first course was entitled "Children's Environmental Health..., *children run better unleaded*" which was developed for Continuing Education and the second is called Integrative Healing Practices and speaks to environmental impacts on health. This second course is delivered in both the Nursing and Midwifery Program and the Integrative Health Coach Program for Continuing Education. I spent many years presenting seminars throughout North America on environmental wellness, served on the Advisory Board for the Integrative Health Institute at Mount Royal University for seven years and as an Advisory Board Member for the Coalition

for a Healthy Calgary for eight years. I am also listed on the Experts Directory at Mount Royal University to address issues identified by the City and community on environmental concerns. Most recognized of these concerns was the asbestos incident in the Harry Hays Building and the mice infestation in a local food chain. I have been employed by Mount Royal University for seventeen years as an Associate Professor, Department of Nursing and Midwifery.

We have far too long overlooked the health of our children not recognizing the trends that have occurred over the past years. Disturbing health care trends already well-researched and documented show us that the effects of environmental toxins on children's health could turn out to be one of the largest public health crises we will ever face. Much of the delay for attending to this very serious problem is related to the fact that it takes many years to realize the consequences of toxic exposures. Decades later, we begin to see epidemics of diseases we refer to as "*new*" or "*rising*" and at that time we look back and see a correlation between exposure to certain toxic chemicals and these epidemics of disease and disorders.

We have seen this scenario before with cigarette smoke, asbestos, lead additives, bisphenol A (hormone disruptors), PBCs, DDT and hundreds of consumer products promoted as safe and nontoxic until it was discovered how dangerous they were - this is far too late. Let me refer to the Precautionary Principle". This Principle states that if an action or policy has a suspected risk of causing morally unacceptable harm to the public, or to the environment, in uncertainty or the absence of scientific consensus or understanding, the "*burden of proof*" that it is not harmful falls on those taking that action -- that means the persons who are responsible for making those decisions shall also take action to avoid or diminish that harm. "*Morally unacceptable*" refers to: threatening to human life or health, having serious or effectively irreversible health effects and/or imposed without adequate consideration of the human rights of those affected. This Principle clearly denotes a duty to prevent harm when it is within our power to do so. Advocates of this approach not only see it as a means of "*preventing morally acceptable harm to the public*" but as a means of fast-tracking inherently toxic contaminants towards regulatory phase-down and ultimately a total phase-out.

Earlier decisions to ban substances were examples of standards that recognized the “*inherent toxicity*” of the substances in question. In the majority of these cases, evidence of morally unacceptable harm was only suspected, difficult or impossible to prove, and strongly contested by the industries responsible for the production of these substances and ultimately, the contamination.

In making public health policy decisions, it is important to recognize that the majority of occupational standards for toxic contaminants were derived from animal testing which means that standards for environmental exposure could have been set at 10 to 100 times the level for human exposure in occupational or environmental settings. This notion of using “safety factors” in order to set standards for chemical exposures at levels 10 times, 100 times, etc., lower than the level where health effects are known or detected continues to be a key aspect of ever-more refined standard setting approaches to this day. Out of this practice comes the term “*threshold*” - the level at which a health effect is detected. Considerable debate continues over whether or not morally unacceptable health effects occur below these thresholds, once again, a strong reason for applying the Precautionary Principle.

There is now much scientific evidence to support the long standing belief of many researchers that pesticide use has both immediate and long-term impacts on human health, and especially the health of children. It is so important to differentiate the impact of toxic chemicals on children as they are much more vulnerable in so many ways. So often we think of children as “*little adults*”; this is a serious mistake as children are so much more impacted by exposure to toxic chemicals.

Published data from a variety of reputable sources strongly suggest a link between toxic exposure, developmental abnormalities, and a variety of chronic diseases and disorders in children. Several factors make children particularly vulnerable to toxic contaminants including increased exposure, immature detoxifying systems, and timing in children's critical developmental growth stages when exposures would normally occur.

Children are generally more susceptible to the toxic effects of pesticides because of their immature stage of neurological development. We have known for some time that the blood brain barrier does not fully close until about the age of two and there is now considerable scientific evidence that the brain is not fully formed until the age of 12. Because of this very slow development, childhood exposure to very common pesticides may greatly impact the development of the nervous system resulting in numerous health problems. Children's ability to detoxify chemicals is also not as efficient as in adults as they have immature enzymatic defense (antioxidant) pathways coupled with limited intake of detoxifying nutrients.

There are many things to consider about children when we look at the impact of pesticides. They have a much greater skin surface for their size than adults so absorb proportionally a greater amount of all toxic substances they are exposed to through their skin, lungs and intestinal tracts. Because children breathe faster than adults they take in more air. They also take in more food and water per pound of body weight than adults. Scientific evidence has also shown us that children do not fully develop their immune systems or detoxifying mechanisms until early teenage years greatly reducing their ability to fight the introduction of toxic contaminants into their system.

Many toxins are absorbed through the skin and stored in fatty tissue. Children have a much higher proportion of fatty tissue per body size than adults increasing their vulnerability.

Children are also much closer to the ground than adults and often engage in activities that have contact with ground and grass -- this is how they explore and get to know the world. Very young children tend to put their hands or other things in their mouths which further increases their exposure to toxic pesticides. It is this combination of increased exposure to pesticides and the lack of defenses related to bodily development to combat the toxic effects of pesticides that puts children at such a high risk.

The vulnerability of children is also enhanced as they experience all types of changes in their hormonal

chemistry, especially during puberty. When the rapid shifts in growth occur during puberty, important endocrine signals need to occur in a very precise fashion. The disruption of these hormonal messages is highly suspected for the reason girls are going through puberty at such an early age. We are commonly witnessing girls beginning menstrual periods at 8 years of age even though they are not yet ovulating -- a suspected strong connection to additional years of exposure to unopposed estrogen -- a risk factor for breast cancer. Organophosphate pesticides are ubiquitous environmental toxins that have been linked to damage of the brain and nervous system, especially in young children.

Toxic chemicals are being produced at a rate that is impossible to test for human safety and without a doubt, many of these toxins end up inside our children's bodies making adherence to the Precautionary Principle so much more critical.

Years of study have continued to connect toxic chemicals to many of the "*new*" or "*rising*" health problems we are now seeing in children. Let me remind you of some of the disturbing health trends we have seen in children over the past 30-40 years that should certainly make us wonder "*what has changed*".

There has been a dramatic increase in a range of health conditions over the past few decades including birth defects, childhood cancers, immune disorders, autoimmune diseases, endocrine and reproductive disorder as well as a huge increase in neuropsychiatric problems such as autism, attention-deficit hyperactivity disorder (ADHS) and attention-deficit disorder (ADD).

We are understanding that these increases may relate to a number of factors including overconsumption of the wrong types of foods, lack of proper nutrition, deficient immunological education related to excessive hygiene, overuse of antibiotics, mood regulators and a wide-variety of pharmaceuticals, often used in excess. However, within this list of causative factors is the issue of environmental toxicity and it must be examined carefully.

Birth defects have been increasing -- especially genital defects in boys. Research has also shown a link between the increase in the incidence of hypospadias (urethra does not grow all the way to the tip of the penis during fetal development) and increase in undescended or undersized testicles and exposures to environmental toxins.

There has been a dramatic increase in certain childhood cancers, especially lymphoblastic leukemias and brain cancers; both systems very vulnerable to environment exposures. Although cancer in childhood is rare compared with cancer in adults, it is the second most common cause of death, after injuries and accidents, among children 1 to 19 years of age. Studies have connected the rise in incidence of childhood cancers to exposure to a wide range of toxins in the environment including pesticides.

Asthma is also increasing dramatically, especially in children similarly to the peanut and tree nut allergies which have more than doubled in children. Researchers have recognized that multiple factors need to be considered but environmental toxins remain highly suspect. In the past 20 years it is well established that several environmental pollutants that are found outdoors and indoors exacerbate asthma. Certain environmental factors may also contribute to the development of asthma.

A number of environmental chemicals have been linked to Type 2 Diabetes, a disease that is also becoming dramatically more prevalent in children. This correlates directly with the rise in childhood obesity. A variety of environmental chemicals have come to be referred to as "obesogens". These chemicals interfere with the feedback loop that tells the child that he or she has had enough to eat, so they just keep on eating. These chemicals are also suspected disruptors of a brain-behavior mechanism in metabolism that leads to increased insulin secretion and decreased insulin sensitivity and ultimately puts on more body fat.

Overall, the biggest area of concern in children is the dramatic increase in behavioral and neuropsychiatric problems. A lot of this focus has been on autism, aggressive behaviors and serious mental disorders which has tripled since the early 1990s. Few studies have looked explicitly at the

relationship between ADHD and exposures to environmental contaminants. However, evidence supports a hypothesis that environmental contaminants may contribute to some portion of the incidence of ADHD, based on studies focusing on specific symptoms or types of behavior associated with ADHD. Many studies have found relationships between behavioral problems—including attention problems, hyperactivity, and impulsivity. Along with the increase in ADD and ADHS, there has been a marked increase in depression and bipolar disorders amongst children.

Children are being prescribed antipsychotic medication, antidepressant medications and are often taking several at one time. These powerful medications affect their metabolism in many different ways as well as their quality of life.

This was clearly not the case 30 years ago. We need to ask “why are so many children agitated today requiring all types of medications to calm them down? This is a very sad problem and we all know it has to be addressed. We desperately need to determine the connection between environmental toxins and the dramatic rise in childhood disease and disorders. Never in history have children lived with this kind of total body burden of environmental toxins. Sadly, if we continue in this way, we are participating in conducting a major uncontrolled experiment on our children with no end in sight. This may draw similarities for many of you to the “*canaries in the coal mines*”. This phrase alone serves as an early warning sign of a coming crisis. More specifically, it refers to information that was common knowledge for earlier generations but not addressed.

As we reflect on all the changes in children’s health that have occurred over the past 30-40 years, and recognize the dramatic increase in existing and new children’s diseases and disorders we need to be sure we are not asking “*what is the matter with these children*”. Instead, we need to ask “***what matters to these children***”, and hopefully, this will ethically and morally direct our actions.

My message is that we have to be aware of the problem before we can take action to solve it. In the meantime, applying the “Precautionary Principle” would be a great start. This principle shifts the

"burden of proof" from the general public who are often not aware to those who create public health policies related to environmental risk. We can do something about this issue and it "can" make a difference. Our children's futures are at stake. So, ultimately, this is a message of hope rather than of despair. Hopefully..., it will not fall on deaf ears.

Respectfully submitted by

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Please see Appendix A - Studies involving exposure to pesticides

In this Appendix, you will see several studies related to pesticides that are on the list of use by the City of Calgary, i.e. glyphosate and dicamba

Appendix A - Studies involving exposure to pesticides

1. In 2015, WHO (World Health Organization) found that there was sufficient evidence of carcinogenicity in

experimental organisms to classify glyphosate, the active ingredient in the most popular lawn care brand

(Roundup) as "probably carcinogenic to humans" (Group 2A). WHO also found that 2,4-D- found in many

'weed and feed' products- is possibly carcinogenic.

[IARC. IARC Monographs Volume 112: evaluation of five organophosphate insecticides and herbicides. 20 march 2015. <http://www.iarc.fr/en/media-centre/iarcnews/pdf/MonographVolume112.pdf>; and IARC. Carcinogenicity of lindane, DDT, and 2,4-dichlorophenoxyacetic acid. The Lancet Oncology, 16(8).p891-892.

2. A 2010 meta-analysis of 15 studies on residential pesticide use and childhood leukemia finds an

association with exposure during pregnancy, as well as to insecticides and herbicides. An association is also

found for exposure to insecticides during childhood.

Turner, M.C., et al. 2010. Residential pesticides and childhood leukemia: a systematic review and meta-analysis. Environ Health Perspect 118(1):33-41

3. A 2013 study suggests that preconception pesticide exposure, and possibly exposure during pregnancy, is associated with an increased risk of childhood brain tumors.

Green KR, Peters S, Bailey HD. 2013) Exposure to pesticides and the risk of childhood brain tumors. Cancer Causes Control. DOI 10.1007/s10552-013-0205-1

4. According to a 2015 study, living in agricultural regions is linked to increased leukemia and central nervous system cancers in children.

Booth BJ, Ward MH, Turyk ME, et al. 2015. Agricultural crop density and risk of childhood cancer in the midwestern United States: an ecologic study. Environmental Health:14(82)

5. A meta-analysis study by scientists at the Harvard University's School of Public Health finds that children's exposure to pesticides in and around the home results in an increased risk of developing certain childhood cancers. Authors found that cancer risks were connected most closely to the type of pesticide used and the location where it was applied.

Chen M, Chi-Hsuan C, Tao L, et al. 2015. Residential Exposure to Pesticide During Childhood and Childhood Cancers: A Meta-Analysis. Pediatrics. DOI: 10.1542/peds.2015-0006

6. The probability of an effect such as cancer, which requires a period of time to develop after exposure, is enhanced if exposure occurs early in life.

Vasselinovitch, S., et al. 1979. "Neoplastic Response of Mouse Tissues During Perinatal Age Periods and Its Significance in Chemical Carcinogenesis," Perinatal Carcinogenesis, National Cancer Institute Monograph 51.

7. A study published by the American Cancer Society finds an increased risk for non-Hodgkin's lymphoma (NHL) in people exposed to common herbicides and fungicides, particularly the weedkiller mecoprop

(MCPPE). People exposed to glyphosate (Roundup®) are 2.7 times more likely to develop NHL.

Hardell, L., et al. 1999 Mar. "A Case-Control Study of Non-Hodgkins Lymphoma and Exposure to Pesticides," J of the Am Cancer Soc, (85):6. p.1353.

8. 75 out of all 99 human studies done on lymphoma and pesticides find a link between the two.

Osburn, S. 2001. Do Pesticides Cause Lymphoma? Lymphoma Foundation of America, Chevy Chase, MD.

9. Four peer-reviewed studies demonstrate the ability of glyphosate-containing herbicides to cause genetic

damage to DNA (mutagenicity), even at very low concentration levels.

Cox C. 2004 Winter. "Glyphosate." Journal Of Pesticide Reform Vol. 24 (4).

10. A 2007 study published in Environmental Health Perspectives finds that children born to mothers living

in households with pesticide use during pregnancy had over twice as much risk of getting cancer, specifically

acute leukemia (AL) or non-Hodgkin lymphoma (NHL).

Rudant, J. et al. 2007. Household Exposure to Pesticides and Risk of Childhood Hematopoietic Malignancies: The ESCALE Study (SFCE). Environ Health Perspect. 115:1787-1793.

11. A 2007 Canadian report shows that a greater environmental risk exists for boys, specifically when it comes to cancer, asthma, learning and behavioral disorders, birth defects and testicular dysgenesis syndrome.

Canadian Partnership For Children's Health and Environment. 2007. A Father's Day Report - Men, Boys And Environmental Health Threats. www.healthyenvironmentforkids.ca.

12. Children, asthma and pesticides. Researchers find that pesticides may increase the risk of developing

asthma, exacerbate a previous asthmatic condition or even trigger asthma attacks by increasing bronchial

hyper-responsiveness.

Hernández, AF, Parrón, T. and Alarcón, R. 2011. Pesticides and asthma. *Curr Opin Allergy Clin Immunol.* 11(2):90-6

13. One 2015 farmworker study found an association between early-life exposure to OPs and respiratory symptoms consistent with possible asthma in childhood.

Raanan R, Harley KG, Balmes JR, et al. 2015. Early-life exposure to organophosphate pesticides and pediatric respiratory symptoms in the CHAMACOS cohort. *Environ Health Perspect.* 123(2):179-85.

14. A 2012 study concluded that prenatal PBO exposure was associated with childhood cough in inner city children.

Liu B, Jung KH, Horton MK, et al. 2012. Prenatal exposure to pesticide ingredient piperonyl butoxide and childhood cough in an urban cohort, *Environ Int.* 48:156-61.

15 . A 2004 study finds that young infants and toddlers exposed to herbicides (weedkillers) within their first year of life are 4.5 times more likely to develop asthma by the age of five, and almost 2.5 times more likely when exposed to insecticides.

Salam, MT, et al. 2004. "Early Life Environmental Risk Factors for Asthma: Findings from the Children's Health Study." *Environmental Health Perspectives* 112(6): 760.

16. EPA material safety data sheets for the common herbicides 2,4-D, mecoprop, dicamba, (often combined

as Trimec®) and glyphosate (Roundup®) list them as respiratory irritants that can cause irritation to skin and

mucous membranes, chest burning, coughing, nausea and vomiting.

17. Scientists believe that the amount of toxic chemicals in the environment that cause developmental and

neurological damage are contributing to the rise of physical and mental effects being found in children.

National Research Council. 2000. *Scientific frontiers in developmental toxicology and risk assessment*. Washington, DC: National Academy Press; Physicians for Social Responsibility, The National Environmental Trust, and the Learning Disabilities Association of America. 2000. *Polluting our future: Chemical pollution in the U.S. that affects child development and learning*. http://www.net.org/health/tri_report.pdf (accessed 6/2/05).

18. According to researchers at the University of California Berkeley School of Public Health, exposure to

pesticides while in the womb may increase the odds that a child will have attention deficit hyperactivity disorder (ADHD).

Marks AR, Harley K, Bradman A, Kogut K, Barr DB, Johnson C, et al. 2010. *Organophosphate Pesticide Exposure and Attention in Young Mexican-American Children: The CHAMACOS Study*. *Environ Health Perspect* 118:1768-1774.

19. Studies show children's developing organs create "early windows of great vulnerability" during which

exposure to pesticides can cause great damage.

Landrigan, P.J., L Claudio, SB Markowitz, et al. 1999. "Pesticides and inner-city children: exposures, risks, and prevention." *Environmental Health Perspectives* 107 (Suppl 3): 431-437.

20. A Beyond Pesticides Fact Sheet (such as "weed and feed" products) tested on mice show increased risk of infertility, miscarriage and birth defects at very low dosages.

Greenlee, A. et al. 2004. "Low-Dose Agrochemicals and Lawn-Care Pesticides Induce Developmental Toxicity in Murine Preimplantation Embryos," *Environmental Health Perspectives* 112(6): 703-709; Cavieres, M., et al. 2002. "Developmental toxicity of a commercial herbicide mixture in mice: Effects on embryo implantation and litter size." *Environmental Health Perspectives* 110:1081-1085.

21. Results from a CHARGE study finds that agricultural exposures to organophosphates at some point during gestation was associated with a 60% increased risk for autism higher for third-trimester exposures,

and second-trimester chlorpyrifos applications. Similarly, children of mothers residing near pyrethroid insecticide applications just before conception or during third trimester were at greater risk for both autism

and developmental delay.

Shelton, Geraghty, Tancredi. 2014. Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: The CHARGE Study. Environmental Health Perspectives:122(10).

22. Researchers at the Cincinnati Children's Hospital Medical Center found an association between increasing pyrethroid pesticide exposure and ADHD which they conclude may be stronger for symptoms seen in boys compared to girls.

Wagner-Schuman, M, Richardson, J, Auinger, P et al. 2015. Association of pyrethroid pesticide exposure with attention-deficit/hyperactivity disorder in a nationally representative sample of U.S. children. Environmental Health. 14:44

23. Additional studies on lawn pesticide product formulations show effects on learning ability, aggressiveness, memory, motor skills and immune system function.

Porter, W. 2004 Spring. "Do Pesticides Affect Learning and Behavior? The neuro-endocrine-immune connection," Pesticides and You, Beyond Pesticides 21(4): 1115; Shettler, T., et al. 2000. "Known and suspected developmental neurotoxicants," In Harms Way: Toxic Threats to Child Development, Greater Boston Physicians for Social Responsibility: Cambridge, MA; Mitchell, J. et al. 1989. "The Behavioral Effects of Pesticides in Male Mice," Neurotoxicology and Teratology 11: 45-50.

24. A 2002 study finds children born to parents exposed to glyphosate (Roundup®) show a higher incidence of attention deficit disorder and hyperactivity.

Cox C. 2004. Journal Of Pesticide Reform Vol. 24 (4) citing: Garry, V.F. et al. 2002. "Birth defects, season of conception, and sex of children born to pesticide applicators living in the Red River Valley of Minnesota." Environmental Health Perspectives 110 (Suppl. 3):441-449.

25. In a 2004-2005 review of 2,4-D, EPA finds that, "there is a concern for endocrine disruption."

EPA. 2004 June. 2,4-D. HED's Human Health Risk Assessment for the Reregistration Eligibility Decision (RED). p7.

26. Children ages 6-11 nationwide have significantly higher levels of pesticide residues in their bodies than all other age categories.

27. Biomonitoring testing in Canada finds residues of lawn pesticides, such as 2,4-D and mecoprop, in 15 percent of children tested, ages insecticides are present in 98.7 percent of children tested.

Valcke, Mathieu, et al. 2004. "Characterization of exposure to pesticides used in average residential homes with children ages 3 to 7 in Quebec." Nat Inst of Public Health, Québec. www.inspq.qc.ca/pdf/publications/319-CharacterisationPesticidesEnfants.pdf (accessed 6/2/05).

28. One 2014 analysis of 129 preschool children, ages 20 to 66 months, found that children were exposed to

indoor concentrations of pyrethroids, organophosphates and organochlorines pesticides which were detected in soil, dust and indoor air.

Morgan, M, Wilson, N, and Chuang C. 2014. Exposures of 129 Preschool Children to Organochlorines, Organophosphates, Pyrethroids, and Acid Herbicides at Their Homes and Daycares in North Carolina. Int. J. Environ. Res. Public Health, 11(4), 3743-3764

29. Samples from 120 Cape Cod homes, where elevated incidence of breast, colorectal, lung, and prostate cancers are reported, find high indoor air and dust concentrations of carbaryl, permethrin, and 2,4-D.

Rudel, Ruthann, et al. 2003. "Phthalates, Alkylphenols, Pesticides, Polybrominated Diphenyl Ethers, and Other Endocrine-Disrupting Compounds in Indoor Air and Dust." Environmental Science and Technology 37(20): 4543-4553.

30. A study published in Environmental Health Perspectives found that children who eat a conventional diet of food produced with chemical-intensive practices carry residues of organophosphate pesticides that are reduced or eliminated when they switch to an organic diet.

Lu, C. et al. 2008. Dietary Intake and Its Contribution to Longitudinal Organophosphorus Pesticide Exposure in Urban/Suburban Children. Environmental Health Perspectives doi:10.1289/ehp.10912 available via <http://dx.doi.org/>.

31. Scientists at the California Department of Public Health found that 28% of the mothers studied who

lived near fields in the Central Valley, which were sprayed with organochlorines, such as endosulfan and dicofol, have children with autism.

Roberts, C. et al. 2007. Maternal Residence Near Agricultural Pesticide Applications and Autism Spectrum Disorders among Children in the California Central Valley. Environmental Health Perspectives 115(10)

32. A 2005 study published in the Journal of the American Medical Association found that students and school employees are being poisoned by pesticide use at schools and from drift off of neighboring farmlands.

Alarcon, WA. et al. 2005. Acute illnesses associated with pesticide exposure at school. J Am Medical Association 294(4); 455-465.

33. National Research Council, National Academy of Sciences. 1993. Pesticides in the Diets of Infants and Children, National Academy Press, Washington, DC. 184-185.

34. US EPA, Office of the Administrator, Environmental Health Threats to Children, EPA 175-F- 96-001, September 1996.

See also: <http://www.epa.gov/pesticides/food/pest.htm>.

35.. Bearer, CF. 2000. "The special and unique vulnerability of children to environmental hazards." Neurotoxicology 21: 925-934; Fenske, R., et al. 1990. "Potential Exposure and Health Risks of Infants following Indoor Residential Pesticide Applications." Am J. Public Health. 80:689-693.

36. Faustman EM, Silbernagel SM, Fenske RA, Burbacher TM, Ponce RA. 2000. "Mechanisms underlying children's susceptibility to environmental toxicants." Environmental Health Perspectives. 108(suppl 1):13-21.

37. Chevrier C, Limon G, Monfort C, Rouget F, Garlantézec R, Petit C, et al. 2011. Urinary Biomarkers of

Prenatal Atrazine Exposure and Adverse Birth Outcomes in the PELAGIE Birth Cohort.

Atrazine Exposure and Adverse Birth Outcomes in the PELAGIE Birth Cohort. Environ Health Perspect. 119:1034-1041

38. Brender, JD., et al. 2010. Maternal Pesticide Exposure and Neural Tube Defects in Mexican Americans.

Ann Epidemiol. 20(1):16-22

39. Pauff G. Canaries' role in mines safety. The Morning Call

Web site. http://articles.mcall.com/2000-05-04/news/3309370_1_canaries-mines-carbon-monoxide..