

Making an
Impact Fact
by Fact



Promoting Good Prenatal Health: Air Pollution and Pregnancy

Information for Prenatal Health Care Providers

With tips for patients on preventing and reducing
exposure to air pollution

Recent literature suggests that exposure to air pollution during pregnancy can cause adverse birth outcomes and health problems for the mother and child.

Some pollutants of concern are secondhand smoke, carbon monoxide, fumes from paint and household cleaners, particulate matter, and ozone.^{1, 2, 3, 4, 5, 6}

Women of child-bearing age, pregnant women, new mothers, families, and their health care providers should be aware of the potential hazards of outdoor and indoor air pollution to developing fetuses and small children. Research shows that prenatal exposure to pollutants can increase the risk of preterm delivery and low birth weight (LBW; less than 2,500 grams, or 5.5 pounds), which are public health challenges in

the United States, as they contribute significantly to infant mortality and developmental disabilities.^{7, 8, 9} This fact sheet identifies some common environmental exposures and provides simple steps that health care providers can recommend to pregnant women and new mothers to avoid exposure.



Sources Of Air Pollution and Risks Associated with Exposure

Tips for Preventing Exposure to Tobacco Smoke

- Pregnant women should not smoke.
- Pregnant women should avoid public places where smoking is allowed.
- Pregnant women should make their homes and cars smoke-free.

Tobacco Smoke

It is well documented that maternal smoking during pregnancy is associated with poor fetal development.^{10, 11, 12, 13} However, exposure to secondhand smoke during pregnancy might also result in a higher risk of poor fetal development (i.e., reduced birth weight and birth length), reduced lung function, respiratory illnesses (e.g., asthma), and cognitive deficits (e.g., impaired speech, language skills, and intelligence).^{2, 3, 14, 15}

Secondhand smoke, also known as environmental tobacco smoke (ETS), contains more than 4,000 compounds, of which at least 250 have been found to be toxic to human health.¹⁶ Some of these chemicals can cross the placenta to the developing fetus and increase the risk of adverse birth outcomes.¹⁴ Children exposed to secondhand smoke after birth are more likely to suffer serious health problems such as asthma, lower respiratory tract infections, ear infections or Sudden Infant Death Syndrome (SIDS).^{2, 3, 14, 15}



Carbon Monoxide

Carbon monoxide (CO) is often referred to as a silent killer. CO is a toxic gas that is difficult to detect because it is colorless, odorless, tasteless, and does not irritate the skin.¹⁷

Malfunctioning or improperly used fuel-burning appliances and idling automobiles in enclosed spaces are responsible for hundreds of unintentional CO-related deaths every year.¹⁸ Indoor sources of CO include back-drafting from woodstoves and gas water heaters, gas stoves, the improper use of generators in enclosed spaces such as homes, cigarette smoke, and unvented gas and kerosene space heaters.¹⁷ CO reduces the capacity of a mother's blood to carry oxygen (O_2), complicating delivery of O_2 to the developing fetus.^{19, 20} Epidemiological and animal toxicological studies suggest that long-term exposure to ambient CO, especially during the first trimester, may increase risk for preterm birth, reduced fetal growth, and certain birth defects such as cardiac birth defects and otoacoustic deficits.^{19, 21, 22} The severity of CO poisoning for the fetus depends on the amount and length of exposure, as well as gestational age at the time of exposure.²³

In situations of suspected CO poisoning, if a pregnant woman experiences very mild symptoms, or no symptoms at all, generally it is unlikely her fetus is at significant risk. However, detecting CO poisoning in pregnant women can be more difficult because symptoms mirror conditions that normally appear in pregnancy (nausea, vomiting, and tiredness).²³ Symptoms of high exposure to CO are serious and potentially life-threatening, and include mental confusion, lack of muscular coordination, and loss of consciousness.

***Anyone who exhibits symptoms that could be related to CO exposure should be taken to an emergency room immediately. The source of the CO should be identified and the problem corrected to prevent further exposure.¹⁸*

Tips for Preventing CO Exposure

- Install carbon monoxide alarms that are Nationally Recognized Testing Laboratory (NRTL) approved (such as Underwriters Laboratories Inc.) outside all sleeping rooms.
- Have fuel-burning appliances, furnace flues, and chimneys checked at the beginning of every heating season by a trained professional to ensure proper working order.
- Don't use gas ovens or burners to heat a home, not even for a short time.
- Don't use charcoal grills indoors, even in a fireplace.
- Don't use any gasoline-powered engines (mowers, weed trimmers, snow blowers, chain saws, small engines, or generators) in enclosed spaces.
- Don't idle cars in the garage.
- Don't ignore symptoms (nausea, vomiting, and tiredness) when around a CO source, especially if more than one person is feeling them. You could lose consciousness and even die if you do nothing.
- Go to the emergency room if CO poisoning is suspected.

Tips for Reducing Exposure to Particle Pollution and Ozone

- Check local news media for air quality forecasts and plan outdoor activities for days when particle and ozone levels are lower. EPA's Air Quality Index (AQI) is a tool that state and local agencies use to issue public reports of actual levels of particles, ground-level ozone, and other common air pollutants.
- When the AQI indicates poor air quality, reduce activity time or substitute another activity that requires less energy. For example, walk rather than jog.
- Don't exercise near high-traffic roads, where particle levels are generally higher.
- Protect yourself from exposure to particulate matter in wood smoke.
 - Burn only clean, seasoned wood, not trash or plastics.
 - If you have a woodstove purchased before 1992, upgrade to either an EPA-certified wood or pellet stove, or other cleaner burning heater.
 - Maintain your stove annually.
 - Consider upgrading your outdoor wood-fired boiler to a new EPA-qualified model.

Particle Pollution

Particle pollution, also known as particulate matter or PM, is the generic term for a broad class of chemically and physically diverse substances that exist as discrete particles (liquid droplets or solids) over a wide range of sizes. Particles originate from a variety of anthropogenic stationary and mobile sources as well as from natural sources. Particles may be emitted directly, or formed in the atmosphere by transformations of gaseous emissions such as sulfur oxides (SO_x), nitrogen oxides (NO_x), and volatile organic compounds (VOCs). The chemical and physical properties of PM vary greatly with time, region, meteorology, and source category, thus complicating the assessment of health and welfare effects.^{24, 25} Size directly determines a particle's potential for causing health problems, with the smaller particles, those 10 micrometers in diameter or less (PM₁₀ and PM_{2.5}), being more dangerous. These small particles can enter the respiratory system and penetrate deep into the lungs, with possible serious health effects.^{24, 25}

Research suggests that exposure to ambient levels of particle pollution may increase the risk for adverse cardiovascular and/or respiratory health effects.²⁵ Some research has linked particle exposure to a greater risk of low birth weight (LBW) and infant mortality, especially due to respiratory causes during the postnatal period. However, outcomes are highly variable based on the size of particles, duration of exposure, and time during pregnancy when the mother is exposed.²⁵ The risk of being affected by particle pollution and ground-level ozone increases with the difficulty and duration of outdoor activities, and with increased pollution levels in the area.

Ozone

Ozone is a gas composed of three oxygen atoms (O₃). "Good" ozone is a naturally formed layer in the stratosphere that helps protect life on Earth from the sun's rays. "Bad" ozone exists at ground level and can be harmful to health.



Ground-level ozone is created by chemical reactions of tailpipe exhaust, gasoline vapors, industrial emissions, chemical solvents, and natural sources. Joined with particulate matter and acted on by sunlight and heat, ozone creates “smog.”²⁶

Ozone can be present in indoor air as well. Ozone generators, personal air purifiers, “pure-air” generators and “super oxygen” purifiers are devices that emit ozone gas into the indoor air at levels that can irritate airways and exacerbate existing respiratory conditions. Evidence shows that at concentrations that do not exceed public health standards, ozone is ineffective at removing indoor air contaminants or biological pollutants such as mold from the air.²⁷

Exposure to ozone has been linked to LBW babies. Researchers at the University of Southern California found that women who breathe air heavily polluted with ozone are at particular risk for having babies afflicted with intrauterine growth retardation (IUGR), meaning they fall below the 15th percentile of expected size. The association was even stronger for ozone exposure over the second and third trimesters.⁶

Animal studies contribute to the understanding of the role of ozone in LBW. Pregnant rats were found particularly vulnerable to lung inflammation from ozone. Researchers suspect that lung inflammation initiates a biochemical response that may harm the placenta.^{25, 28, 29}

Paint Fumes

When preparing the house for the new baby, be aware that exposure to paint fumes can be hazardous to the health of the mother and developing fetus. There are two general types of household paints, oil-based and water-based. Oil-based (alkyd) paint is often used on the exterior of houses because it dries very hard and withstands harsh weather for a long time. Water-based (latex) paint generally emits fewer chemical

Tips for Preventing Exposure to Paint Fumes

- Pregnant women and children should avoid exposure to paint fumes and limit their time in freshly painted rooms.
- Creating a nursery can involve exposure to hazardous substances. Before using any product, always read the label first for instructions and safety information.
- Open the windows and doors fully in any room that is being painted or has recently been painted.
 - Put a box fan in the window directing the air and fumes outdoors. Keep the fan on while painting and for about 48 hours afterward.
 - If the room does not have a window, use a fan to circulate and exhaust air away from the work area. Keep doors open.
- Do not paint indoors with paint labeled “for exterior use only.”
- Ask a local paint dealer whether they carry low-VOC or zero-VOC paint. Due to environmental regulations and consumer demand, there are now several low-VOC and zero-VOC paints on the market. Currently, low- and zero-VOC paints as marketed may still emit VOCs of concern, and efforts should be taken to properly ventilate the room, and keep exposures to a minimum.

Tips for Reducing Exposure to Cleaning Products

- Never mix cleaning products, as the fumes can be hazardous or deadly! For example, mixing chlorine bleach and ammonia can generate very harmful chloramine gas.
- Pregnant women should only use cleaning products in well-ventilated areas, wearing protective gloves.
- Consider using alternative cleaners. Baking soda can be used to scrub greasy pots, pans and ovens; and vinegar and water to clean countertops and other surfaces.
- Look for the Design for the Environment (DfE) logo on safer cleaning products.
 - The DfE logo on a product means that EPA scientists have screened each ingredient for potential human health and environmental effects, and that based on currently available information, the product contains only those ingredients that pose the least concern among chemicals in their class.

vapors, often called volatile organic compounds (VOCs), than alkyd paint, but may still contain some hazardous chemicals such as ethylene glycol ethers and biocides (e.g., mercury or formaldehyde). VOCs are emitted as a gas from various solids or liquids, including most paints, and can cause adverse health effects, especially with extended duration or frequency of exposure to fumes.^{4, 30, 31}

Short-term exposure to solvents from alkyd paints can be significantly higher than from latex paints.⁴ Headaches, nausea, dizziness, and fatigue are typical symptoms of paint fume inhalation and can be worse with acute, higher level exposure.^{4, 31} Pregnant women should avoid alkyd paint, and limit the use of latex paint in order to reduce exposure to potentially harmful vapors in both home and occupational settings.

Cleaning Products

Exposure to fumes from some cleaning products during pregnancy can pose risks when used in the home and in the workplace.

Common cleaning products contain a range of ingredients including solvents, strong acids and bases, and fragrances. Some of these ingredients pose health concerns, others can be bad for the environment, and some of them can release toxic fumes either individually, or if mixed together.^{5, 32, 33} Phthalates can be carriers for fragrance in glass cleaners, deodorizers, laundry detergents, and fabric softeners. Some phthalate compounds can be associated with potential adverse effects in male children, reduced sperm count in adult men, and increased allergic symptoms and asthma in children.³⁴



Additional Resources

Environmental Protection Agency

- Office of Children's Health Protection www.epa.gov/children
- Air Quality Index: www.airnow.gov
- Indoor air quality: www.epa.gov/iaq – Burn Wise Program: www.epa.gov/burnwise
- National Ambient Air Quality Standards (NAAQS): www.epa.gov/air/criteria.html
- Particle pollution and your health: www.epa.gov/oar/particlepollution/pdfs/pm-color.pdf
- Protect your family and yourself from CO poisoning: www.epa.gov/iaq/pubs/coftsht.html
- Six common air pollutants: www.epa.gov/air/urbanair/6poll.html
- Consumer Product Safety Commission: www.cpsc.gov
- Learn about chemicals around your house: www.epa.gov/kidshometour
- Find safer products that bear EPA's DfE logo: www.epa.gov/dfe
- Smoke-free homes: www.epa.gov/smokefree

Pediatric Environmental Health Specialty Units (PEHSU)

- Children's environmental health experts: www.pehsu.net

Centers for Disease Control and Prevention

- CO poisoning: www.cdc.gov/co/faqs.htm
- Indoor air quality information: www.cdc.gov/nceh/airpollution/indoor_air.htm

U.S. Department of Health and Human Services

- Office on Women's Health www.womenshealth.gov/owh

References

- ¹ Sram, R.J., Binkova, B., Dejmek, J., et al. (2005). Ambient air pollution and pregnancy outcomes: a review of literature. *Environmental Health Perspectives*, 113 (4): 378-382. Retrieved from: www.ehponline.org/members/2005/6362/6362.pdf on May 28, 2009.
- ² Miller, R.L., Garfinkel, R., Horton, M., et al. (2004). Polycyclic aromatic hydrocarbons, environmental tobacco smoke, and respiratory symptoms in an inner-city birth cohort. *Chest*, 126: 1071-1078. Retrieved from: www.chestjournal.org/content/126/4/1071.full.pdf+html on May 28, 2009.
- ³ Rauh, V.A., Whyatt, R.M., Garfinkel, R., et al. (2004). Developmental effects of exposure to environmental tobacco smoke and material hardship among inner-city children. *Neurotoxicology and Teratology*, 26(3): 373-85.
- ⁴ U.S. Environmental Protection Agency (EPA). (2000). Healthy Indoor Painting Practices. EPA 744-F-00-011. Retrieved from: www.epa.gov/oppt/exposure/pubs/inpaint5.pdf on April 27, 2009.
- ⁵ EPA. (2007). Learn About Chemicals Around Your House: Kitchen and Bathroom. Retrieved from: www.epa.gov/kidshometour/tour.htm#view on December 31, 2008.
- ⁶ Salam, M.T., Millstein, J., Li, Y., et al. (2005). Birth outcomes and prenatal exposure to ozone, carbon monoxide, and particulate matter: results from the children's health study. *Environmental Health Perspectives*, 113(11):1638-1644.
- ⁷ Lacasana, M., Esplugues, A. and F. Ballester. (2005). Exposure to ambient air pollution and prenatal and early childhood health effects. *European Journal of Epidemiology*, 20:183-99.
- ⁸ U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (CDC). (2002). Infant mortality and low birth weight among black and white infants—United States, 1980–2000. *Morbidity and Mortality Weekly Report*, 51(27):589-592. Retrieved from: www.cdc.gov/mmwr/preview/mmwrhtml/mm5127a1.htm on June 12, 2008.
- ⁹ Paneth, N.S. (1995). The problem of low birth weight. *Future Child*, 5(1): 19-34. Retrieved from: <http://futureofchildren.org/futureofchildren/publications/journals/article/index.xml?journalid=60&articleid=370§ionid=2478> on June 12, 2008.
- ¹⁰ Jaakkola, J.J., Kosheleva, A.A., Katsnelson, B.A., et al. (2006). Prenatal and postnatal tobacco smoke exposure and respiratory health in Russian children. *Respiratory Research*, 7(1): 48. Retrieved from: www.princeton.edu/futureofchildren/publications/journals/article/index.xml?journalid=60&articleid=370§ionid=2477&submit on June 12, 2008.
- ¹¹ Werler, M. (1997). Teratogen update: smoking and reproductive outcomes. *Teratology*, 55:382-88. Retrieved from: <http://teratology.org/updates/55pg382.pdf> on June 12, 2008.
- ¹² Bardy, A.H., Seppala, T., Lillsunde, P., et al. (1993). Objectively measured tobacco exposure during pregnancy: neonatal effects and relation to maternal smoking. *British Journal of Obstetrics and Gynecology*, 100(8):721-6.
- ¹³ Jaakkola, J.J. and M. Gissler. (2004). Maternal smoking in pregnancy, fetal development, and childhood asthma. *American Journal of Public Health*, 94(1): 136-40. Retrieved from: www.ajph.org/cgi/reprint/94/1/136 on May 28, 2009.
- ¹⁴ CDC, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. (2006). The health consequences of involuntary exposure to tobacco smoke: a report of the surgeon general. Retrieved from: www.surgeongeneral.gov/library/secondhandsmoke on June 12, 2008.
- ¹⁵ Herrmann, M., King, K. and M. Weitzman. (2008). Prenatal tobacco smoke and postnatal secondhand smoke exposure and child neurodevelopment. *Current Opinion in Pediatrics*, 20(2):184-90.
- ¹⁶ EPA. (2008). Health Effects of Exposure to Secondhand Smoke. Retrieved from: www.epa.gov/smokefree/healtheffects.html on May 14, 2009.
- ¹⁷ EPA. (2006). Sources of indoor air pollution—carbon monoxide. Retrieved from: www.epa.gov/iaq/co.html#Definition on May 19, 2009.
- ¹⁸ EPA. (2006). Protect your family and yourself from carbon monoxide poisoning. Retrieved from: www.epa.gov/iaq/pubs/cofsh.html on May 19, 2009.
- ¹⁹ EPA. (2009). Integrated Science Assessment for Carbon Monoxide (First External Review Draft). EPA-600-R-09-019. Retrieved from: http://oaspub.epa.gov/eims/eimscomm.getfile?p_download_id=487236 on May 18, 2009.
- ²⁰ Di Cera, E., Doyle, M.L., et al. (1989). Carbon monoxide and oxygen binding to human hemoglobin F0. *Biochemistry*, 28(6): 2631-2638.
- ²¹ Wilhelm, M. and B. Ritz. (2005). Local variations in CO and particulate air pollution and adverse birth outcomes in Los Angeles County, California, USA. *Environmental Health Perspectives*, 113(9):1212-1221. Retrieved from: www.ehponline.org/members/2005/7751/7751.pdf on May 28, 2009.
- ²² Bell, M.L., Ebisu, K., and K. Belanger. (2007). Ambient Air Pollution and Low Birth Weight in Connecticut and Massachusetts. *Environmental Health Perspectives*, 115:1118-1125.
- ²³ CDC. (2005). Hurricanes—special population. Effects on pregnant women—carbon monoxide. Retrieved from: www.cdc.gov/ncbddd/hurricanes/environmental.htm on May 19, 2009.
- ²⁴ EPA. (2006). Particulate matter. Retrieved from: www.epa.gov/oar/particlepollution on May 19, 2009.
- ²⁵ EPA. National Center for Environmental Assessment-RTP Division (2008). Integrated Science Assessment for Particulate Matter: First External Review Draft. Retrieved from: <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=201805> on January 27, 2009.
- ²⁶ EPA. (2003). Ozone: Good Up High, Bad Nearby. EPA-451/K-03-001. Retrieved from: www.epa.gov/oar/oaqps/gooduphigh/ozone.pdf on April 9, 2009.
- ²⁷ EPA. (2009). Ozone Generators that are sold as air cleaners. Retrieved from: www.epa.gov/iaq/pubs/ozonegen.html on May 20, 2009.
- ²⁸ Acevedo, S., Bizarro, P., Fortoul, T., Lopez, I., Sanchez, I., and M. Ustarroz. (2008). Ultrastructural alterations during embryonic rats' lung development caused by ozone. *Journal of Electron Microscopy*, 57(1):19-23.
- ²⁹ Gunnison, AF, Sobo, M., and P.A. Weideman. (1992). Enhanced inflammatory response to acute ozone exposure in rats during pregnancy and lactation. *Fundamental and Applied Toxicology*, 19(4):607-12.
- ³⁰ EPA. (2009). An Introduction to Indoor Air Quality: Volatile Organic Compounds (VOCs). Retrieved from: www.epa.gov/iaq/voc.html on December 10, 2009.
- ³¹ American Pregnancy Association. Pregnancy and Paint Exposure. Retrieved from: www.americanpregnancy.org/pregnancyhealth/paintexposure.html on December 31, 2008.
- ³² EPA. (2000). Read the Label First! Protect Your Household brochure. EPA 740-F-00-004. Retrieved from: www.epa.gov/pesticides/regulating/labels/pdf/home.pdf on December 10, 2009.
- ³³ National Institutes of Health. U.S. National Library of Medicine. (2009). Medline Plus: Household Products. Retrieved from: www.nlm.nih.gov/medlineplus/householdproducts.html#cat7 on December 10, 2009.
- ³⁴ Hauser, R. and A.M. Calafat. (2005). Phthalates and Human Health. *Occupational and Environmental Medicine*, 62: 806-818. Retrieved from: <http://oem.bmj.com/cgi/reprint/62/11/806> on January 9, 2009.