Pediatric Environmental Health Toolkit

Environmental Health Reference Card

Please refer to the AAP's Pediatric Environmental Health handbook for more detailed information on these topics.

Endorsed by:
American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Topic	Health Effects Summary	Sources and Routes of Exposure	Prevention Strategy
Arsenic A heavy metal found naturally in the earth's crust, as well as incorporated into certain products. 	Acute high dose exposures can cause nausea, vomiting, hematemesis, diarrhea, abdominal cramping, and shock. Lower dose exposures can cause GI upset followed by a more protracted course of bone marrow suppression, hepatic dysfunction, myocardial depression with cardiac conduction disturbances, and a peripheral sensimotor neuropathy that can mimic Guillain-Barre Syndrome. Chronic exposures produce fatigue, malaise, and low-grade bone marrow depression. Skin changes include Mee's lines (white, transverse creases across fingernails), hyperkeratosis, hyperpigmentation, and eczematoid eruptions. Chronic exposure is also associated with heart disease, peripheral neuropathy (parasthesias, pain, ataxia). Arsenic is also a known carcinogen with dose-response increases in bladder, lung, and skin cancer as well as links with acute myelogenous leukemia, and cancer of the kidney and liver.	Arsenic is ingested or inhaled; not usually absorbed through the skin. A common contaminant of drinking water (either naturally or as a by-product of mining, smelting, or the manufacturing of chemicals and glass). A component of the wood preservative chromated copper arsenate (CCA), widely used to treat outdoor-use wood (decks, playground equipment, fences, porches). Added to poultry feed as an antimicrobial, released into the environment through manure.	**Test** water (especially well water) for arsenic and filter/remediate if necessary. Reverse osmosis filtration systems can remove arsenic, but they are expensive. **Wash** children's hands after playing on CCA-treated wood ("pressure-treated wood"). **Seal** CCA-treated wood structures every 1-2 years with sealant such as an oil-based stain or polyurethane, not paint. **Avoid** using CCA-treated wood for growing fruits/veggies or anything for human consumption. **Never** burn CCA-treated wood. Notes: In 2002, the Environmental Protection Agency (EPA), reduced the maximum contaminant level of arsenic in public water from 50ppb to 10ppb. Complete compliance is due by 2006. As of 2004 manufacturers no longer treat wood with CCA (existing stocks can be sold until depleted) but because these structures will remain intact for decades, children will be at risk for continued exposure even in the absence of new wood sales.

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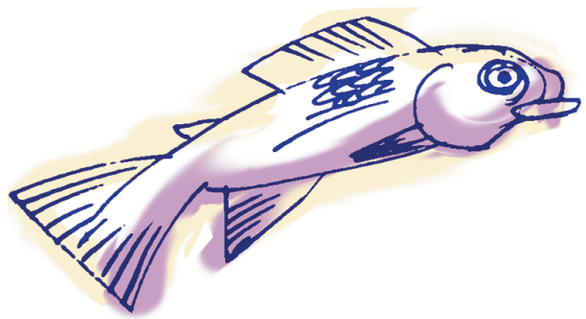
Mercury			
A neurotoxic metal that exists in several different forms: **Organic mercury** – Includes methylmercury found in contaminated fish. **Elemental mercury** – "Quicksilver" – A liquid at room temperature, volatilizes readily to a colorless and odorless vapor. Used in thermometers, thermostat switches, sphygmomanometers, dental amalgams, fluorescent light bulbs and button batteries. It is also used in magico-religious rituals such as in the Santeria religion, and in some folk remedies for gastrointestinal problems (empacho). Elemental mercury is also sometimes used by people who pan for gold as a hobby. **Inorganic mercurial salts** – Have been used in a number of consumer products ranging from teething powders to skin lightening creams. While banned in the US, they remain available on the world market.	Methylmercury is a known teratogen causing disruption of normal patterns of neuronal migration and histology in the developing brain. Unlike elemental mercury, methyl mercury is absorbed from the gastrointestinal tract and readily crosses the placenta and blood brain barrier. Appears in human milk. High-level fetal exposures may cause psychomotor retardation, blindness, deafness, and seizures. Lower level fetal exposures, such as those resulting from regular maternal fish consumption, have been implicated in language, attention, and memory impairments.	Mercury in contaminated fish is the major source of human exposure to methyl mercury. The largest contributors of mercury to the environment are runoff from mines, industries that burn fossil fuels like coal, medical and municipal waste incinerators that burn mercury-containing products, and chlor-alkali plants that make caustics. In addition, some mercury is released from natural sources. Elemental mercury released into the air eventually falls to earth contaminating waterways. Bacteria that live in water convert elemental or inorganic mercury to organic mercury, such as methyl mercury. Methylmercury bioaccumulates in the lean muscle mass of fish, with large predatory fish like swordfish, tuna, and shark having higher mercury levels. Less common sources of exposure include the direct exposure to elemental mercury via inhalation of mercury vapors, e.g. broken thermometers, Santeria rituals.	**In Waste Stream:** **Keep** mercury out of the waste stream, dispose of mercury-containing products during hazardous waste days or at waste sites in community. **Exchange** mercury thermometer for digital at community recycling centers. **Never** vacuum up mercury from broken thermometers – carefully sweep up and dispose of as hazardous waste. **In Food:** **Serve** children a variety of fish and seafood low in mercury and other contaminants: Haddock, pollock, and shrimp are among the low fat, low mercury choices. Fish sticks are usually made from fish that are low in pollutants. Do not feed children swordfish, shark, mackerel (king), and tilefish. Follow any fish advisories released by health officials at state or local level. **Choose** "chunk light" canned tuna instead of canned "solid white" albacore and fresh tuna. Limit the *amount* of each child's serving based on age and body weight. A toddler should eat a serving of only 1-2 ounces, while an older and larger child may be served 2-3 ounces. **Other** inexpensive, low fat sources of protein include beans, lean chicken, turkey, and eggs without the yolk.
Lead			
A heavy metal and a proven neurotoxicant to the developing brain.	Fetal or early childhood exposure linked with lower IQ scores, language and attention difficulties, and increased aggression and delinquency. Other possible health effects: decreased growth, decreased hearing acuity, elevated blood pressure, and renal disorders. Centers for Disease Control (CDC) guidelines issued in 1991 define a blood lead level $\geq$ 10ug/dl as elevated but recent research indicates that health effects may be present at much lower levels.	Unintentional ingestion of lead containing particles such as indoor house dust, paint, water, soil or foreign bodies. Lead is found in paint in homes built before 1978 and tapwater may contain lead from pipes or lead solder or if originating from a lead-contaminated source. Less common exposures include certain imported cosmetics and ceramic ware; vinyl mini-blinds made before 1997; certain candle wicks and crayons; soft vinyl lunch boxes; and certain traditional/herbal remedies and foods. Occupations or hobbies like painting and refinishing, cleaning and shooting of firearms, battery repair, stained glass making, and ceramics may result in lead poisoning.	**In Paint** – Should be removed by trained professionals. Never sand or remove yourself. If you can't safely remove, cover with wallpaper, tile, etc. **In Dust** – To control exposure to lead dust, wash child's hands after playing, wash floors and other surfaces regularly, especially window sills. **In Water** – With lead pipe/solder concerns, consider running cold tap water for 1-2 minutes first thing in the morning or after a long period of non-use to clear pipes, or consider filtration systems that will remove lead regardless of its source. **In Products** – Don't buy or use products with lead in them. **In Soil** – Don't grow food in soil with lead, or add a min. 6" layer of clean topsoil for gardening. Don't let children play in lead-contaminated soil. continued →



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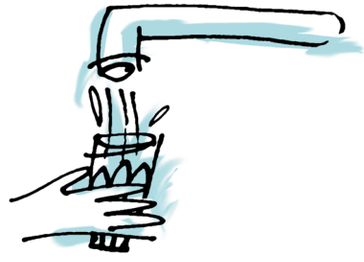
Polychlorinated biphenyls (PCBs), Dioxins, and Furans			
PCBs were used as an insulating material and were banned from manufacture in the United States in 1977 because of possible links with cancer. Dioxins and furans are chemicals that form during the incineration of waste, especially plastics. They can also be made during the bleaching of paper pulp and during the manufacture of products containing chlorine.	Fetal exposure to low-levels of PCBs in the mother's diet increases the risk of IQ deficits, hyperactivity, and attention deficits. Dioxins can also adversely affect reproductive health and brain development and are associated with ectodermal defects including abnormalities of skin, hair, teeth, and nails. Dioxins are also known to cause cancer in humans.	Both PCBs and dioxins are called persistent organic pollutants ("POPs") because they do not degrade easily and they persist for years in the environment. Both are lipid soluble and bioaccumulate in fatty tissue. Exposures are mainly through dietary fat, including fish, meat, and dairy products. PCBs and dioxins are now found ubiquitously in the environment. All of us have small amounts of PCBs and dioxins in our tissues.	**The best way** to minimize exposure is to select lean cuts of meat, low or nonfat dairy products, and to abide by local and state fishing advisories.
Asbestos			
A fireproofing, insulating, and soundproofing material widely used in the U.S. during the 1940s-70s in the construction of homes, schools, public buildings.	The association between asbestos and both lung cancer and mesothelioma has been well documented, particularly for occupationally-exposed persons. Risk is higher in those exposed who are also smokers.	Exposures via inhalation generally occur when buildings containing asbestos are in poor condition or when asbestos is removed improperly. Vermiculate, produced from mined ore, is used for agricultural, construction and insulation purposes, and can be contaminated with asbestos.	**Removal** should be performed only by EPA or state-certified asbestos contractors.
Water Pollutants			
For metals, pesticides, and solvents – see relevant section. **Bacteria** – E coli, campylobacter, salmonella, shigella, vibrio species. **Viruses** – Enterovirus, hepatitis A, rotavirus. **Parasites** – Giardia, cryptosporidium, entamoeba histolytica. **Nitrates** – Nitrogen-oxygen chemical units. **Perchlorate** – Salt containing chlorine and oxygen. **Chlorination by-products** – Chloroform, haloacetic acids, trihalomethanes. **Toxins** – Pfiesteria toxin, microsystins.	**Bacteria** – Gastroenteritis. **Viruses** – Gastroenteritis or hepatitis. **Parasites** – Gastroenteritis. **Nitrates** – Methemoglobinemia in infants. Bottle-fed infants are at greatest risk. **Perchlorate** – Blocks iodine uptake into thyroid gland. **Chlorination by-products** – Spontaneous abortion, spermatotoxicity, bladder cancer, rectal cancer. **Toxins** – Hepatotoxicity, neurotoxicity.	Exposure can occur through drinking water. Inhalation or dermal exposures via showering/ bathing can be significant. Exposure can also occur through swimming and other recreational activities. Water for irrigation of crops may be contaminated. Bottled water and well water are less regulated than municipal tap water. In the absence of known microbial contamination, boiled water is not necessary. Boiling can concentrate some chemical contaminants such as nitrates, heavy metals, and perchlorate. **Nitrates** – Usually from well water that has been contaminated through agricultural practices and substandard septic systems. **Perchlorate** – From rocket fuel, fireworks manufacture. Is persistent in water and difficult to remove. **Chlorination by-products** – Mostly a problem when unfiltered surface water with dissolved organic material is treated with chlorine.	**Know** your water source (e.g., surface water, groundwater, well water, and bottled water). Work to protect it in your community. **Read** annual Community Consumer Confidence Reports on public water supply quality. Test well water regularly. Filter or take community action if necessary. **For more** extensive evaluation, treatment and prevention consult EPA, CDC, and state and local health departments. 

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Indoor Air Pollutants			
Carbon monoxide – An odorless, colorless gas produced by appliances or heaters that burn natural gas, oil, wood, propane, or kerosene. A major component of car exhaust.	**In General** – Typically associated with respiratory problems and may contribute to the development and exacerbation of asthma. But other organ systems may also be affected (see below).	Poor ventilation may exacerbate exposures.	**In General** – Keep indoor environments clean and well ventilated.
Environmental tobacco smoke (ETS) is composed of more than 3,800 different chemical compounds.	**Carbon monoxide** – Intoxication is associated with neurologic, cardiovascular, and pulmonary pathology.		**ETS** – Don't smoke inside building or in the car.
Radon – An odorless, colorless radioactive gas that comes from the natural breakdown of uranium in rock and soil. It can seep into homes through cracks in the foundation, floors, walls. Can be found in water.	**ETS** – Prenatal exposure has been associated with decreased birth weight, increased risk of SIDS and decreased pulmonary function. Postnatal exposure is associated with an increased risk of asthma, respiratory tract infections, otitis media, breast and lung cancer, and heart disease.		**Carbon Monoxide** – Use CO monitors in the home to ensure no leaks.
Molds – Require moisture to grow and tend to be found in damp basements, refrigerators, air conditioners, humidifiers, mattresses, carpeting, under ceiling panels, or behind walls (if there are chronic water leaks).	**Radon** – After smoking, radon is the most common cause of lung cancer in the U.S.		**Radon** – Consider testing for radon; if unknown or high (above 4 pCi/L), ventilate well, avoid sleep and play areas in basement level – if high, consider remediation – Call 1-800-SOS-RADON.
Solvents – Household cleaners, degreasers, arts and craft supplies, glues, "off-gassing" from newly installed carpets, flooring, particle board, and furniture.	**Molds** – Molds can trigger allergic reactions, exacerbate asthma or cause infection in the immune compromised.		**Molds** – Keep mold at bay by preventing excess moisture/water leaks and ensuring good ventilation.
Pesticides – Residues of some pesticides volatilize after application, and may concentrate at floor level. (See the section on pesticides for more information.)	**Solvents** – Most are neurotoxicants. Some, such as formaldehyde, are respiratory irritants. Others are reproductive toxicants.		**Solvents** – Replace products that contain volatile (typically petroleum-based) ingredients with those containing safer "nontoxic" ingredients, such as water-based glues or paints, and citrus-based solvents. Avoid volatile adhesives.
	Pesticides – See pesticide section.		**Pesticides** – Avoid spraying pesticides in the home, garden, and on pets. If necessary, use only licensed professionals. Avoid sprays and dusts (esp. where there are carpets, soft fabrics) – baits/traps/gels leave less residues. Never spray near kids' pillows, bedding, and primary spaces where kids crawl and play. (See AAP's Pediatric Environmental Health handbook for specific guidance if using pesticides.)
Outdoor Air Pollutants			
Ozone (O_3) – A free radical of oxygen (smog).	**Ozone** – Triggers asthma attacks, and may cause asthma in active children. Airway inflammation, decreased lung function.	**Ozone** – Produced by a chemical reaction of sunlight on other air pollutants (nitrogen oxides and volatile organic compounds).	The Air Quality Index (AQI) is reported in newspapers, on television, and radio and at www.epa.gov/airnow. **Follow** the associated activity recommendations (e.g., limit outdoor activities etc.), particularly if your child has asthma or respiratory illness.
Particulate matter (PM) – Sooty particles that are most toxic when they are small (<10 microns).	**PM** – Linked to premature mortality, cardiovascular and respiratory disease.	**PM** – Combustion byproduct produced by industrial sources and motor vehicles.	**Avoid** wood fires and backyard burning, whenever possible.
Sulfur dioxide/sulfuric acid (SOx) – Key component of acid rain.	**SOx** – Airway irritant, decreases lung function in asthmatics.	**SOx** – Emitted from power plants and other sources that burn coal and oil.	**Avoid** driving on "Spare the Air" days.
Carbon monoxide – Product of incomplete combustion.	**CO** – Binds irreversibly to hemoglobin, reduces oxygen carrying capacity of the blood. Hypoxia, adverse reproductive outcomes.	**CO** – Produced outdoors mainly by automobiles.	**Community Measures:**
Nitrogen oxides (NOx) – Common pollutants from burning of fossil fuels.	**NOx** – Increased respiratory symptoms and illness in children, ozone precursor.	**NOx** – Produced by diesel vehicles, other petroleum combustion.	**Promote** "no idling" ordinances locally to limit motor vehicle emissions.
Diesel exhaust – A mixture of particles, gases, and other chemicals.	**Diesel exhaust** – Human carcinogen, associated with asthma attacks and may potentiate effects of allergens.	**Diesel exhaust** – Produced by trucks, buses, trains, boats, heavy equipment, and generators.	**Replace** old diesel school buses with cleaner alternatives whenever possible.
Polycyclic aromatic hydrocarbons (PAHs) – Chemical constituents of soot.	**PAHs** – Human carcinogens.	**PAHs** – Produced from fires, other combustion processes.	**Avoid** construction of schools adjacent to major roadways, rail yards, and ports.

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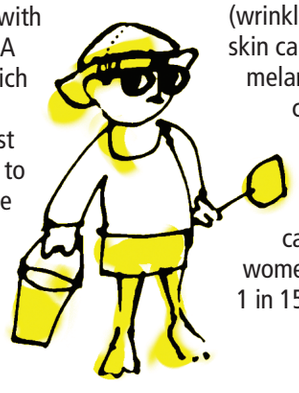
Sun Exposure Sunlight is comprised of visible light (400-700nm), infrared (>700nm and also known as heat) and UV radiation (<400nm) with UV radiation further divided into: UV-A (320-400nm), UV-B (290-320nm), which is more skin-penetrating, and UVC (<290nm). UVB is responsible for most of the acute and chronic sun damage to normal skin. UVB has increased on the earth's surface due to damage to the earth's protective stratospheric ozone layer. 	Short and long term exposure to UV radiation have been linked with sunburn, tanning, skin aging (wrinkles, weakening elasticity), non-melanoma skin cancer (basal cell, squamous cell), malignant melanoma, phototoxicity and photoallergy, cataracts, and immunosuppression. UV radiation is the single most preventable cause of melanoma, the U.S. incidence of which has risen more rapidly than any other cancer, with the exception of lung cancer in women. In 1930, the lifetime risk of melanoma was 1 in 1500; in 2001, it was 1 in 75.	Children and teens are exposed through direct contact to skin and eyes while outdoors or while using sunlamps and sunbeds. UVB is more intense during summer than during winter, at midday compared with early morning or late afternoon, in places closer to the equator than in temperate zones, and at high altitudes. Sand, snow, concrete, and water reflect up to 85% of sunlight, resulting in greater exposure. Approximately 25% of lifetime sun exposure occurs before the age of 18 years.	**Cover up** with tightly woven, light-colored clothing and wide-brimmed hat. Wear sunglasses with 99-100% protection against both UVA/UVB. **For children** older than 6 months, use sunscreen with an SPF of 15 or greater, and re-apply every 2 hours. Also consider using lip balm or lip cream containing sunscreen. **Do NOT** use sunscreens that are combined with DEET or other insect repellant. **Watch** for the UV Index on local weather forecasts in your area. Remind families that even on cloudy winter days, children can get sunburn. **Avoid** sunlamps and tanning salons/booths. **Note:** Babies with limited sun exposure and who are exclusively breastfed or receive less than 500 ml/day of formula may benefit from supplementation with vitamin D 200 iu/day.
Solvents A solvent is capable of dissolving another substance. It is usually a liquid that is water-based or hydrocarbon-based. Examples include: benzene, toluene, trichloroethylene, formaldehyde, MtBE (methyl tertiary butyl ether). 	Most are skin irritants and defatting agents, upper respiratory irritants, and hepatoxic at sufficient doses. Acute and chronic neurotoxicity can occur and is dose-related. Some are known or probable carcinogens (eg. benzene has been linked to leukemia). Some are reproductive toxicants associated with spontaneous abortion or birth defects.	Solvents are volatile compounds and are readily absorbed through the lungs, as well as through the skin. They penetrate many types of gloves. Maternal exposure can contaminate human milk. Found in gasoline, degreasers, arts and craft supplies, nail products, paints, glues, varnishes, "off-gassing" from newly installed carpets, flooring, particle board, and furniture. Also found in dry cleaning products and freshly dry-cleaned clothes. Common indoor and outdoor air, drinking water contaminants.	**Replace** products that contain volatile (typically petroleum-based) ingredients with those containing safer, "nontoxic" ingredients, such as water-based glues or paints, and citrus-based solvents. Avoid volatile adhesives. If using solvents, ventilate area. **Avoid** dry cleaning clothes. Air dry-cleaned clothes outdoors before putting them in the closet. **Read** annual Community Consumer Confidence Reports on public water supply quality or check your well water if there are industrial sites nearby. **Handle** solvents with nitrile or butyl rubber gloves and a respirator, and keep them away from children.

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Pesticides			
Pesticides are chemicals that are made to kill or reduce unwanted rodents, insects, weeds, bacteria or molds. There are over 900 pesticides registered in the US, most of which fall into the following categories: **Insecticides** – Organophosphates, carbamates, pyrethrum and synthetic pyrethroids, organochlorines, and boric acid and borates. **Herbicides** – Glyphosate (Roundup, Rodeo), Bipyridyls, Chlorphenoxy Herbicides (2,4-D, Weed-be-gone). **Fungicides** – Substituted benzenes, thiocarbamates, ethylene bisdithiocarbamates, copper, organotin, cadmium compounds, elemental sulfur, and miscellaneous compounds such as captan, benomyl, and ipriodine. **Wood preservatives** – Chromated copper arsenate (CCA), Pentachlorophenol. **Rodenticides** – Anticoagulants, cholocalciferol. **Insect repellants** – N, N-diethyl-m-tolouamide (DEET), Permethrin (Permanone, Duranon).	Exposure to high levels of pesticides can cause acute poisoning. Pesticides can also cause rashes, and may cause respiratory irritation. Low-dose exposure to pesticides may have chronic effects. Animal data suggest that even transient, low-dose exposure to certain classes of pesticides during brain development may cause hyperactivity and permanent changes in neurotransmitter receptor levels of the brain. Links have also been made with birth defects, mutations, adverse reproductive effects (primarily spontaneous abortion). Human epidemiologic studies have associated pesticide exposure with increased risk for leukemia, lymphomas, and brain cancers. Some studies link chronic pesticide exposures to neuro-degenerative diseases such as Parkinson's Disease.	Major sources of exposure include use in households, on gardens and lawns, in schools, agriculture, drift from spraying, and pesticide residues on certain fruits and vegetables. Other: • "Run-off" and inappropriate disposal of pesticides that contaminates drinking water. • Pesticides in some lice removal shampoos. • Pesticides in drinking or bathing water.	**In Food:** **Peel** or wash fruits and veggies. **Buy** organic if possible (look for USDA organic label). Children that eat an organic diet have lower exposure to certain pesticides, especially foods that children eat most. **In Home, Outdoors:** **Avoid** spraying pesticides in the home, garden, and on pets. Keep unwanted insects or animals out of your house or apartment by sealing cracks and holes around doors, windowsills, and around baseboards. **Get rid** of standing water that helps breed insects, repair drips and holes. Clean up food crumbs and spills and put away all food that will attract unwanted insects or animals. **Remove** shoes worn outdoors. Use a commercial-grade doormat. **Use** "Integrated Pest Management" (IPM) techniques that use pesticides as a last resort. If using pesticides, choose baits, traps, gels instead of sprays, dusts, or pest strips (esp. indoors and where there are carpets, soft fabrics), and keep out of reach of children. Never spray near kids' pillows, bedding, and primary spaces where kids crawl. Avoid "preventive" or scheduled lawn applications. Use only licensed professionals. (See AAP's Pediatric Environmental Health handbook for specific guidance if using pesticides.) **Try** organic gardening methods. **On Pets:** **Do not** use chemical tick-and-flea collars, flea baths or "dips" on your pets. Do not use lindane. Wash pets and their bedding frequently to keep away fleas. Do not use "flea bombs" in your home. **On Children:** **Don't** use lice shampoo containing lindane on children.

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