

Mental Health and Environmental Exposures



from the Learning and Developmental Disabilities Initiative, November 2008

This fact sheet discusses the connections between environmental exposures to physical and chemical agents and mental health symptoms and conditions. While many of us recognize that environmental exposures to toxic substances can lead to disease, disability and other medical conditions, the connections to psychiatric conditions are not as well-known. However, there is a substantial amount of scientific evidence that certain exposures can lead to both temporary and long-term psychiatric symptoms and illness.

In this fact sheet, you'll find a summary of what is known about the connections between these substances and mental health symptoms, the most common sources of exposure, and ways that you might reduce or prevent these exposures.

Prevention	2
Metals	3
lead, mercury, aluminum, arsenic, manganese, thalium and tin	
Pesticides	7
Solvents	7
Toxic Gases	8
PBBs and PCBs	9
Other Chemicals and Compounds	10
alcohol and recreational drugs, tobacco, boron, carbon dioxide, vinyl chloride, endocrine disruptors and food additives	
Ionizing Radiation	11
Glossary	13

Mental health professionals often use a specific, technical vocabulary when describing symptoms. This fact sheet uses this vocabulary to be as accurate and precise as possible, even though some terms may not be familiar to our audience. You'll find many terms defined in the glossary.

Symptoms and Diagnoses

There is a difference between psychiatric symptoms and psychiatric diagnoses. Psychiatric symptoms may range from relatively minor symptoms such as changes in sleep patterns or appetite to severe symptoms such as hallucinations, memory loss or suicidal behavior. Diagnoses are medical designations performed by licensed professionals or trained researchers using validated instruments. A particular diagnosis can require the presence of a group of symptoms and may also take into account the duration of symptoms, absence of certain other symptoms, or the level of impairment. (See the Resources section on page 15 for more information.) This fact sheet provides information on how both diagnoses and symptoms are impacted by exposures to chemicals and substances in our environment.

Although developmental delays, mental retardation and learning disabilities are sometimes regarded as psychiatric disorders, this fact sheet does not discuss these conditions. Other materials from the Learning and Developmental Disabilities Initiative (LDDI), listed in the Resources section on page 15, focus on connections between environmental exposures and these conditions.

A list of all the psychiatric symptoms associated with environmental exposures discussed in this fact sheet is on page 16.

Symptoms Often Associated with Some Common Psychiatric Conditions

Mood Disorders

includes depressive and bipolar disorders

- depressed mood
- diminished interest or pleasure in all or almost all activities
- weight loss
- insomnia or hypersomnia
- fatigue

(Continued on page 2)

(Continued from page 1)

feelings of worthlessness
 excessive or inappropriate guilt
 diminished ability to think or concentrate
 recurrent thoughts of death
 suicidal ideation or suicide attempt
 persistently elevated, expansive, or irritable mood
 inflated self-esteem or grandiosity
 decreased need for sleep
 more talkative than usual
 flight of ideas, racing thoughts
 distractibility

Anxiety Disorders

includes panic, obsessive-compulsive and posttraumatic stress disorders

pounding heart, accelerated heart rate
 sweating
 trembling or shaking
 sensations of shortness of breath or smothering
 feeling of choking
 chest pain or discomfort
 nausea
 feel dizzy, unsteady, lightheaded, faint
 feelings of unreality or feel detached from oneself
 fear of losing control or going crazy
 fear of dying
 numbness or tingling sensations
 chills or hot flushes
 recurrent and persistent thoughts, impulses or images that cause anxiety or distress

repetitive behaviors or mental acts
 intense fear, helplessness, or horror
 recurrent and intrusive images, thoughts, distressing dreams, feeling as if a traumatic event is recurring

symptoms of increased arousal

- difficulty falling or staying asleep
- irritability or outbursts of anger
- difficulty concentrating
- hypervigilance
- exaggerated startle response

Attention-Deficit and Disruptive Behavior Disorders

includes attention-deficit/hyperactivity, conduct and oppositional defiant disorders

inattention
 hyperactivity
 impulsivity
 aggression to people and animals
 destruction of property
 deceitfulness or theft
 serious violation of rules
 negativistic, hostile and defiant behavior

Psychotic Disorders

includes schizophrenia and other psychotic disorders

delusions
 hallucinations
 disorganized speech
 grossly disorganized or catatonic behavior
 flat or inappropriate affect

Prevention

You can take actions to prevent environmental exposures to toxic substances that can contribute to psychiatric symptoms. Identifying and removing the exposure may improve the symptoms and the quality of life for the affected individuals and their families. Unfortunately, some effects of some exposures are irreversible, and so preventing the exposure in the first place is always the best route. The Resources section on page 15 lists organizations that have more information about preventing exposures.

Many of the tables in this document provide information about likely places of exposure to toxic substances, including at home, at school, in the

workplace, in food and water, and so on. Even our very neighborhoods may be toxic, with some research showing that residential proximity to industrial activity can have a negative impact on mental health.

Parents and other family members, teachers, coworkers and health-care providers are encouraged to look for physical cues related to mental health issues. However, individual vigilance can go only so far: prevention of many exposures requires society-level policy changes. We need to work as a society — through public policy, regulation and enforcement — to remove toxic substances from consumer products, buildings, workplaces, water, soil and air to prevent unwanted health outcomes.

Some of the toxic substances listed in this fact sheet are no longer used or may even have been banned. That does not mean that we are safe from them. Some of these substances remain in landfills, homes, schools, workplaces, soil and water, where we or our food may come into contact with them.

Occupational exposure is obviously a risk for workers, but it may put their families at risk as well. Pesticides, metal particles or dust, solvents and other substances are often taken home on clothing, shoes, equipment, tools, and even skin and hair. Careful removal of take-home exposures is especially important when children are involved, for they are often more sensitive to exposures than adults.

This fact sheet does not discuss the level of exposure that can lead to mental health symptoms, in part because much more research needs to be done to ascertain specific levels. There are also substantial differences in individual sensitivity — an exposure that may produce effects in one person may not cause any harm in another.

If you suspect that environmental exposures may be related to symptoms or conditions described in this fact sheet — in yourself or someone close to you — please look for a mental-health professional who is willing to investigate environmental causes with those affected and their families.

Metals

Exposure to any of several metals in our environment can be associated with psychiatric diagnoses and symptoms including dementia, depression, anxiety, confusion, memory loss, poor concentration, insomnia and more. The metals most commonly associated with these symptoms are lead, mercury and aluminum. Other metals that can cause symptoms include arsenic, manganese, thallium and tin.

Lead

Considerable evidence connects childhood lead exposure, including prenatal exposure, to diagnoses of conduct disorder, criminal behavior and attention deficit hyperactivity disorder (ADHD). Lead

exposure early in life has also been connected to Alzheimer’s disease many years later, and some evidence also associates lead with diagnoses of schizophrenia.

Symptoms	Sources of Exposure
academic problems or behavior changes aggression agitation anger antisocial behavior anxiety confusion decreased libido delinquent behavior delusions dementia depression hallucinations impulsivity insomnia irritability mania mood lability nervousness paranoia personality change poor concentration poor memory or memory loss suicidal ideation tension <i>In children, also:</i> antisocial crying distractibility hyperactivity impulsivity lack of attention	leaded paint on walls, furniture and toys drinking or cooking water that contacts lead solder in plumbing vinyl toys, lunchboxes, bibs, miniblinds and other objects soil contaminated by auto exhaust or downwind of a smelter some herbal and folk remedies some paints and pigments used in cosmetics or hair coloring some ceramics or candies, especially from outside the US homemade wine artist’s paint Occupational exposures: Exposure to lead is a risk in a wide variety of occupations involving ammunition, batteries, many metals, soldering, fertilizers, auto or boat repair, cement, ceramics, inks/printing, electronics, construction/demolition, jewelry, artificial flowers or leather, insecticides, paint, varnish, shellac, plastics, rubber, glass, or shoe production or repair.

The US Agency for Toxic Substances and Disease Registry (ATSDR) recommends that families with lead in their plumbing systems run or flush water that has been standing overnight before drinking or

cooking with it. Also, if your home was built before 1978, it probably contains lead-based paint. Lead from the paint is likely to contaminate house dust and will coat most surfaces and accumulate in carpets and upholstery. Some neighborhoods have soil contaminated with lead from industry or auto exhaust. LDDI recommends removing shoes before entering your home, washing children's hands and faces often to remove lead dusts and soil, and regularly cleaning the house of dust and tracked-in soil.

Mercury

Symptoms	Sources of Exposure
abusive language academic decline anhedonia anxiety/nervousness apathy crying depression excessive embarrassment excitability explosive speech fatigue hallucinations inability to take orders insomnia irritability loss of libido memory loss mood lability nightmares paranoia personality change phobic avoidance poor attention poor concentration shyness social withdrawal suicidal/homicidal timidity violence	fish or shellfish contaminated with methylmercury, especially shark, swordfish, king mackerel, tuna, sea bass, Gulf Coast oysters and others vapors in air from spills, incinerators or industries that burn mercury-containing fuels, including coal dental work and medical treatments some substances used in folk or religious rituals release of mercury from dental work and medical treatments latex paint made before 1990 Occupational exposures: contaminated workplace air or skin contact during use in dental services, health services, chemical and other industries that use mercury

Mercury poisoning has been connected in adults with erethism, a syndrome whose psychiatric symptoms include irritability, excitability, timidity and excessive embarrassment, depression and anxiety.

Fetuses, infants and children are more susceptible to mercury exposures than adults. Exposures that may cause no symptoms in a mother can cross the placenta and concentrate in her breast milk, injuring her child.

ATSDR recommends that you carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, as it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Check fish advisories in your area from your public health or natural resources department.

Aluminum

Symptoms	Sources of Exposure
agitation anxiety bizarre behavior confusion depression hallucinations homicidal insomnia memory loss mood lability paranoia personality change poor concentration suicidal violence	antacids, antidiarrheals and some buffered analgesics cosmetics water from aluminum containers, such as soda cans, water heaters and coffeepots antiperspirants dermatological pastes food additives some infant formulas intravenous or dialysis fluids some teas utensils and appliances Occupational exposures: manufacturing aircraft, autos, explosives, rubber, utensils or electrical equipment foundry work mining painting grinding petroleum refining welding waterworks

Aluminum in water has been correlated with dementing diseases, including dialysis dementia. While aluminum has been studied as a possible contributor to Alzheimer’s Disease, there is controversy regarding a connection. Recent research indicates that the connection may be real.

ATSDR states that very little aluminum enters your body from aluminum cooking utensils. However, exposure from eating substances containing high levels of aluminum (such as antacids) can be increased when eating or drinking citrus products at the same time. ATSDR encourages adults to avoid taking large quantities of aluminum-containing antacids and buffered aspirin and to take these medications as directed. Parents can make sure all medications have child-proof caps so children will not accidentally eat them.

Arsenic

Arsenic poisoning occurs infrequently in the United States but is more common in other countries. Psychiatric symptoms of arsenic poisoning may appear as major depressive or psychotic disorders (see the table on pages 1-2 for symptoms of these disorders).

The US Environmental Protection Agency has set the arsenic standard for drinking water at .010 parts per million (10 parts per billion) to protect consumers served by public water systems from the effects of long-term, chronic exposure to arsenic.

Symptoms Related to Arsenic Exposure	
agitation	poor memory and concentration
anxiety	psychosis
disordered thinking	singing
irritability	suicidal ideation
muttering	visual hallucinations
paranoia	
personality change	

If you use arsenic-treated wood in home projects, ATSDR recommends that you wear dust masks, gloves and protective clothing to decrease exposure to sawdust. If you live in an area with high levels of arsenic in water or soil, you should

use cleaner sources of water and limit contact with soil. The Learning and Developmental Disabilities Initiative (LDDI) also recommends that you paint exposed surfaces of CCA-treated wood, such as in picnic tables, decks or posts, and keep children from climbing or playing on exposed wood.

Sources of Arsenic Exposure
touching, breathing sawdust, or breathing smoke from wood treated with arsenic (CCA lumber)
adulteration of drug abuse substances
paints
some herbicides, pesticides and rodenticides
“moonshine” liquors
living near a smelter
seafood
ground water in areas where rocks are high in arsenic
skins of root vegetables grown in soil that contains arsenic
Occupational exposures:
manufacturing soap/detergent, artificial flowers or leather, enamel, rubber and insulators, jewelry, semiconductors, silicon microfilm, textiles, velvet or wax
bookbinding
making/using disinfectants, pigment/dye, fertilizer, fungicides, or insecticides
working with metals, including brass and bronze, soldering or welding
copper or lead smelting
glassblowing or etching
mining
sheep dipping
taxidermy

Tin

Sources of Tin Exposure
food stored in unlined tin cans
some seafood from contaminated coastal waters
some plastics, including polyurethane, plastic polymers and silicon-coated baking parchment paper
Occupational exposures:
working with organotin chemicals

Tin was used for a brief time in medical treatments before its toxic properties were discovered. Organotin poisoning is now rare and is mostly seen in industrial or laboratory settings among chemists, chemical engineers and other chemical workers.

Manganese is present in pesticides that may be used around the home, so try less toxic pest-control methods first. If you use toxic pesticides, follow the precautions on the package during use and keep children away from pesticides.

Symptoms Related to Tin Exposures	
aggression (physical and sexual) and rage	insomnia and other sleep disturbances
cognitive dysfunction	irritability
depression	loss of libido
disorientation	loss of motivation
fatigue/weakness	loss of vigilance
hyperactivity	memory loss
hyperphagia or anorexia	psychotic behavior
inappropriate affect	rapid cycles of depression and rage
indifference	

Sources of Manganese Exposure
natural manganese deposits can contaminate surrounding water and soil
pesticides such as maneb and mancozeb
Occupational exposures:
Most exposures occur in mining and manufacturing, but pesticide use is also a route of exposure.

Because tin is more resistant to corrosion than steel, some steel food cans are lined with tin. Tin concentrations in canned food increase if food is stored in opened cans, and so ATSDR recommends that you not store unused portions of food in their cans. Move the food to a separate container before storing.

Thallium
Thallium was used for several decades in the 20th century in medical treatments and in pesticides and was the source of hundreds of poisonings. Chronic or subacute poisonings are associated with prominent psychiatric symptoms.

Manganese

Symptoms	Sources of Exposure
anxiety	food or soil
confusion	contaminated with thallium
crying spells	cigarettes
delirium	hazardous waste sites containing thallium
dementia	Occupational exposures:
depression	manufacturing
diffuse electroencephalogram (EEG) abnormalities	electronic devices, switches and closures, primarily for the semiconductor industry
hysteria	
insomnia	
irritability	
Korsakoff's syndrome	
nervousness	
paranoia	
personality changes	
poor memory	
psychosis	
rage	
restlessness	
sleep-wake reversal	

Symptoms Related to Manganese Exposures
aggression
compulsive running or walking
depression (rare)
hallucinations
hypersexuality
hypersomnia or insomnia
irritability
mild euphoria
minor criminal acts
nervousness or anxiety
nightmares
paranoia
personality change
poor memory and concentration
silliness
social withdrawal
uncontrollable laughing and/or crying

Pesticides

Exposure to any of several different types of chemicals that are used to kill insects may cause psychiatric symptoms. Chlorinated hydrocarbon (CH) insecticides such as DDT have been banned in the United States and Europe due to health effects and their persistence in the environment — they do not easily break down. They are stored in fat cells and accumulate and concentrate in the food chain. Organophosphate (OP) insecticides are chemically related to nerve gas, which was developed for military uses. Carbamates function much like OP insecticides, but the neurologic impact is less irreversible and, therefore, the toxicity is less.

Methyl bromide, a colorless, odorless gas, is a broad-spectrum pesticide used to control insects, weeds, rodents and pathogens. Because it is considered an ozone-depleting substance, its use has been reduced but not eliminated in the United States.

Pesticide exposure is a risk for those who work in agriculture, landscaping or other settings in which pest problems are treated with chemicals. A 2008 study of farmers found that those with the highest number of lifetime exposure days to agricultural pesticides were 50% more likely to be diagnosed with clinical depression than those with the fewest application days and were 80% more likely if they had applied organophosphates.

Commonly used organophosphates have included parathion, malathion, methyl parathion, chlorpyrifos, diazinon, dichlorvos, phosmet, tetrachlorvinphos and azinphos methyl.

Drift from aerial spraying of pesticides can also expose those living, working or playing downwind from the spray, and both surface and groundwater can be contaminated from spray and runoff. While fruits and vegetables that are treated with pesticides during growth, storage and/or transportation have detectable levels of pesticide residues, there is some controversy whether these levels are high enough to cause health effects.

Pesticides and Symptoms

CH Insecticides

academic decline
agitation
anxiety
confusion
depression
fatigue
hallucinations
insomnia
irritability
loss of libido
memory loss
mood lability
nervousness
nightmares
personality change
poor appetite
somatic complaints

Methyl Bromide (Fumigant)

anxiety
apathy
confusion
decreased libido
delusions
depression
euphoria
hallucinations
homicidal/suicidal ideation
hypersomnia
impotence
insomnia
irritability
mania
melancholia
neurosis
paranoia
poor concentration
violence

OP Insecticides

academic decline
anxiety
apathy
change in libido
confusion
depression
dissociation
excessive dreaming
fatigue
giddiness
hallucinations
hyperactivity
insomnia
irritability
memory loss
mood lability
nightmares
paranoia
poor appetite
poor concentration
restlessness
somatic complaints
suicidal ideation

Carbamates

confusion
irritability
memory loss
mood lability

Solvents

Solvents are a range of chemicals that extract, dissolve or suspend insoluble materials such as fats

and polymers. Solvents include alcohols, ketones, ethers, esters, glycols, aldehydes, saturated and unsaturated aliphatic and aromatic hydrocarbons, halogenated hydrocarbons, carbon disulfide, and a variety of petroleum byproducts.

Solvents in the Home

Solvents can be found in many of these products:

- gasoline and other fuels
- automotive and mechanical grease and lubricants
- degreasing agents in cleaning products
- paints and wood stains and finishes
- paint stripper and thinner, including turpentine
- nail polish and polish remover
- rubbing alcohol
- glues and adhesives
- furniture and floor polishes and waxes
- spot removers
- metal and wood cleaners
- correction fluid
- computer disk cleaners
- dry-cleaning fluid

While exposure to solvents may come from occupational activities or result from environmental accidents, exposure may also be the result of solvent abuse, such as intentionally sniffing glues, aerosols or gasoline. Solvent abuse can result in depression, anxiety, irritability, mood swings, suicidal ideation, violence, behavior problems, personality changes, hallucinations, delusions and academic problems.

There is no question that high-dose exposure to solvents causes psychiatric symptoms. The effects of low-level, chronic exposures to solvents have not been definitively resolved. Most of the recent controlled studies on this question indicate that low-level exposures have a deleterious effect. One study found an increased incidence of schizophrenia in offspring of parents who were dry cleaners and therefore exposed regularly to tetrachloroethylene.

Symptoms Related to Solvent Exposures

Each type of solvent has its own set of symptoms, which may include any of these:

agitation	mania
anxiety	memory loss
bizarre behavior	mood lability
cataplexy	poor concentration
delusions	psychosis
depression	restlessness
irritability	suicidal or homicidal attempts
hallucinations	violence
hilarity/weeping	sexual problems
insomnia	sleep apnea or other sleep disturbances
lack of initiative	
lethargy	
loss of libido	

Toxic Gases

Carbon monoxide and hydrogen sulfide are two toxic gases, either of which may deprive the brain of oxygen. They both are capable of causing psychiatric symptoms.

Carbon Monoxide

Sources of Exposure to Carbon Monoxide

- burning charcoal, gas, oil or wood in a poorly ventilated area
- automobile exhaust, such as in a garage or in enclosed pickup truck beds
- tobacco smoke

Occupational exposures:

- baking and cooking
- fire fighting
- auto repair
- forklift operating
- foundry working
- mining
- welding
- working with formaldehyde, Linotype, paper or petroleum

Carbon monoxide is a colorless, odorless gas formed from incomplete combustion. Survivors of carbon monoxide poisoning can experience chronic and

progressive neurological and psychiatric deterioration.

Symptoms Related to Carbon Monoxide

agitation	impulsivity
amnesia	inappropriate laughter
anxiety	insomnia
apathy	irritability
astasia-abasia	Klüver-Bucy syndrome
confabulation	loss of concentration
crying	loss of libido
delirium	mania
delusions	memory loss
dementia	mood changes
depression	odd behavior
echolalia	paranoia
excitement	paraphilias
fatigue	poor hygiene
Gilles de la Tourette's syndrome	restlessness
hallucinations	shouting
hyperreligiosity	singing
	violence/homicide

LDDI highly recommends a carbon monoxide detector for homes or workplaces which have any fuel-burning appliances or devices. These may include furnaces, water heaters, fireplaces, gas stoves and ovens, kerosene heaters, grills or clothes dryers. If a house has an attached garage or is close to heavy traffic, LDDI also recommends a detector.

Hydrogen Sulfide

Hydrogen sulfide is also colorless, but it has the odor of rotten eggs. It occurs naturally in natural gas and is produced by decaying organic matter. Hydrogen sulfide poisoning remains a hazard in several occupations and environments.

Symptoms Related to Hydrogen Sulfide

amnesia	irritability
anxiety	mania
decreased libido	nervousness
delusions	nightmares
dementia	personality change
depression	poor concentration
fatigue	poor memory
hallucinations	somnolence
insomnia	violence

Sources of Exposure to Hydrogen Sulfide

living near contaminated air or water, especially from a landfill, hospital, wastewater treatment plant, sulfur spring, gas and oil drilling operation or farm with manure storage or livestock-confinement facilities

pesticides

natural gas

sulfur

Occupational exposures:

working with rayon textiles, propane, wood pulp or rubber

petroleum and natural gas drilling and refining

working with or near sewers or septic tanks, wastewater treatment, manure or landfills

mining or iron smelting

roofing

processing sugar beets

tanning leather

PBBs and PCBs

Polybrominated biphenyls (PBBs) and polychlorinated biphenyls (PCBs) were used in a variety of electrical and chemical applications including capacitors, transformers, machine oils, plastics, carbonless copy paper and sealants. In 1977, the US Environmental Protection Agency banned further production of PCBs and PBBs. However, PCB molecules do not easily break down, persisting in the environment. When transformers containing PCBs burn, the PCBs are released and pose a hazard, further contaminating soil and water as the chemicals settle.

Symptoms Related to PBBs and PCBs

PBBs and/or PCBs	PCBs Only
decreased libido	depression
fatigue	impotence
irritability	insomnia
nervousness	
poor concentration	
poor memory	
somatic complaints	
somnolence	

PCBs accumulate in animal fats and fatty tissues, including human tissues. Most environmental exposures involve “background” levels of PCBs in food. The main food sources of PCBs are fish (especially sport fish caught in contaminated lakes or rivers), meat and dairy products.

Fetuses and newborns are especially susceptible to the effects of PBBs and PCBs, as are adults who have liver disease or who use alcohol and drugs.

Other Chemicals and Compounds

Alcohol and recreational drugs. Problem drinking, drinking abuse, binge drinking and at-risk drinking are all behaviors that increase the risk of depressive symptoms, depression, anxiety, suicide, violence, neglect, dementia and antisocial behavior. Chronic alcoholism is associated with Korsakoff’s syndrome.

Drinking by pregnant women can lead to fetal alcohol syndrome (FAS) in the child. The effects of alcohol increase with maternal age, and binge drinking is more important than average intake. Several studies have shown an increased risk for cognitive disorders, psychiatric illness, or psychological dysfunction among individuals with FAS. According to the US Centers for Disease Control and Prevention, the most frequently diagnosed disorders are attention problems including ADHD, conduct disorder, alcohol or drug dependence, depression and psychotic episodes. Other psychiatric problems, such as anxiety disorders, depression, eating disorders and posttraumatic stress disorder, have also been reported for some patients. Alcohol exposure before birth has also been associated with delinquency in children 10-18 years old.

Use by a pregnant woman of marijuana appears to have long-term effects specifically on her child’s attentional skills.

The connections between substance abuse and psychiatric problems are well-documented. In addition to serious psychological distress (SPD) and major depressive episode (MDE), there are also many psychiatric symptoms associated with recreational drug use, such as hallucinations,

changes in appetite or sleep, compulsive behavior, irritability, paranoia, aggressiveness and violence. A detailed discussion of this topic is beyond the scope of this fact sheet.

Tobacco. Tobacco exposure, both before and after birth, has been associated with increased risk for conduct disorder in children eight to 15 years of age.

An outcome of tobacco use, nicotine withdrawal involves symptoms including irritability, anxiety, difficulty concentrating and increased appetite.

Boron. Boron is an element found in compounds that are used in glass, ceramics, detergents, bleaches, fire retardants, disinfectants, alloys, specialty metals, preservatives, pesticides and fertilizers. Boron hydrides have been used in rockets fuels, and poisoning from these has led to symptoms including euphoria, anxiety, depression, personality change, inappropriate behavior, agitation, restlessness, sleepwalking, memory loss, poor concentration, confusion, hallucinations, somnolence, derealization, insomnia and nightmares.

Carbon dioxide. Increased carbon dioxide levels seem to play a role in triggering panic attacks in some individuals.

Vinyl chloride. Vinyl chloride, the base for polyvinyl chloride (PVC) plastic, is used in a wide variety of products, such as building materials (vinyl siding, window profiles, flooring, plumbing pipes and fixtures), portable electronic devices, signs, toys, medical equipment (intravenous bags and other devices), shower curtains, car interiors and some textiles.

Exposure to vinyl chloride comes from breathing the gases that new products give off, breathing fumes when vinyl products are manufactured or burned, skin contact with products during manufacture, and drinking water from contaminated wells.

Psychiatric symptoms attributed to vinyl chloride poisoning include nervousness; euphoria; irritability; depression; singing, whistling and sardonic or careless laughter; memory loss; hallucinations; insomnia; somnolence; loss of libido; or fatigue.

Endocrine disruptors. Major endocrine-disrupting

chemicals (EDCs) include commercial chemicals such as bisphenol A (BPA), phthalates, nonylphenol, octylphenol, organotins, polychlorinated biphenyl (PCB), and other organohalogens, plus the naturally-occurring substances cadmium, genistein and other phytoestrogens.

BPA is a common ingredient of many plastic and resin products including food and drink containers, internal linings of food cans, and dental enamels. BPA has been found to leach from containers to food, especially when heated.

Phthalates are a group of chemicals commonly added to plastics (including vinyl), cosmetics, fragrances in many products, lubricants, wood finishes and medical devices. They are responsible for the “new car smell” that is most noticeable when a car has been sitting in sunshine.

Several lines of evidence suggest a possible role of endocrine disruption in the origin and development of schizophrenia. Research suggests that an estrogen mimic or other endocrine signal from some source in prenatal life could be reduced, delayed, increased, or premature, disrupting brain development so as to cause schizophrenia.

Food additives. Observed increases in irritability, restlessness, and sleep disturbance have been associated with the ingestion of tartrazine (yellow dye number 5) in some children. Combinations of some synthetic food colors and/or the preservative sodium benzoate have been associated with increased hyperactivity in children.

Ionizing Radiation

Exposure to ionizing radiation from atomic bombs, nuclear accidents or medical treatments can lead to a variety of psychiatric symptoms. Cranial radiation therapy can cause mild, acute reactions which can progress to a condition known as postirradiation syndrome. Symptoms include tingling, paresthesias, fever, irritability and somnolence.

Symptoms from exposures due to nuclear bombs or accidents are confounded with symptoms from trauma. Victims may exhibit typical stress symptoms

in addition to those directly from the radiation.

Psychiatric Symptoms Related to Therapeutic Radiation

radiation necrosis, which may include decreased appetite, weakness, depression, nightmares, paranoia, psychosis, mood lability, personality changes, cognitive decline and dementia

Psychiatric Symptoms Related to Nuclear Bombs or Accidents

acute stress symptoms
 posttraumatic stress symptoms
 personality disorders
 “radiation response syndrome,” including excessive anxiety over symptoms of exposure, fear of cancer, or subclinical stress symptoms

Children are especially vulnerable to the effects of ionizing radiation, exhibiting an increased risk for future psychoses, personality disorders and neuroses following exposure. Decreased cognitive and intellectual performance, mental retardation, fatigue and somnolence are also noted after childhood exposures.

Some professionals have begun to question the recent increased frequency of CT scans for medical diagnosis and treatment. While CT scans provide crucial information for certain types of injuries and conditions, their use is not always called for in place of x-rays, which produce much lower exposures to radiation. LDDI encourages you to verify the necessity of a CT scan over an x-ray if your physician orders one.

Sources for this Fact Sheet

The information in this fact sheet draws substantially from *Environmental and Chemical Toxins and Psychiatric Illness* by James S. Brown Jr., MD, published 2002 by American Psychiatric Publishing, Inc.

Other sources:

The website of the Agency for Toxic Substances and Disease Registry (ATSDR), a federal public

health agency of the US Department of Health and Human Services, <http://www.atsdr.cdc.gov/>

Practice Prevention columns from the Institute for Children's Environmental Health, <http://www.iceh.org/resources.html>

The website of the US Centers for Disease Control and Prevention, <http://www.cdc.gov/>

Wikipedia, <http://en.wikipedia.org>

Baker EL, Feldman RG, White RF, Harley JP. The role of occupational lead exposure in the genesis of psychiatric and behavioral disturbances. *Acta Psychiatrica Scandinavica Supplementum*. 1983;303:38-48.

Bazargan-Hejazi S, Bazargan M, Gaines T, Jemanez M. Alcohol misuse and report of recent depressive symptoms among ED patients. *The American Journal of Emergency Medicine*. 2008 Jun;26(5):537-44.

Beseler, CL, Stallones L, Hoppin JA, Alavanja MCR, Blair A, Keefe T, Kamel F. Depression and pesticide exposures among private pesticide applicators enrolled in the Agricultural Health Study. *Environmental Health Perspectives*. www.ehponline.org/members/2008/11091/11091.pdf, viewed 13 October 2008.

Braun JM, Froehlich TE, Daniels JL, Dietrich KN, Hornung R, Auinger P, Lanphear BP. Association of environmental toxicants and conduct disorder in U.S. children: NHANES 2001-2004. *Environmental Health Perspectives*. 2008 Jul;116(7):956-62.

Braun JM, Kahn RS, Froehlich T, Auinger P, Lanphear BP. Exposures to environmental toxicants and attention deficit hyperactivity disorder in U.S. children. *Environmental Health Perspectives*. 2006 Dec;114(12):1904-9.

Brown JS Jr. Effects of bisphenol-A and other endocrine disruptors compared with abnormalities of schizophrenia: an endocrine-disruption theory of schizophrenia. *Schizophrenia Bulletin*. 2008 Jan 31.

Colburn T, Dumanoski D, Myers, JP. About phthalates. *Our Stolen Future*. updated 6 November 2006.

<http://www.ourstolenfuture.org/NEWSSCIENCE/onco>

[mpounds/phthalates/phthalates.htm](http://www.ourstolenfuture.org/NEWSSCIENCE/onco), viewed 20 November 2008.

Department of Health and Human Services, Substance Abuse and Mental Health Services Administration (SAMHSA), Office of Applied Studies (OAS). *Results from the 2007 National Survey on Drug Use and Health: National Findings*, Chapter 8. <http://www.oas.samhsa.gov/NSDUH/2k7NSDUH/2k7results.cfm#Ch8>, viewed 31 October 2008.

Downey L, Van Willigen M. Environmental stressors: the mental health impacts of living near industrial activity. *Journal of Health and Social Behavior*. 2005 Sep;46(3):289-305.

Haig S. Avoiding unnecessary CT scans. *Time*. 2007 Dec 24. www.time.com/time/health/article/0,8599,1698163,00.html, viewed 13 October 2008.

McCann D, Barrett A, Cooper A, Crumpler D, Dalen L, Grimshaw K, Kitchin E, Lok K, Porteous L, Prince E, Sonuga-Barke E, Warner JO, Stevenson J. Food additives and hyperactive behaviour in 3-year-old and 8/9-year-old children in the community: a randomised, double-blinded, placebo-controlled trial. *Lancet*. 2007 Nov 3;370(9598):1560-7.

National Center for Chronic Disease Prevention and Health Promotion, Division of Adolescent and School Health. Healthy Youth! *Alcohol & Drug Use*. <http://www.cdc.gov/HealthyYouth/alcoholdrug/>, viewed 2 November 2008..

Needleman H, Riess J, Tobin M, Biesecker G, Greenhouse J. Bone lead levels and delinquent behavior. *Journal of the American Medical Association*. 1996 Feb 7;275(5):363-9..

Needleman HL, McFarland C, Ness RB, Fienberg SE, Tobin MJ. Bone lead levels in adjudicated delinquents. A case control study. *Neurotoxicology and Teratology*. 2002 Nov-Dec;24(6):711-7.

Opler MG, Brown AS, Graziano J, Desai M, Zheng W, Schaefer C, Factor-Litvak P, Susser ES. Prenatal lead exposure, delta-aminolevulinic acid, and schizophrenia. *Environmental Health Perspectives*. 2004 Apr;112(5):548-52.

Perrin MC, Opler MG, Harlap S, Harkavy-Friedman J, Kleinhaus K, Nahon D, Fennig S, Susser ES,

Malaspina D. Tetrachloroethylene exposure and risk of schizophrenia: offspring of dry cleaners in a population birth cohort, preliminary findings. *Schizophrenia Research*. 2007 Feb;90(1-3):251-4.

Powell, T. Chronic Neurobehavioural Effects of Mercury Poisoning on a Group of Zulu Chemical Workers. *Brain Injury*. 2000; 14(9):797-814.

Rassovsky Y, Kushner MG. Carbon dioxide in the study of panic disorder: issues of definition, methodology, and outcome. *Journal of Anxiety Disorders*. 2003;17(1):1-32.

Rowe KS, Rowe KJ. Synthetic food coloring and behavior: a dose response effect in a double-blind, placebo-controlled, repeated-measures study. *Journal of Pediatrics*. 1994 Nov;125(5 Pt 1):691-8.

Schonfeld AM, Mattson SN, Riley EP. Moral maturity and delinquency after prenatal alcohol exposure. *Journal of Studies on Alcohol*. 2005 Jul;66(4):545-54.

Stein J, Schettler T, Rohrer B, Valenti M. *Environmental Threats to Healthy Aging*. Greater Boston Physicians for Social Responsibility and Science and Environmental Health Network. 2008.

US Centers for Disease Control and Prevention. Methamphetamine Use and Risk for HIV/AIDS. <http://www.cdc.gov/hiv/resources/factsheets/PDF/meth.pdf>, viewed 2 November 2008.

US Centers for Disease Control and Prevention. Smoking & Tobacco Use Fact Sheet: Cessation. http://www.cdc.gov/tobacco/data_statistics/fact_sheets/cessation/cessation2.htm, viewed 2 November 2008.

Williams JH, Ross L. Consequences of prenatal toxin exposure for mental health in children and adolescents: a systematic review. *European Child & Adolescent Psychiatry*. 2007 Jun;16(4):243-53.

Wright JP, Dietrich KN, Ris MD, Hornung RW, Wessel SD, Lanphear BP, Ho M, Rae MN. Association of prenatal and childhood blood lead concentrations with criminal arrests in early adulthood. *PLoS Medicine*. 2008 May 27;5(5):e101.

Glossary

affect: feeling or emotion

amnesia: partial or total loss of memory

anhedonia: lack of pleasure

anorexia: loss of appetite

anxiety: distress caused by fear of danger or misfortune

apathy: lack of interest or concern; lack of emotion or feeling

astasia-abasia: the inability to stand or walk normally as a symptom of conversion hysteria

ataxia: a gross lack of coordination of muscle movements

cataplexy: a condition characterized by lack of response to external stimuli and by muscular rigidity

conduct disorder: a behavior disorder of childhood or adolescence characterized by a pattern of conduct in which either the basic rights of others or the societal norms or rules appropriate for a certain age are violated

confabulation: creating false memories

conversion hysteria: a mental disorder in which physical symptoms, as paralysis or blindness, occur without apparent physical cause and instead appear to result from psychological conflict or need

delinquent behavior: failing to do what law or duty requires

delirium: a state of mental confusion and fluctuating consciousness characterized by anxiety, disorientation, hallucinations, delusions and incoherent speech

delusions: a false belief strongly held in spite of invalidating evidence

depression: a condition of general emotional dejection and withdrawal

derealization: the feeling that things in one's surroundings are strange, unreal or somehow altered, as seen in schizophrenia

disordered thinking: a failure to be able to “think straight”; thoughts may come and go rapidly

disorientation: mental confusion or impaired awareness, especially regarding place, time or personal identity

dissociation: a psychological defense mechanism in which specific, anxiety-provoking thoughts, emotions or physical sensations are separated from the rest of the psyche

echolalia: the uncontrollable and immediate repetition of words spoken by another person

erethism: an unusual or excessive degree of irritability or stimulation in an organ or tissue

euphoria: a feeling of great happiness or well-being

Gilles de la Tourette’s syndrome (or just Tourette syndrome): a nervous system disorder which causes a person to make repeated and involuntary movements and sounds (vocalizations) called tics

hallucination: a perception of sensory (visual, auditory, tactile, olfactory or gustatory) experiences without an external stimulus and with a compelling sense of their reality

hyperphagia: abnormally increased appetite for and consumption of food

hyperreligiosity: a condition in which the outward forms and other aspects of religion become life disabling; an ill-fitting grasp of the role of religion and God in one’s life; a disability that can lead to isolation from others because one thinks God is vengeful and punishing

hypersexuality: excessively interested or involved in sexual activity

hypersomnia: a condition in which one sleeps for an excessively long time but is normal in the waking intervals

hypervigilance: condition of maintaining an abnormal awareness of environmental stimuli

hysteria: an uncontrollable outburst of emotion or fear, often characterized by irrationality, laughter, weeping, etc.

insomnia: chronic inability to fall asleep or remain

asleep for an adequate length of time

Klüver-Bucy syndrome: a rare behavioral impairment that causes individuals to put objects in their mouths and engage in inappropriate sexual behavior

Korsakoff’s syndrome: a brain disorder caused by the lack of thiamine (vitamin B1) in the brain, often due to chronic alcoholism or malnutrition; the syndrome is marked by amnesia, confabulation, apathy, tremors, ataxia, paralysis of muscles controlling the eye, lack of insight to the condition and coma

lethargy: a state of sluggishness, inactivity, and apathy

libido: sexual instinct or sexual drive

major depressive episode: a period of at least two weeks when a person experienced a depressed mood or loss of interest or pleasure in daily activities and had at least four of the seven additional symptoms reflecting the criteria for major depressive disorder

mania: a condition characterized by profuse and rapidly changing ideas; exaggerated sexuality, gaiety or irritability; and decreased sleep

menalcholia: a mental disorder characterized by severe depression, guilt, hopelessness and withdrawal

mood lability: changing moods

necrosis: death of cells or tissues through injury or disease, especially in a localized area of the body

neurosis: a relatively mild personality disorder typified by excessive anxiety or indecision and a degree of social or interpersonal maladjustment

paranoia: extreme, irrational distrust of others

paraphilias: any of a group of psychosexual disorders characterized by sexual fantasies, feelings or activities involving a nonhuman object, a nonconsenting partner such as a child, or pain or humiliation of oneself or one’s partner

paresthesias: a skin sensation, such as burning, prickling, itching or tingling, with no apparent physical cause

phobic avoidance: a condition in which individuals avoid entering specific fear-provoking situations

psychosis: a severe mental disorder characterized by derangement of personality and loss of contact with reality

schizophrenia: any of a group of psychotic disorders usually characterized by withdrawal from reality, illogical patterns of thinking, delusions and hallucinations, and accompanied in varying degrees by other emotional, behavioral or intellectual disturbances

serious psychological distress: an overall indicator of past year psychological distress

sleep apnea: a temporary suspension of breathing occurring repeatedly during sleep

sleep-wake reversal: a condition in which sleep patterns have been disrupted; people fall asleep at inappropriate times and then cannot sleep when they should

somatic complaints: of the body; physical

somnolence: sleepiness; drowsiness

subacute: less than acute; between acute and chronic

subclinical: having no noticeable clinical symptoms

suicidal ideation: thinking about suicide

tension: a state of mental or emotional strain or suspense

Resources

For more information about psychiatric symptoms and disorders:

<http://www.mentalhealth.com/>

Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision,
<http://www.behavenet.com/capsules/disorders/dsmivtrcodes.htm>

<http://www.mentalhelp.net/>

New York Online Access to Health,
<http://www.noah-health.org/en/mental/>

The Psychiatric Review of Symptoms: A Screening

Tool for Family Physicians,
<http://www.aafp.org/afp/981101ap/carlat.html>

For more information about the connection between environmental exposures and psychiatric symptoms:

National Association for the Dually Diagnosed Environmental Health Project,
<http://www.envhealthproject.org/>

Environmental and Chemical Toxins and Psychiatric Illness by James S. Brown Jr., MD, published 2002 by American Psychiatric Publishing, Inc.

Clinical Environmental Health and Toxic Exposures by John Burke Sullivan and Gary R. Krieger, published 2001 by Lippincott Williams & Wilkins

A Small Dose of Toxicology by Steven G. Gilbert, published 2004 by CRC Press (covers all health effects, including psychiatric)

For more information about reducing or preventing environmental exposures:

Practice Prevention columns and fact sheets from the the Learning and Developmental Disabilities Initiative and the Institute for Children's Environmental Health,
<http://www.iceh.org/resources.html>

Alternatives to pesticides from Beyond Pesticides,
<http://www.beyondpesticides.org/alternatives/factsheets/index.htm>

CHE Toxicant and Disease Database,
<http://database.healthandenvironment.org/>

Environmental Working Group, <http://www.ewg.org/>

US Environmental Protection Agency Office of Children's Health Protection,
<http://yosemite.epa.gov/ochp/ochpweb.nsf/content/homepage.htm>

Healthy Child, Healthy World,
<http://www.healthychild.org/>

Database of environmental health resources from the Institute for Children's Environmental Health,
<http://www.iceh.org/cgi-bin/searchresources.cgi>

Environmental Working Groups's Fish List,
<http://www.ewg.org/safefishlist>

Environmental Exposures and Psychiatric Symptoms

Mental health symptoms associated with environmental exposures, grouped by type:

Mood	Cognitive	Behavior	Perceptual
anger anhedonia anxiety apathy depression euphoria excitability giddiness inappropriate affect mania melancholia mood lability mood swings nervousness neurosis silliness	academic decline or problems amnesia cognitive dysfunction confabulation confusion delirium dementia disorientation dissociation distractibility Korsakoff's syndrome lack of attention or poor attention loss of vigilance memory loss poor concentration poor memory suicidal ideation	abusive language aggression agitation antisocial behavior changes bizarre or odd behavior compulsive running or walking crying delinquent behavior excessive embarrassment excitement explosive speech hilarity homicidal hyperactivity hyperreligiosity hysteria impulsivity inability to take orders indifference irritability lack of initiative laughing (inappropriately) loss of motivation minor criminal acts muttering personality change phobic avoidance poor hygiene	delusions disordered thinking hallucinations paranoia psychosis rage restlessness shouting shyness singing sleepwalking social withdrawal suicidal tension timidity violence weeping whistling
Other anorexia or decreased appetite astasia-abasia catalepsy derealization diffuse electroencephalogram abnormalities echolalia excessive dreaming fatigue Gilles de la Tourette's syndrome hyperphagia hypersexuality hypersomnia	impotence insomnia Klüver-Bucy syndrome learning problems lethargy loss of libido nightmares panic attack paraphilias poor appetite sexual problems sleep apnea somatic complaints somnolence weakness		



For more information or for other Practice Prevention columns, visit the Institute for Children's Environmental Health (ICEH) online at www.iceh.org/resources.html or call 360-331-7904.

ICEH serves as the national coordinator for the Collaborative on Health and the Environment's Learning and Developmental Disabilities Initiative.

