



Toxic Environmental Test

Physician:
Patient:
Accession #: 800604

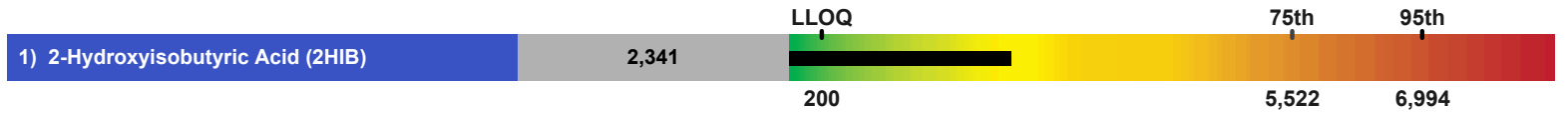
Sex:
Age:

Collected:
Received:
Print Date: 7/22/2015

Toxic Compounds

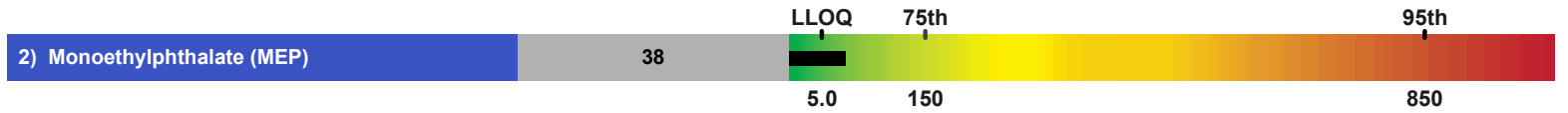
Table with 3 columns: Metabolite, Result mg/g creatinine, Percentile

Industrial Toxicants



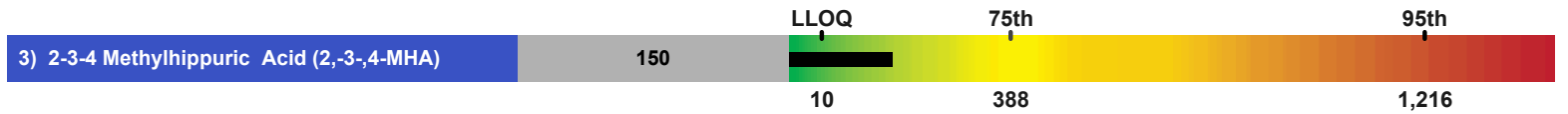
Parent: MTBE/ETBE

MTBE and ETBE are gasoline additives used to improve octane ratings. Exposure to these compounds is most likely due to groundwater contamination, and inhalation or skin exposure to gasoline or its vapors and exhaust fumes.



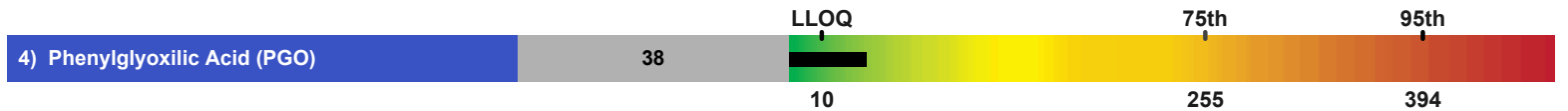
Parent: Diethylphthalates

Phthalates may be the most widespread group of toxins in our environment, commonly found in many bath and beauty products, cosmetics, perfumes, oral pharmaceuticals, insect repellants, adhesives, inks, and varnishes.



Parent: Xylene

Xylenes (dimethylbenzenes) are found not only in common products such as paints, lacquers, pesticides, cleaning fluids, fuel and exhaust fumes, but also in perfumes and insect repellents.



Parent: Styrene/Ethylbenzene

Styrene is used in the manufacturing of plastics, in building materials, and is found in car exhaust fumes. Polystyrene and its copolymers are widely used as food-packaging materials.

\*LLOQ - Lower Limit of Quantitation

Testing performed by The Great Plains Laboratory, Inc., Lenexa, Kansas. The Great Plains Laboratory has developed and determined the performance characteristics of this test. This test has not been evaluated by the U.S. FDA; the FDA does not currently regulate such testing.

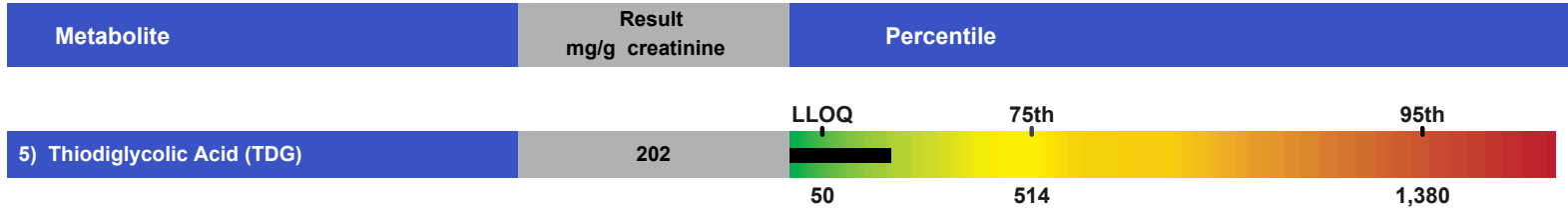
# The Great Plains Laboratory, Inc.

Physician:  
Patient:  
Accession #: 800604

Sex:  
Age:

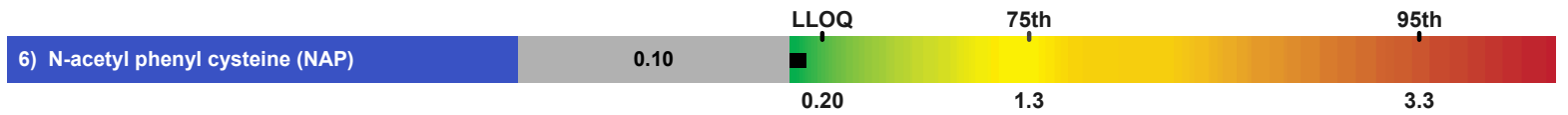
Collected:  
Received:  
Print Date: 7/22/2015

## Toxic Compounds



**Parent: Vinyl Chloride**

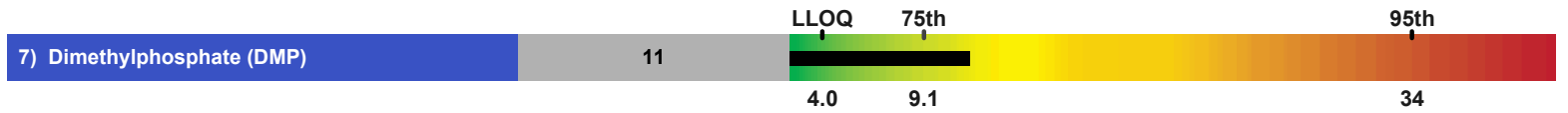
Vinyl chloride is an intermediate in the synthesis of several commercial chemicals, including polyvinyl chloride (PVC). Exposure to vinyl chloride may cause central nervous system depression, nausea, headache, dizziness, liver damage, degenerative bone changes, thrombocytopenia, enlargement of the spleen, and death. Elevated urinary values of TDG, the vinyl chloride metabolite, may also be found after ingestion of large amounts of fresh onion, or after vitamin B12 administration, due to stimulation of sulfur amino acid metabolism.



**Parent: Benzene**

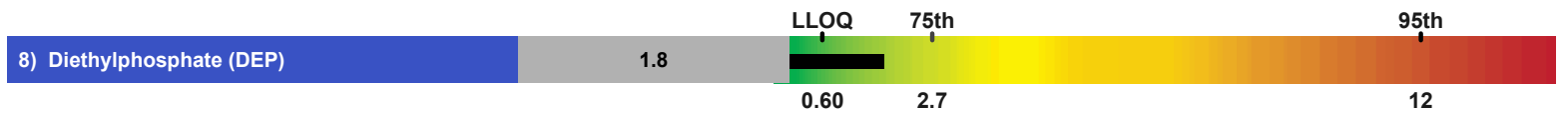
Benzene is an organic solvent that is widespread in the environment. Benzene is a by-product of all types of industrial processes and combustion, including motor vehicle exhaust and cigarette smoke, and is released by outgassing from synthetic materials. Benzene is an extremely toxic chemical that is mutagenic and carcinogenic. High exposures to benzene cause symptoms of nausea, vomiting, dizziness, lack of coordination, central nervous system depression, and death. It can also cause hematological abnormalities.

## Organophosphate Insecticide Metabolites



**Parent: Organophosphates**

Organophosphates are one of the most toxic groups of substances in the world, primarily in found in pesticide formulations. They are inhibitors of cholinesterase enzymes, leading to overstimulation of nerve cells, causing sweating, salivation, diarrhea, abnormal behavior, including aggression and depression. Children exposed to organophosphates have more than twice the risk of developing pervasive developmental disorder (PDD), an autism spectrum disorder. Maternal organophosphate exposure has been associated with various adverse outcomes including having shorter pregnancies and children with impaired reflexes.



**Parent: Organophosphates**

Organophosphates are one of the most toxic groups of substances in the world, primarily in found in pesticide formulations. They are inhibitors of cholinesterase enzymes, leading to overstimulation of nerve cells, causing sweating, salivation, diarrhea, abnormal behavior, including aggression and depression. Children exposed to organophosphates have more than twice the risk of developing pervasive developmental disorder (PDD), an autism spectrum disorder. Maternal organophosphate exposure has been associated with various adverse outcomes including having shorter pregnancies and children with impaired reflexes.



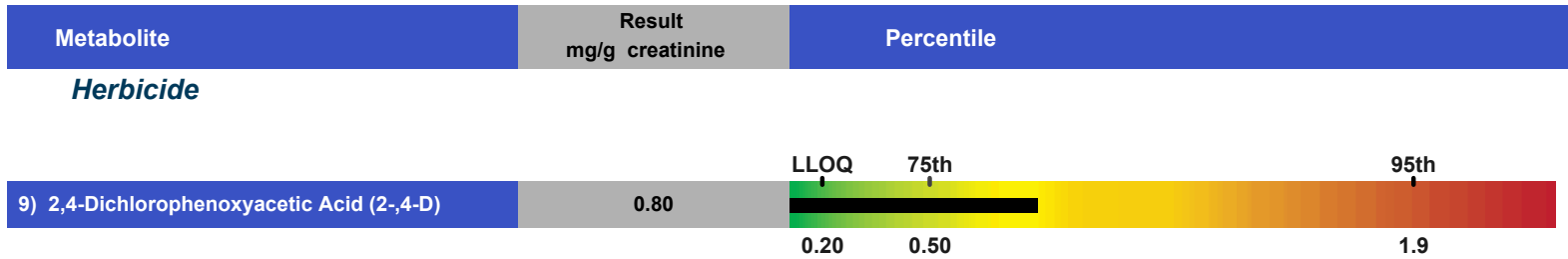
# The Great Plains Laboratory, Inc.

Physician:  
Patient:  
Accession #: 800604

Sex:  
Age:

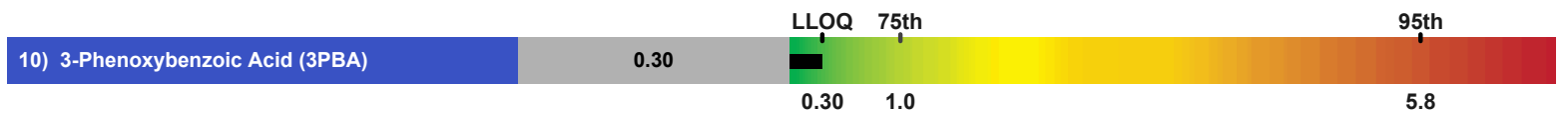
Collected:  
Received:  
Print Date: 7/22/2015

## Toxic Compounds



2,4-Dichlorophenoxyacetic Acid (2,4-D) is a very common herbicide that was a part of Agent Orange, which was used by the U.S. in the Vietnam War. It is most commonly used in agriculture on genetically modified foods, and as a weed killer for lawns. Exposure to 2, 4-D via skin or oral ingestion is associated with neuritis, weakness, nausea, abdominal pain, headache, dizziness, peripheral neuropathy, stupor, seizures, brain damage, and impaired reflexes. 2, 4-D is a known endocrine disruptor, and can block hormone distribution and cause glandular breakdown.

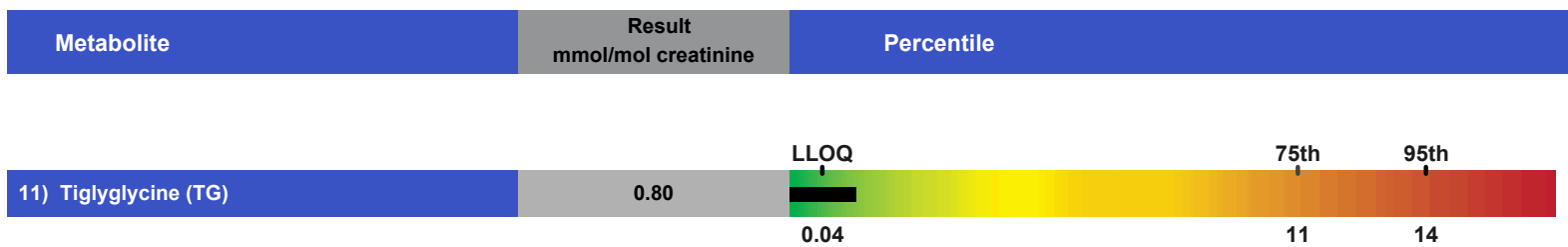
## Pyrethroid Insecticide



**Parent: Pyrethroids - Including Permethrin, Cypermethrin, Cyhalothrins, Fenpropathrin, Deltamethrin, Trihalomethrin**

Pyrethrins are widely used as insecticides. Exposure during pregnancy doubles the likelihood of autism. Pyrethrins may affect neurological development, disrupt hormones, induce cancer, and suppress the immune system.

## Marker for Mitochondria Function



Tiglyglycine (TG) is a marker for mitochondrial disorders resulting from mutations of mitochondrial DNA, which can manifest from exposure to toxic chemicals, infections, inflammation, and nutritional deficiencies. TG indicates mitochondrial dysfunction by monitoring a metabolite that is elevated in mitochondrial deficiency of cofactors such as NAD<sup>+</sup>, flavin-containing coenzymes, and Coenzyme Q10. Disorders associated with mitochondrial dysfunction include autism, Parkinson's disease, and cancer.



# The Great Plains Laboratory, Inc.

Physician:  
Patient:  
Accession #: 800604

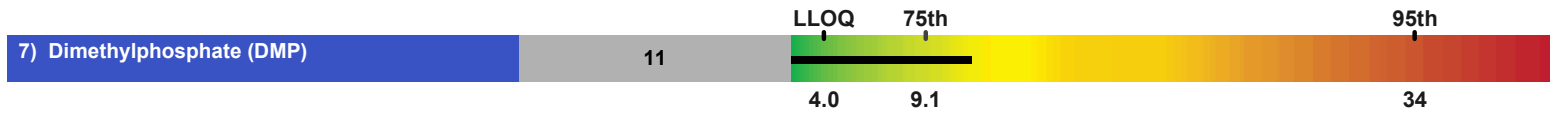
Sex:  
Age:

Collected:  
Received:  
Print Date: 7/22/2015

## Toxic Compounds

Metabolite	Result mg/g creatinine	Percentile
------------	---------------------------	------------

### Organophosphate Insecticide Metabolites



- |                                |                                  |                     |
|--------------------------------|----------------------------------|---------------------|
| -Amidithion                    | -Fenthion                        | -Phosnichlor        |
| -Anilofos                      | -Fenthion oxon                   | -Phosphamidon       |
| -Azamethiphos                  | -Formothion                      | -Phoxim-methyl      |
| -Azinphos                      | -Fosmethilan                     | -Pirimiphos-methyl  |
| -Azinphos-methyl               | -Fospirate                       | -Quinalphos-methyl  |
| -Azinphos-methyl oxygen analog | -Heptenophos                     | -Ronnel             |
| -Azothoate                     | -Iodofenfos                      | -Sophamide          |
| -Bomyl                         | -Isazophos-methyl                | -Temephos           |
| -Bromophos                     | -Isochlorthion                   | -Temephos sulfoxide |
| -Chlorpyrifos-methyl           | -Isothioate                      | -Tetrachlorvinphos  |
| -Chlorthion                    | -Lythidathion                    | -Thiometon          |
| -cis-Azodrin                   | -Malaoxon                        | -Tolclofos-methyl   |
| -cis-Methocrotophos            | -Malathion                       | -Vamidothion        |
| -Crotoxyphos                   | -Menazon                         |                     |
| -Cyanophos                     | -Methacrifos                     |                     |
| -Cythioate                     | -Methidathion OA                 |                     |
| -DDVP                          | -Methyl paraoxon                 |                     |
| -Demephion-O                   | -Methyl phenkapton               |                     |
| -Demephion-S                   | -Methyl trithion                 |                     |
| -Demeton-O-methyl              | -Mevinphos                       |                     |
| -Demeton-S-methyl              | -(E)-Mevinphos                   |                     |
| -Dicrotophos                   | -(Z)-Mevinphos                   |                     |
| -Dimethoate                    | -Monocrotophos                   |                     |
| -Dimethoate-ethyl              | -Morphothion                     |                     |
| -DMCP                          | -Naled                           |                     |
| -Endothion                     | -OOS-Trimethyl phosphorodithiate |                     |
| -Etrimfos                      | -Omethoate                       |                     |
| -Famphur                       | -Oxydemeton-methyl               |                     |
| -Famphur O-analog              | -Phenthoate                      |                     |
| -Fenitrothion                  | -Phosmet                         |                     |
|                                | -Phosmetoxon                     |                     |



# The Great Plains Laboratory, Inc.

Physician:  
Patient:  
Accession #: 800604

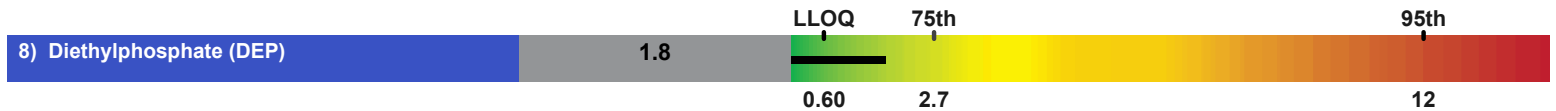
Sex:  
Age:

Collected:  
Received:  
Print Date: 7/22/2015

## Toxic Compounds

Metabolite	Result mg/g creatinine	Percentile
------------	---------------------------	------------

### Organophosphate Insecticide Metabolites



-Acethion	-5-Dichloro-alpha-(chloro-methylene) benzyl diethyl pho	-Phorate
-Acetoxon	-Diethyldithio phosphate	-Phosalone
-Akton	-Diethylthio phosphate	-Phoxim
-Amiton	-Dioxathion	-Pirimiphos ethyl
-Amiton oxalate	-Disulfoton	-Primidophos
-Athidathion	-Disulfoton sulfone	-Propoxon
-Azethion	-Disulfoton sulfoxide	-Prothidathion
-Azinphos-ethyl	-Ethion	-Prothion
-Bromophos-ethyl	-Ethion O-analog	-Prothoate
-Butathiofos	-Fensulfothion	-Pyrazophos
-Carbophenothion	-Isazophos	-Pyrazophos
-Chlorethoxyphos	-Isoxathion	-Pyridiphenthion
-Chlorfenvinphos	-Mecarbam	-Quinalphos
-Chlorphoxim	-Miral	-Quinothion
-Chlorprazophos	-Miral	-Sulfotep
-Chlorpyrifos	-Naphthalophos	-TEPP
-Chlorpyrifos oxygen analog	-OO-diethyl O-naphthaloximido phosphorothioate	-Terbufos
-Chlorthiophos	-OO-diethyl O-naphthaloximido phosphorothioate	-Terbufos sulfone
-Chlorthiophos II	-OO-diethyl phosphoro chloridothionate	-Terbufos sulfoxide
-Chlorthiophos III	-OO-Diethyl S-(46-dimethyl-2-pyrimidinyl) phosphorodith	-Thionazin
-Coumaphos	-OO-diethyl-O-phenyl phosphoro thioate	-Thionazin O-analog
-Coumithioate	-Paraoxon	-Triazophos
-Cyanthoate	-Parathion	
-Demeton	-Phenkapton	
-Demeton-O	-Phorate	
-Demeton-S		
-Dialifor		
-Diazinon		
-Diazoxon		
-Dichlofenthion		





Physician:  
Patient:  
Accession #: 800604

Sex:  
Age:

Collected:  
Received:  
Print Date: 7/22/2015

## Interpretation

**2-hydroxyisobutyric acid (2HIB) (Marker 1)** is most often the result of exposure to methyl tertiary-butyl ether (MTBE) or ethyl tertiary butyl ether (ETBE), which are gasoline additives used as octane enhancers. MTBE has been found to pollute large quantities of groundwater when gasoline with MTBE is spilled or leaked at gas stations. In addition, MTBE and ETBE are volatile and may be inhaled or absorbed through the skin by drivers during fueling or from exhaust exposure. MTBE and its metabolites have been shown to be to cause hepatic, kidney and central nervous system toxicity, peripheral neurotoxicity, and cancer in animals. Excretion half-lives in humans range from 10 to 28 hours. MTBE and ETBE are also formed endogenously as a product of branched-chain amino acid degradation and ketogenesis. High values have been reported in both isovaleric acidemia and multiple acyldehydrogenase deficiency. Reduce exposure if possible. Elimination is accelerated by sauna therapy, by the Hubbard detoxification protocol employing niacin supplementation to aid in MTBE and ETBE excretion, or by treatment with glutathione (reduced) supplementation (oral, intravenous, transdermal, or precursors such as N-acetyl cysteine [NAC]).

**Monoethylphthalate (MEP) (Marker 2)** is the result of exposure to phthalates and the major metabolite of diethyl phthalate. Diethyl phthalate makes plastics more flexible and appears in many common household products including food packaging, tools, toothbrushes, toys, aftershave lotions, aspirin, bath products, cosmetics, detergents, eye shadows, hairsprays, insecticides, mosquito repellants, nail extenders, nail polish, nail polish removers, skin care products, hairstyling products, and auto parts. Adults and children are exposed to phthalates through everyday contact with these products as well as contact with indoor air and dust. When mouthed, chewed or sucked in the course of normal play, phthalates leach from toys into children's' mouths. Phthalates have been linked to premature birth, reproductive defects, and early onset puberty. Phthalates have been linked to cancer, autoimmunity, and organ damage in laboratory tests on rodents. Children's' allergies have been linked to phthalate exposure. Phthalate exposure in pregnant women changed the anogenital distance in neonatal boys; a change that in rodents exposed to phthalates was associated with genital abnormalities. Use of infant lotion, infant powder, and infant shampoo were associated with increased infant urine concentrations of phthalate metabolites. Individuals with high values, especially women who want to have children or children who have been exposed, may wish to dramatically reduce their exposures to these substances. Virtually all phthalates may cause quinolinic acid elevation because of interference with tryptophan metabolism. Seven European countries have outlawed two major types of the compounds in cosmetics and baby toys. Elimination of MEP, diethyl phthalate, and all phthalates can be accelerated by sauna treatment, by the Hubbard detoxification protocol employing niacin supplementation, or by glutathione (reduced) supplementation (oral, intravenous, transdermal, or precursors such as N-acetyl cysteine [NAC]).

**Methylhippuric acid (2,-3,4-MHA) (Marker3)** is the result of exposure to the solvent xylene that is widespread in the environment. Xylene is found in paints, lacquers, cleaning agents, pesticides, and gasoline. It is also used in the pathology laboratory for tissue processing. High exposure to xylene may cause nausea, vomiting, dizziness, incoordination, central nervous system depression, and even death. An exposure to 100 ppm xylene in the air resulted in a urine value of 1840 mmol/mol creatinine for methylhippuric acid. Rats given xylene experienced a significant decrease in locomotor activity, deficits in learning ability and memory loss. These xylene-induced behavioral changes were associated with a decrease in beta-endorphins. Treatment begins with removing all potential sources of exposure. Elimination of xylene can be accelerated by sauna treatment, the Hubbard detoxification protocol employing niacin supplementation, supplementation with glycine to encourage metabolism of xylene to methylhippuric acid in the liver, or by glutathione (reduced) supplementation (oral, intravenous, transdermal, or precursors such as N-acetyl cysteine [NAC]).

**Phenylglyoxylic acid (PGO) (Marker 4)** usually results from exposure to styrene. Reduce exposure by eliminating plastic and styrofoam containers for cooking, reheating, eating or drinking (especially warm or hot) food or beverages. Replace these containers with glass, paper, or stainless steel whenever possible. Elimination of styrene can be accelerated by sauna treatment, reduced glutathione supplementation (oral, intravenous, transdermal, precursors such as N-acetyl cysteine [NAC]). Elimination of styrofoam products is recommended, especially with hot foods.



# The Great Plains Laboratory, Inc.

Physician:  
Patient:  
Accession #: 800604

Sex:  
Age:

Collected:  
Received:  
Print Date: 7/22/2015

**Thiodiglycolic acid (TDGA) (Marker 5)** is mainly due to exposure to vinyl chloride, an intermediate in the synthesis of several major commercial chemicals, including polyvinyl chloride, and used in the past as an aerosol propellant. Exposure to vinyl chloride has been associated with increased incidence of autism. High concentrations of vinyl chloride may cause central nervous system depression, nausea, headache, dizziness, liver damage and liver cancer, degenerative bone changes, thrombocytopenia, enlargement of the spleen and even death. Urinary TDGA acid values in unexposed individuals average 0.4 - 0.5 mmol/mol creatinine and up to 3 mmol/mol creatinine in exposed workers. This compound is also a metabolite of acrylonitrile, S-carboxymethyl-L-cysteine (CMC) (an orally administered mucolytic agent), the anticancer drug ifosfamide, and exposure to vapors of ethylene oxide, vinylidene chloride, 1,2-dichloroethane, 1,2-dibromoethane, and chloro-alkyl ethers. Vinyl chloride is contained in plastic bottles with the recycling code "3" and in many plastic cling wraps.

Elevated values of TDGA have been found to result from ingestion of large amounts of fresh onion. Increased urinary TDGA was also found after a subject had drunk certain alcoholic beverages or had undergone treatment for pollen allergy with cetirizine. In addition, increased TDGA is excreted after vitamin B12 administration due to stimulation of sulfur amino acid metabolism. To reduce exposure, eliminate use of plastic containers for cooking, reheating, eating or drinking (especially warm or hot) food or beverages. Replace these containers with glass, paper, or stainless steel whenever possible. Elimination of vinyl chloride can also be accelerated by sauna treatment, the Hubbard detoxification protocol employing niacin supplementation, vitamin B-12 therapy, by glutathione (reduced) supplementation (oral, intravenous, transdermal, or precursors such as N-acetyl cysteine [NAC]).

**N-acetyl phenyl cysteine (NAP) (Marker 6)** is the result of exposure to the solvent benzene which is widespread in the environment from cigarette smoke, gasoline, and as a byproduct of all types of combustion, including motor vehicle exhaust. Benzene also outgases from synthetic materials (carpet, drapes, and furniture), glues, and detergents. Numerous industrial processes release this pollutant. Benzene causes hematological abnormalities as well as being mutagenic and carcinogenic. High exposure to benzene may cause nausea, vomiting, dizziness, poor coordination, central nervous system depression, and even death. N-acetyl phenyl cysteine (NAP) is also a metabolic byproduct of potassium sorbate or sorbic acid, a common and safe food preservative. Remove sources of exposure if possible. The solvent can be eliminated by sauna treatment, by the Hubbard detoxification protocol employing niacin supplementation, or by glutathione (reduced) supplementation (oral, intravenous, transdermal, or precursors such as N-acetyl cysteine [NAC]).

**Dimethylphosphate (DMP) (Marker 7)** indicates exposure to an organophosphate insecticide. Approximately 340 million kilograms of pesticide active ingredient is used agriculturally in the United States annually, and 85% of U.S. households store at least one pesticide for home use. These insecticides kill insects (and mammals such as humans) by the inhibition of the enzyme acetyl-cholinesterase and other enzymes in which serine is part of the active site, such as dipeptidyl peptidase IV. When acetylcholine breakdown is inhibited, overstimulation can lead to constant nerve transmission or overstimulation of neurons or muscles, resulting in excessive salivation, abnormal behavior, diarrhea, urinary incontinence, vomiting, tremors, muscle paralysis, and even death. High exposure levels have been associated with attention deficit, memory impairment and pervasive developmental disorders. Exposure has also been linked to violent behavior, depression, suicide and may have played a role in the onset of Gulf War syndrome. If levels are high, toxicity can be measured by decreased cholinesterase or pseudocholinesterase activity in plasma. Acute toxicity is treated with atropine and/or pralidoxime. DMP is a major metabolite of the following pesticides: methyl azinphos, methyl chlorpyrifos, dichlorvos, dicrotophos, dimethoate, fenitrothion, fenthion, methyl isazaphos, malathion, methidathion, methyl parathion, naled, methyl oxydemeton, phosmet, and methyl pirimiphos. (The complete list is on the report.) Organophosphate exposure can be reduced by eating organic foods, avoiding using pesticides in house or garden, avoiding residence near agricultural areas or golf courses, and staying indoors if insecticides are being sprayed. Lice shampoo, pet flea collars, and flea spray are also major sources of organophosphates. Remove sources of exposure if possible. Elimination of organophosphates can be accelerated by sauna treatment, by the Hubbard detoxification protocol employing niacin supplementation, or by glutathione (reduced) supplementation (oral, intravenous, transdermal, or precursors such as N-acetyl cysteine [NAC]).





# The Great Plains Laboratory, Inc.

Physician:  
Patient:  
Accession #: 800604

Sex:  
Age:

Collected:  
Received:  
Print Date: 7/22/2015

**Diethylphosphate, (DEP) (Marker 8)** indicates exposure to an organophosphate insecticide. Approximately 340 million kilograms of pesticide active ingredient is used agriculturally in the United States annually, and 85% of U.S. households store at least one pesticide for home use. These insecticides kill insects (and mammals such as humans) by the inhibition of the enzyme acetyl-cholinesterase and other enzymes in which serine is part of the active site such as dipeptidyl peptidase IV. When acetylcholine cannot be broken down, overstimulation can lead to constant nerve transmission or overstimulation of neurons or muscles, resulting in excessive salivation, abnormal behavior, diarrhea, urinary incontinence, vomiting, tremors, muscle paralysis, and even death. High exposure levels have been associated with attention deficit, memory impairment and pervasive developmental disorders. Exposure has also been linked to violent behavior, depression, suicide and may have played a role in the onset of Gulf War syndrome. If levels are high, toxicity can be measured by decreased cholinesterase or pseudocholinesterase activity in plasma. Acute toxicity is treated with atropine and/or pralidoxime. DEP is a major metabolite of the following pesticides: chlorethoxyphos, chlorpyrifos, coumaphos, diazinon, disulfoton, ethion, parathion, and phorate. (The complete list is on the report.) Organophosphate exposure can be reduced by eating organic foods, avoiding using pesticides in house or garden, avoiding residence near agricultural areas or golf courses, and staying indoors if insecticides are being sprayed. Lice shampoo, pet flea collars, and flea spray are also major sources of organophosphates. Remove sources of exposure if possible. Elimination of organophosphates can be accelerated by sauna treatment, by the Hubbard detoxification protocol employing niacin supplementation, or by glutathione (reduced) supplementation (oral, intravenous, transdermal, or precursors such as N-acetyl cysteine [NAC]).

**2,4-dichlorophenoxyacetic acid (2,4-D) (Marker 9)** can result from exposure to this very common herbicide that was a part of a chemical mixture called Agent Orange <[http://envirocancer.cornell.edu/factsheet/pesticide/fs14.2\\_4-d.cfm](http://envirocancer.cornell.edu/factsheet/pesticide/fs14.2_4-d.cfm)>, used by the U.S. during the Vietnam War to increase the visibility for war planes by destroying plant undergrowth and crops. Mean urinary levels of 2,4-D among workers involved in mixing, loading, and applying this herbicide ranged from 5 to 837 µg /L. Median urine 2,4-D concentrations at baseline and day after application of this herbicide were 2.1 and 73.1 µg/L for farming applicators, and 1.5 and 2.9 µg/L for their children. Herbicides are chemical agents intended to kill unwanted vegetation such as broadleaf weeds and woody plants. They are used in agriculture and on residential properties. People can be exposed to herbicides by breathing them or by skin contact from their residential use or living near application sites, and by eating contaminated food and drinking contaminated water. 2,4-D has a half-life of approximately 12-36 h. Neuritis, weakness, nausea, abdominal pain, headache, dizziness, peripheral neuropathy, stupor, seizures, brain damage, and impaired reflexes have been associated with dermal or oral exposure. 2,4-D is a known endocrine disruptor, and can block hormone distribution and cause glandular breakdown. It is linked to immune system damage, birth defects and reproductive issues possibly due to its frequent contamination with dioxins. Small amounts of 2,4-dichlorophenoxyacetic acid may be found in many urine samples because of widespread environmental contamination. The risk factors associated with low-level exposure are not well established. High values may be treated by removing the person from likely sources of exposure. Elimination of 2,4-D can also be accelerated by sauna treatment, the Hubbard detoxification protocol employing niacin supplementation, vitamin B-12 therapy, by glutathione (reduced) supplementation (oral, intravenous, transdermal, or precursors such as N-acetyl cysteine [NAC]).

If children have high values, parents should avoid lawn chemicals and prevent their children from playing on lawns that use such chemicals.



# The Great Plains Laboratory, Inc.

Physician:  
Patient:  
Accession #: 800604

Sex:  
Age:

Collected:  
Received:  
Print Date: 7/22/2015

**3-phenoxybenzoic acid (3PBA) (Marker 10)** is the result of exposure to pyrethroid insecticides (pyrethrins). Pyrethrins are the collective name for a group of pesticidal compounds derived from pyrethrum flowers in the genus *Chrysanthemum* that includes permethrin, cypermethrin, deltamethrin, cyhalothrins, fenpropathrin and trihalomethrin. Pyrethroids are synthetic analogs of pyrethrins. Pyrethroids may affect neurological development, disrupt hormones, induce cancer, and suppress the immune system. Pyrethroids are axonic poisons that work by keeping the sodium channels open in the neuronal membranes. Inhaling high levels of pyrethrins or pyrethroids may bring about asthmatic breathing, sneezing, nasal stuffiness, headache, nausea, incoordination, tremors, convulsions, facial flushing and swelling, and burning and itching sensation. A 37-year-old woman died of cardiorespiratory arrest after shampooing her dog with pyrethrin shampoo. Individuals who have ragweed sensitivity are especially vulnerable to allergic reactions to these products. Mothers of children with autism spectrum disorder (ASD) were twice as likely to have reported using pet shampoos containing pyrethrins as those who had healthy children; the effect was most severe if exposure was during the second trimester of pregnancy. In addition, parents of ASD children have reported the first onset of autistic behavior after the use of pyrethrin insecticide sprays in the home.

Increased incidence of hyperactivity was associated with any detectable amount of 3-phenoxybenzoic acid in the urine. Most formulations of pyrethrins and pyrethroids also contain piperonyl butoxide, which inhibits cytochrome P-450, increasing the insecticidal efficacy by slowing the metabolic breakdown of pyrethrins and pyrethroids. Thus, the toxicity of such products may be potentiated by simultaneous exposure to piperonyl butoxide. Exposures of animals to these chemicals cause abnormal behaviors and neurological symptoms. 30 million households in the U.S. are estimated to have pyrethrin and pyrethroid products. Remove all sources of exposure. Elimination is accelerated by sauna treatment, by the Hubbard detoxification protocol employing niacin supplementation, or by glutathione (reduced) supplementation (oral, intravenous, transdermal, or precursors such as N-acetyl cysteine [NAC]).

**Tiglylglycine (TG) (Marker 11)** is associated with both mitochondrial and/or genetic disorders. Toxic chemical exposure may be one of the most common causes of mitochondrial dysfunction. In mitochondrial disorders of the respiratory chain, TG values are usually more moderately increased than in the genetic disorders. In the medical literature, a normal value is less than 3.8 mmol/mol creatinine.

It is an intermediate product of the catabolism of isoleucine and ketone bodies. TG is found at variable high concentration in the urine of patients with 2-methylacetoacetyl-CoA thiolase or 2-methyl-3-hydroxybutyryl-CoA dehydrogenase (MHBD) deficiencies, which are inherited neurometabolic disorders affecting isoleucine catabolism. Biochemically, 2-methylacetoacetyl-CoA thiolase deficiency is characterized by intermittent ketoacidosis and urinary excretion of 2-methyl-acetoacetate (MAA), 2-methyl-3-hydroxybutyrate (MHB) and tiglylglycine (TG), whereas in MHBD deficiency only MHB and tiglylglycine accumulate. Typical clinical symptoms in both disorders include intermittent ketoacidotic episodes, seizures, and retardation. These diseases can be treated by switching to a diet low in protein and without isoleucine. In some cases, patients were asymptomatic until provoked by vaccinations or viral infection. In both disorders, biochemical abnormalities became more pronounced after a 100mg/kg oral isoleucine challenge. Tiglylglycine is also moderately elevated in short-chain acyl dehydrogenase (SCAD) deficiency, in propionyl CoA carboxylase, in methylmalonic aciduria, in the mitochondrial disorder Pearson syndrome (caused by mitochondrial DNA deletion), and in disorders of the respiratory chain in mitochondria.

Abnormal results may be confirmed by advanced mitochondrial DNA testing. Normal values of lactate and pyruvate do not rule out the presence of mitochondrial disorders; elevated TG should be considered a better marker of mitochondrial dysfunction than lactate or pyruvate levels. Extremely elevated values are likely due to genetic chromosomal mutations. Confirmation of genetic disorders requires DNA and/or enzyme testing at advanced biochemical genetics centers. Coenzyme Q-10 (300-600 mg), NAD 25 mg, L-carnitine and acetyl-L-carnitine (1000-2000 mg), riboflavin (40-80 mg), nicotinamide (40-80 mg), biotin (4-8 mg), and vitamin E (200-400 IU's) per day may improve mitochondrial dysfunction. Hyperbaric oxygen therapy (HBOT) may also be beneficial.

