

Kalamazoo River Oil Spill Health Hazards

This document provides information on the health hazards of crude oil to help people understand the health risks of crude oil exposure.

The information is provided by:

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July 28, 2010 - Kalamazoo River (oil slick)



July 28, 2010 - Kalamazoo River (disaster site cleanup)



July 28, 2010 - Kalamazoo River (oil contaminated riverbank)

Introduction

When the crude oil spilled in Kalamazoo, many people in the vicinity were exposed to oil itself, or fumes from the oil. Crude oil contains hundreds of chemicals and many of them can cause health problems. People vary in their responses, depending on individual characteristics and the amount of exposure that they had. Some people will have no health problems, and others may become very ill.

Exposure



July 28, 2010 - Kalamazoo River (oil saturated riverbank)



July 28, 2010 - Kalamazoo River (impacted wildlife)

Exposure to crude oil can occur in many ways:

- skin contact with oil-contaminated materials,
- inhaling chemicals that have moved into the air,
- ingestion of contaminated water or food.

Exposure varies from one person to the next. Children often have a higher internal exposure (dose) than adults, even when they are in the same location. Pregnant women may also be more highly exposed than many other adults because they are breathing in more air, eating more food, and drinking more water than usual.

Some ingredients in crude oil can evaporate into the air and travel long distances. Odors may be noticeable, but some chemicals have no odors. Even when there is no odor, the air can be contaminated.

Standard crude oil chemicals that people can be exposed to when a spill occurs are listed in Table D-1 of the U.S. Centers for Disease Control (CDC) "Toxicological Profile for Petroleum Hydrocarbons" published in 1999 at:

<http://www.atsdr.cdc.gov/ToxProfiles/tp123.pdf>. Crude oil ingredients vary slightly, but its toxic properties are fairly consistent. Chemicals such as benzene and polycyclic aromatic hydrocarbons (PAHs) are very toxic.

Toxic Effects

Exposure to crude oil can cause visible harm where the contact occurred (e.g., on the skin or in the lungs). But crude oil chemicals can move throughout the body, so health effects can be widespread, even from exposure that only occurs to the skin. Crude oil contains chemicals that can move quickly through the skin.

Regardless of how exposure occurs, once crude oil chemicals are in the body, they enter the bloodstream and circulate rapidly. They can move through cell walls and

change the way the cells work, damage DNA, and disrupt normal body functions. For more details, see <http://www.atsdr.cdc.gov/ToxProfiles/tp123.pdf>

Crude oil's toxic ingredients can damage every system in the body:

- respiratory system
- liver
- kidneys
- circulatory system
- immune system
- musculoskeletal system
- skin and integumentary system
- nervous system, including the brain
- reproductive/urogenital system
- endocrine system
- gastrointestinal system
- sensory systems
- blood forming system
- metabolism

Damaging or altering these systems causes a wide range of diseases and conditions. For example, damage to the reproductive system can cause infertility, impotence, pregnancy loss, and changes in the structure of reproductive organs.

Crude oil chemicals can cause abnormal growth and development in children and damage a developing baby (CDC, 1999). They can disrupt hormone levels and damage DNA, causing cancer and birth defects.

Immediate effects. Exposure to crude oil for a short time can cause skin irritation on contact. Irritation may be mild or severe, causing reddening or more severe harm, including chemical burns, swelling (edema), pain, and permanent skin damage. Common effects of inhaling or ingesting crude oil include difficulty breathing, headaches, dizziness, nausea, confusion, and other central nervous system effects. These are more likely to be noticed than potentially more serious effects that don't have obvious signs and symptoms: lung, liver and kidney damage, infertility, immune system suppression, disruption of hormone levels, blood disorders, mutations, and cancer.

Benzene exposure that is brief, but at high levels can cause abnormal heart beat (ventricular fibrillation), GI problems (congestive gastritis, toxic gastritis, pyloric stenosis), kidney damage, skin irritation and burns, swelling and edema, vascular congestion in the brain, lethal central nervous system depression, and other health problems (<http://www.atsdr.cdc.gov/toxprofiles/tp3.pdf>).

People who don't have immediate effects such as headaches, tiredness, dizziness, nausea, or respiratory distress may still be at risk for health consequences from longer-term exposures (see below). In susceptible individuals such as children and those with health problems, moderate or low level exposures can cause effects that would usually only result from high exposures in healthy adults.

There is no safe level of exposure to crude oil because it contains ingredients that can cause mutations and cancer, even at very low exposure levels. Our bodies can often repair the damage from chemicals, but that doesn't always occur. Any exposure to a mutagenic carcinogen (e.g., benzene) imposes some degree of risk.

Longer-term exposure effects. Exposure over weeks or more, usually at lower levels than short-term exposure can cause some harm that is different than short-term exposure (see CDC, 1999). They vary from cancer to permanent nerve damage. If the

exposure resulting from the Kalamazoo spill is likely to be long-term, additional information will be provided on the health effects that may occur.

Benzene. Benzene is a toxic chemical in crude oil that is of very high concern because it can cause rapid toxic effects and after time in can cause cancer. Details about benzene are at: <http://www.atsdr.cdc.gov/toxprofiles/tp3.pdf>. US EPA's "goal" for benzene in water is zero because it can cause cancer (leukemia). It can also cause aplastic anemia (a precursor of leukemia), abnormal chromosomes, damage to the immune system and abnormal development of blood cells. When blood cells are abnormal, other serious medical conditions can result, including infections and cardiac stress. Nervous system damage, difficulty sleeping, and memory loss have also been reported. Animal studies have shown that benzene can cause endometrial polyps, ovarian lesions, and male reproductive system abnormalities. There is also some evidence that benzene can cause harm to an unborn baby and reduce fertility (<http://www.atsdr.cdc.gov/toxprofiles/tp3.pdf>).

Susceptible Subgroups



Individual responses depend on exposure and each individual's characteristics. Populations that are especially susceptible are discussed below.

Children are vulnerable to toxic chemicals in crude oil that disrupt normal growth and development. Their brains are highly susceptible to many neurotoxic ingredients. Endocrine disruptors in crude oil can cause abnormal growth, infertility, and other health conditions. Children's exposures may be higher than adults and can include contaminated soil or sand. Newborns are especially vulnerable due to incompletely formed immune and detoxification systems.

Many people with medical conditions are more susceptible because crude oil attacks most organ systems, including those affected by other illnesses. Exposure to toxic chemicals can also alter actions of some medications, causing increased or decreased potency. People taking medications that reduce their detoxification ability, and those taking acetaminophen, aspirin, haloperidol, who have nutritional deficiencies or who concurrently drink alcohol may be more susceptible. Some inherited enzyme deficiencies also increase susceptibility (listed in CDC, 1999).

People exposed to other toxic chemicals at work or home may be at higher risk.

Pregnancy places increased stress on the liver, kidneys, and cardiovascular system. Chemicals in crude oil that are toxic to these systems can pose health risks to women. Women who are carrying multiple babies are at higher risk for kidney damage due to the greater physiological stress this causes. Pregnancy also requires a careful balance of hormones insure a baby develops in a healthy way. Hormone disruptors in crude oil can change hormone levels in ways that harm a developing baby. For example, reduced thyroid hormone levels can cause babies with reduced intelligence.

The developing fetus is also directly susceptible to the toxic effects of many chemicals in crude oil. Many cause mutations, endocrine disruption, skeletal deformities, hormone disruption, neurocognitive damage, and other types of damage. Different aspects of development are at high risk during different months of gestation. Most chemicals circulating in the mother can pass through the placenta and reach a baby.

Your Questions

If you have questions about the information in this report, you should contact the law firms listed below. They may recommend a clinical medicine specialist who has experience treating chemically-exposed patients, including many with crude oil exposure.

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Authorship

All scientific text was provided by Kathleen Burns, Ph.D. Dr. Burns is a toxicologist who has managed investigative teams, conducting health evaluations of air, water, soil, and food contamination in the US and other countries, and developing protective policies to reduce people's exposure to toxic chemicals. She has worked for state and federal agencies since 1981. Dr. Burns has published books and papers on the health effects of chemicals, including petroleum ingredients and is the founder and director of Sciencecorps, an organization that has assisted Veterans, tribal organizations, 9/11 cleanup workers, and communities across the US on environmental health issues. She is currently providing Gulf residents with information on health hazards of the oil spill and dispersants. She has degrees from the University of Chicago and the University of Illinois Medical Center, with specialty training from Northwestern University Medical School and Harvard University.

All photos of the Kalamazoo River and environs by James S. Thomson.

Michigan Medical Specialist

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Disclaimer

The information in this report should not be construed as medical guidance or recommendations for any specific patient. Such information must be obtained directly from a licensed medical practitioner who is treating a patient.

Sources for this report and additional information

CDC, 1999: <http://www.atsdr.cdc.gov/ToxProfiles/tp123.pdf>

CDC, 2007: <http://www.atsdr.cdc.gov/toxprofiles/tp3.pdf>

US EPA, 2002 on benzene: <http://www.epa.gov/ttn/atw/hlthef/benzene.html>

OSHA, 2010: <http://www.osha.gov/Publications/3172/3172.html>

NLM: <http://sis.nlm.nih.gov/dimrc/oilspills.html> - very limited information on human health

The National Toxicology Program (NIEHS-NIH) provides information on carcinogenic crude oil ingredients (e.g., benzene) & limited information on reproductive hazards
<http://ntp.niehs.nih.gov/>

California's EPA provides a list of chemicals know to cause cancer and/or reproductive harm: http://www.oehha.org/prop65/prop65_list/files/P65single040210.pdf

US EPA's Exposure Factors Handbook, 1997 (not yet updated):

<http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=12464&CFID=7680523&CFTOKEN=45990564&jsessionid=2830d089441a1b1f5a60617f6564a6e531a3>

US EPA's Exposure Factors Handbook for Children (2003)

<http://permanent.access.gpo.gov/lps35390/cfpub.epa.gov/ncea/cfm/recordisplay.cfm-deid=55145.htm>

Children's Health - International pediatric consensus statement regarding children's susceptibility to toxic chemicals: <http://www3.interscience.wiley.com/cgi-bin/fulltext/119425377/HTMLSTART> This contains a link to 120 scientific papers presented at the Conference on Children's Susceptibility to Environmental Hazards.

Federal focus on children's environmental health including policies designed to protect children: <http://yosemite.epa.gov/ochp/ochpweb.nsf/content/homepage.htm>

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