



# MASSACHUSETTS BREAST CANCER COALITION



## LET'S TALK PREVENTION: REDUCING TOXIC EXPOSURES

Discussing Environmental  
Health with Patients

[www.mbcc.org](http://www.mbcc.org)



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**> “Public health measures should be developed and disseminated to raise awareness of environmental cancer risks and encourage people to reduce or eliminate exposures whenever possible”**

- President’s Cancer Panel

Dear Reader,

The Massachusetts Breast Cancer Coalition (MBCC) is dedicated to preventing environmental causes of breast cancer through community education, research advocacy, and changes to public policy. Established in 1991, MBCC has been instrumental in numerous advances locally and nationwide. MBCC pioneered advocacy efforts that influenced Massachusetts to be the first U.S. state to officially recognize breast cancer as an epidemic.

MBCC's visionary approach to ending the breast cancer epidemic through prevention is supported by a growing body of scientific research revealing avoidable environmental links to the disease. The way to end the epidemic of breast cancer is to prevent it by reducing exposure to carcinogens and endocrine disrupting chemicals throughout the life course.

**Let's Talk Prevention: Reducing Toxic Exposures** is a program that aims to facilitate discussions about environmental exposures between health professionals and patients. Chemicals used and released in manufacturing and production do not remain isolated in factories. Industrial chemicals have been detected in our air, water, soil, consumer products, and in our bodies in biomonitoring research: harmful chemicals have moved from industry into our homes. Reducing exposure to chemicals linked with negative health impacts can lessen the burden of disease and improve public health.

As an organization, MBCC does not receive federal funding. It is with generous contributions from our supporters that we can spread the word about environmental links to disease, especially breast cancer, and educate the public about ways to reduce harmful exposures. Your support of this project truly makes a clear impact on the organization and on the lives of many. When every disease takes a physical and emotional toll on patients and their loved ones, the need for preventative action is clear.

Sincerely,



Cheryl Osimo  
Executive Director  
Massachusetts Breast Cancer Coalition





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**> “It is more effective to prevent disease than to treat it, but cancer prevention efforts have focused narrowly on smoking, other lifestyle behaviors, and chemoprevention interventions. Scientific evidence on individual and multiple environmental exposures effects on disease initiation and outcomes, and consequent health system and societal costs, are not being adequately integrated into national policy decisions and strategies for disease prevention, health care access, and health system reform.”**

- President’s Cancer Panel

# INTRODUCTION

**Let's Talk Prevention: Reducing Toxic Exposures** is an educational program to increase the frequency of discussions about environmental exposures between health professionals and patients. The goal of this program to reduce toxic exposures holds implications for reducing the burden of all environmentally-linked diseases, including breast cancer.

This booklet provides suggestions for discussing environmental health with patients, offers advice for assessing a patient's exposure history, and summarizes scientific evidence on the effects of exposure to common chemicals of concern. It is meant to provide background information for the patient brochure that describes basic steps to reduce everyday exposures within the home. Together, these materials provide the necessary information to facilitate conversations about exposures and offer suggestions for healthy lifestyle changes.

The program corresponds with recommendations of the President's Cancer Panel report, 'Environmental Cancer Risk: What We Can Do Now,' the Institute of Medicine Report, Breast Cancer and the Environment: a Life Course Approach, and the Interagency Breast Cancer and Environmental Research Coordinating Committee (IBCERCC) report, Breast Cancer and the Environment: Prioritizing Prevention. These reports highlight a need for increased attention to the link between environmental factors and cancer.

Living a healthy lifestyle through proper diet, exercise, and limiting alcohol and tobacco use is an important start for preventative health measures. However, these steps will not eliminate the burden of environmentally-linked diseases. Patients should also make lifestyle changes to reduce exposure to chemicals linked with health consequences including cancer, birth defects, reproductive problems, and more. This is especially important for pregnant women and children, as some of the most vulnerable segments of our population.

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***“Acute and chronic, individual and mass toxic exposures occur due to lack of awareness among the general public of risks of chemicals. These exposures are preventable.”***

- World Health Organization

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President's Cancer Panel, *Environmental Cancer Risk: What we can do now*, Annual Report 2008-2009, available at <http://deainfo.nci.nih.gov/advisory/pcp/annualReports/index.htm>

Institute of Medicine, *Breast Cancer and the Environment: A Life Course Approach*, 2011, available at <http://www.iom.edu/Reports.aspx>

Interagency Breast Cancer and Environmental Research Coordinating Committee, *Breast Cancer and the Environment: Prioritizing Prevention*, 2013 <http://www.niehs.nih.gov/about/boards/ibcercc/>





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**> “Over 84,000 chemicals are currently registered for use in the United States but we have complete toxicological screening data for only 7% of these chemicals.”**

- Interagency Breast Cancer and Environmental  
Research Coordinating Committee



# CHEMICAL EXPOSURES AND HEALTH

According to biomonitoring data, American citizens are exposed to hundreds of synthetic chemicals on a daily basis. Researchers have detected contaminants in our air, water, soil, food, and consumer products but complete health screening data is available for only approximately 7% of over 84,000 chemicals currently registered for use. While many states have passed restrictions on specific chemicals, the national Toxic Substances Control Act (TSCA) has not been updated since it was passed in 1976. At the same time, scientists are increasingly demonstrating links between environmental exposures and human health.

## **Timing of Exposure**

Certain periods of development, or “windows of susceptibility,” leave the body more vulnerable to harmful exposures. For many chemicals, early life exposures could increase the risk of negative health effects later in life. Other exposures (such as radiation) are cumulative and can add up over a lifetime. Therefore, it is important to take steps to reduce problematic exposures from throughout the life course; from gestation to old age.

## **Endocrine Disrupting Compounds**

Scientists, toxicologists, and epidemiologists are becoming increasingly concerned about hormone disruptors, or endocrine disrupting compounds (EDCs). EDCs are chemicals which interfere with the endocrine system by mimicking, blocking, or otherwise altering the function of naturally occurring hormones in the body.

EDCs are commonly found in many plastics, food cans, cleaning products, flame retardants, cosmetics, and pesticides. Exposure has been linked to a variety of health effects such as infertility, birth defects, cancer, and more. Some studies have shown health effects with low dose exposures, indicating that a traditional “dose-response curve,” or higher dose = bigger effect, may not always apply to EDC exposures. Again, the timing of exposure is critical. Exposure during hormonally-sensitive times (such as in the womb, throughout childhood and during puberty) could pose the greatest risk for impacting future health.

# DISCUSSING ENVIRONMENTAL EXPOSURES WITH PATIENTS

**Many patients may not be aware of the danger posed by some common chemical exposures.**

To introduce the issue, use the information provided in the first few sections of this booklet and in the brochure. It will be helpful to ask specific questions since patients may not be aware of the variety of exposure sources. See the list of suggested questions on the following page.

**Give patients the brochure; explain the information included and how it is useful for their lifestyle.**

Asking some of the questions on the next page will provide a sense of each patient's personal exposure history. Steps and suggestions can and should be tailored to the lifestyle of each patient. When discussing the brochure, ask patients if they have come in contact with this information before. If they have, inquire as to what steps they are already taking to reduce exposure for themselves and their loved ones. Reinforce positive behaviors and encourage patients to continue making healthy changes.

**Reducing daily exposures may seem unwieldy or overwhelming.**

Reassure patients that they can start with small actions and do as much as they can. Make sure to emphasize the importance of reducing exposure for pregnant women, infants, and children as a top priority during these critical developmental stages.

**Follow up with patients at the next visit.**

Ask if the brochure was helpful, if they have taken any steps to reduce exposure, if they have any questions or comments, and give them a new copy of the brochure if necessary. Again, reinforce positive behaviors and encourage patients to continue making healthy changes.

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**> “Physicians and other medical personnel should routinely query patients about their previous and current workplace and home environments as part of the standard medical history”**

- President's Cancer Panel

## QUESTIONS TO ASK

The Institute of Medicine notes three sectors of a person's environment:

1) home, 2) community, and 3) workplace. It can be helpful to address the three sectors separately to identify potential environmental hazards in each sector of the patient's environment.

If hazards are identified during the initial assessment, additional information can be gathered with questions tailored to each patient's environmental history. In general, health professionals should ask questions about the frequency and duration of exposures and provide suggestions for safer alternatives and healthier practices (when possible).

### HOME

In addition to standard questions about smoking, drug use, and alcohol consumption consider the following questions to evaluate your patient's common chemical exposures inside the home:

**Do you use pesticides or bug spray inside/outside your home or on your pets? Do you use weed killers or other lawn care products?**

Suggest investigating safer alternatives and choosing natural remedies for pest management and lawn care when available.

**How often do you have your clothes dry cleaned?**

Suggest minimizing frequency, choosing eco-friendly dry cleaning facilities free of perchlorate, or PERC. If possible, air out dry cleaned clothes before bringing them inside to let chemicals "off-gas."

**Do you use strong cleaning products inside your home? How often?**

Suggest switching to a natural cleaning method/product and/or using cleaning products in well ventilated areas (open a window) and washing hands thoroughly after each use.

**Do you live in a home built before 1978? Have you recently renovated any part of your home or are you planning to do so?**

Determine possible exposure to lead paint or other harmful chemicals which may be released into the air as dust particles during construction. Suggest ventilation or possible vacating the premises temporarily if there is high risk or potential for exposure of pregnant women and children.

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***> If patients seem to be having a difficult time estimating you can provide them with some of the following choices:***

- More than once a month?***
- More than once a week?***
- More than once a day?***

**How often do you eat canned/processed foods? Do you purchase organic or nonorganic produce?**

Frequently consuming canned and highly processed foods can increase exposure to food additives such as Bisphenol A (BPA) and phthalates. Suggest minimizing these foods and choosing fresh or frozen produce where possible. Studies indicate that leafy greens, berries, and apples have some of the highest pesticide residues. A rule of thumb for produce: if you don't consume the outside of the food, it is less important to buy organic.

**Do you have any furniture in your home that is ripped or breaking down with foam showing?**

This could increase exposure to flame retardant chemicals added to foam. Suggest repairing or replacing ripped furniture.



**Do you use air fresheners inside? How often?**

Air fresheners or other highly scented products can contain untested mixtures of synthetic fragrance compounds. Suggest safer alternatives to commercial air fresheners and opening windows periodically to improve ventilation.

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**> *Washing hands frequently not only prevents the spread of germs but can also reduces exposure.***

***Suggest that patients wash with natural, fragrance-free soap and water several times a day (especially before meals).***

**How many cosmetics or personal care products do you use daily? Do you use skin lightening creams or hair straightening/relaxing treatments? How often?**

Skin lightening creams and hair straightening/relaxing treatments are some of the most toxic personal care products. Suggest investigating safer alternatives online at [www.ewg.org/skindeep/](http://www.ewg.org/skindeep/).

**Do you use plastic containers to reheat or cook food or beverages at home?**

Suggest choosing alternative methods for cooking and storing foods. Try to use glass, stainless steel, or ceramic containers instead of plastic.

**Do you visit hair or nail salons? How often? Do you paint your nails at home?**

Suggest minimizing exposure by choosing well ventilated areas or facilities.

## **COMMUNITY**

**Do you have any concerns about toxic or hazardous facilities in your neighborhood or community?**

Asking this question directly could bring up concerns which may not have otherwise been voiced during the visit.

**Does your home get water from a private or well water source?**

Private wells should be tested periodically to ensure the water is within existing health and safety guidelines.

**Do you know of any pesticide or herbicide spraying in your community?**

Suggest closing windows during spraying and avoid contact with sprayed areas.

**Do you live in a high traffic neighborhood?**

Suggest closing windows during high traffic times and avoid walking outdoors during rush hour to minimize exposure to car exhaust.

## **WORKPLACE**

**What do you do for work?**

Certain occupations involve an increased risk of chemical exposures. For example, pesticide or herbicide application or manufacturing, dry cleaning, nail technicians (or other salon workers), printing (exposure to inks and solvents). This is not a complete list.

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***> Repeat work-related questions to determine potential exposures for other family members in the household. Chemical agents can be brought into the home from workplaces or other locations on shoes and clothing.***

**Do you come into contact with any chemicals or biological agents at work? Do you wear any protective gear or clothing?**

Where applicable it may be appropriate to suggest wearing gloves or a face mask to reduce exposures.



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***“[Children] are at special risk due to their smaller body mass and rapid physical development, both of which magnify their vulnerability to known or suspected carcinogens, including radiation. Numerous environmental contaminants can cross the placental barrier; to a disturbing extent, babies are born ‘pre-polluted.’”***

- President’s Cancer Panel

## TIPS TO REDUCE EXPOSURE IN HOUSEHOLDS WITH YOUNG CHILDREN

Have all family members and guests remove shoes at the door to minimize the presence of pesticides and other chemicals on the floor.

Keep medications, cleaning products, lawn care products, paints, and other chemicals out of sight and out of reach.

Keep dust levels low inside the home to minimize exposures for crawling babies or children who spend time on the floor.

Avoid using strong floor cleaning products if there are crawling babies inside the home.

Try not to let children suck on, chew, or bite non-food items – choose teethingers made from natural materials or try frozen bananas or whole raw carrots (don't give babies hard bite-sized foods as they pose a choking hazard).

Choose fragrance-free bathing products made from natural ingredients.

Avoid pajamas that say “flame resistant” and look for children’s pajamas with a bright yellow tag that indicates the garment is “not flame resistant” or “not treated with flame retardants.”



For child's safety, garment should fit snugly.  
This garment is not flame resistant.  
Loose-fitting garment is more likely to catch fire.



# COMMON CHEMICAL EXPOSURES & EXISTING EVIDENCE

## 1,3-BUTADIENE

CAS RN 106-99-0



- > Buta-1,3-diene
- > Biethylene
- > Erythrene
- > Divinyl
- > Vinylethylene

1,3-Butadiene is found in gasoline, car exhaust and cigarette smoke. It is also used in the production of synthetic rubber and plastics. Humans are exposed primarily through inhalation (especially ambient air in areas of high traffic).

The International Agency for Research on Cancer lists 1,3-butadiene as probably carcinogenic to human, and the Institute of Medicine report, “Breast Cancer and the Environment: A Life Course Approach,” notes that out of all the chemicals reviewed, 1,3-butadiene is one of three chemicals with the strongest evidence for backing attempts to reduce exposure. 1,3-butadiene is also listed by the National Toxicology Program as a known human carcinogen in the “12th Report on Carcinogens.” The US Environmental Protection Agency classifies 1,3-butadiene as carcinogenic to humans by inhalation.

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### Resources:

Agency for Toxic Substances and Disease Registry. Tox-FAQs for 1,3-butadiene. 2009. Available at: [www.atsdr.cdc.gov](http://www.atsdr.cdc.gov)

International Agency for Research on Cancer, Monographs on the evaluation of carcinogenic risk of chemicals to man: 1,3-butadiene. 2012: VOL.: 100. Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).

National Toxicology Program. 2011. 12th Report on Carcinogens. Available at: <http://ntp.niehs.nih.gov/>

Silent Spring Institute. Mammary Carcinogens Database. Available at: [www.sciencereview.silent.spring.org/mamm\\_about.cfm](http://www.sciencereview.silent.spring.org/mamm_about.cfm).

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**> Never smoke or allow smoking inside your home, reduce the amount of time spent at or around gas stations, and avoid being outside in high traffic areas during rush hour as much as possible.**

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**> Turn your car off instead of idling, especially when dropping off or picking up children from school.**

## 1,4-DIOXANE

CAS RN 123-91-1

- > 1,4-Dioxacyclohexane
- > p-Dioxane
- > [6]-crown-2

1,4-Dioxane is an industrial chemical used in the production of wood office work surfaces, auto products, and adhesives. It is used as a solvent in plastics, varnishes, paints, and dyes. 1,4-Dioxane has also been detected in toiletries and cosmetics, including children's bath products. Human exposure occurs through contact with products containing 1,4-dioxane and from ingesting food which has been treated with pesticides containing 1,4-dioxane.

The International Agency for Research on Cancer lists 1,4-dioxane as possibly carcinogenic to humans (sufficient evidence in animals but inadequate human evidence) and the U.S. Environmental Protection Agency lists 1,4-dioxane as probably carcinogenic to humans.

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### Resources:

International Agency for Research on Cancer. *Mono-graphs on the evaluation of carcinogenic risk of chemicals to man: 1,4-Dioxane Summary of Data Reported and Evaluation.* 1999: VOL.: 71. Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).

Silent Spring Institute. *Mam-mary Carcinogens Database.* Available at: [www.sciencere-view.silentspring.org/mammabout.cfm](http://www.sciencere-view.silentspring.org/mammabout.cfm).



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**> “Consumer Products Safety Commission reported that the presence of 1,4-dioxane, even as a trace contaminant, is cause for concern and the Commission continues to monitor its use in consumer products.”**

-National Toxicology Program  
11th Report on Carcinogens

Alkylphenols are a family of highly persistent endocrine disrupting compounds which have been shown to have estrogenic properties. Nonylphenols, a common subset of alkylphenols, are found in the lining of food containers and wraps, cleaning products, and spermicides. It is likely that humans are exposed to alkylphenols on a daily basis. While the health impacts of alkylphenols are understudied, some existing research suggests that early life exposures are links with altered mammary gland development and potentially increased breast cancer risk.

Penols are not listed by the U.S. Environmental Protection Agency. However, their potential carcinogenicity is reviewed by both the President's Cancer Panel and the Interagency Breast Cancer and Environmental Research Coordinating Committee.




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### Resources:

*President's Cancer Panel. Reducing Environmental Cancer Risk: What we can do now. 2008-2009 Annual Report. Available at: [deainfo.nci.nih.gov/advisory/pcp/annualReports](http://deainfo.nci.nih.gov/advisory/pcp/annualReports)*

*Interagency Breast Cancer and Environmental Research Coordinating Committee. Breast Cancer and the Environment: Prioritizing Prevention. 2013. Available at: [www.niehs.nih.gov/about/boards/ibcercc/](http://www.niehs.nih.gov/about/boards/ibcercc/)*

*Moon, H. J., S. Y. Han, J. H. Shin, I. H. Kang, T. S. Kim, J. H. Hong, S. H. Kim, and S. E. Fenton. Gestational exposure to nonylphenol causes precocious mammary gland development in female rat offspring. *J Reprod Dev.* 2007: 53(2):333-344.*

## AROMATIC AMINES

Aromatic amines are a family of industrial chemicals used as dyes or in the making of rubber products. The Interagency Breast Cancer and Environmental Research Coordinating Committee states, “experimental evidence indicates that some aromatic amines, such as 4-aminobiphenyl and 4-naphthylamine, are potentially mutagenic and carcinogenic to human breast cells.”

Aryl aromatic amines, a type of aromatic amines, are a component of tobacco smoke and synthetic fuel combustion. Heterocyclic amines, another type of aromatic amine, are formed when meat is cooked and are also a component of tobacco smoke.

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### Resources:

*Interagency Breast Cancer and Environmental Research Coordinating Committee. Breast Cancer and the Environment: Prioritizing Prevention. 2013. Available at: [www.niehs.nih.gov/about/boards/ibcercc/](http://www.niehs.nih.gov/about/boards/ibcercc/)*

1. Tonelli QJ, Custer RP, Sorof S. Transformation of cultured mouse mammary glands by aromatic amines and amides and their derivatives. *Cancer Res.* 1979; 39(5):1784-92.

2. Shirai T, Fysh JM, Lee MS, Vaught JB, King CM. Relationship of metabolic activation of N-hydroxy-N-acylarylamines to biological response in the liver and mammary gland of the female CD rat. *Cancer Res.* 1981; 41(11 Pt 1):4346-53.

Ghoshal A, Snyderwine EG. Excretion of food-derived heterocyclic amine carcinogens into breast milk of lactating rats and formation of DNA adducts in the newborn. *Carcinogenesis.* 1993; 14(11):2199-203.

Snyderwine EG, Venugopal M, Yu M. Mammary gland carcinogenesis by food-derived heterocyclic amines and studies on the mechanisms of carcinogenesis of 2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (PhIP). *Mutat Res.* 2002; 506-507:145-52.

Atrazine, an S-chloro triazine herbicide, was banned from use in the European Union in 2004 but is currently one of the most heavily used herbicides in the U.S. Atrazine contaminates soil, groundwater and drinking water and is an endocrine disrupting compound linked with cancer, birth defects, low sperm count, and problems with reproductive development. Humans are exposed through contaminated air, water, and non-organic produce.

Atrazine is listed by the International Agency for Research on Cancer as not classifiable as to its carcinogenicity in humans because of inadequate human evidence. While its carcinogenicity is not classified by the U.S. Environmental Protection Agency, atrazine is regulated in drinking water under the Safe Drinking Water Act.



### Resources:

Rayner JL, Enoch RR, Fenton SE. Adverse effects of prenatal exposure to atrazine during a critical period of mammary gland growth. *Toxicol Sci.* 2005; 87(1):255-66.

Enoch RR, Stanko JP, Greiner SN, Youngblood GL, Rayner JL, Fenton SE. Mammary gland development as a sensitive end point after acute prenatal exposure to an atrazine metabolite mixture in female Long-Evans rats. *Environ Health Perspect.* 2007; 115(4):541-7.

Wetzel LT, Luempert LG, 3rd, Breckenridge CB, Tisdell MO, Stevens JT, Thakur AK. Chronic effects of atrazine on estrus and mammary tumor formation in female Sprague-Dawley and Fischer 344 rats. *J Toxicol Environ Health.* 1994; 43(2):169-82.

Silent Spring Institute. Mammary Carcinogens Database. Available at: [www.sciencereview.silentspring.org/mammabout.cfm](http://www.sciencereview.silentspring.org/mammabout.cfm).

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**> To minimize exposure to atrazine and other pesticides, individuals should purchase fresh, organic produce whenever possible.**

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**> Remove shoes upon entering the home to reduce the extent to which pesticides and other chemicals are tracked into the home and trapped inside carpeting.**

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## BENZENE

CAS RN 71-43-2

- > **Benzol**
- > **Phene**

Benzene is an industrial chemical used in the production of plastics, detergents, pesticides, some rubbers, and some synthetic nylon fibers. It is also released into the air via gasoline (filling stations & car exhaust) and cigarette smoke. Human exposure occurs through inhalation from tobacco smoke, gas stations, & car exhaust as well as ingestion of contaminated water and/or food.

The U.S. Environmental Protection Agency lists benzene as carcinogenic to humans at all routes of exposure. The International Agency for Research on Cancer also lists benzene as carcinogenic to humans and the Institute of Medicine report, “Breast Cancer and the Environment: A Life Course Approach,” notes that of all the chemicals reviewed, benzene is one of three chemicals with the most evidence supporting attempts to reduce human exposure. According to the National Toxicology Program, there is clear evidence of carcinogenicity in both mice and rats.



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### Resources:

International Agency for Research on Cancer. Monographs on the evaluation of carcinogenic risk of chemicals to man: Benzene. 2012: Vol. 100. Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).

Institute of Medicine. Breast Cancer and the Environment: A Life Course Approach. 2011. Available at: [www.iom.edu/Reports](http://www.iom.edu/Reports).

Silent Spring Institute. Mammary Carcinogens Database. Available at: [www.sciencereview.silent.spring.org/mamm\\_about.cfm](http://www.sciencereview.silent.spring.org/mamm_about.cfm)

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**> Never smoke or allow smoking inside your home, reduce the amount of time spent at or around gas stations, and avoid being outside in high traffic areas during rush hour as much as possible.**

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**> Turn your car off instead of idling, especially when dropping off or picking up children from school.**



## > 4,4'-isopropylidenediphenol

Bisphenol A (BPA) was originally synthesized in the early-mid 1900's by a chemist seeking a chemical with especially estrogenic properties. After later synthesizing DES, the chemist abandoned work on BPA. Years later it was discovered that BPA could be used as a component of polycarbonate plastics. Now it is widely used in plastics and other products including children's toys, water bottles, food containers, food can linings, thermal paper (receipts), and more. Human daily exposure is widespread.



- **Avoid plastic food and beverage containers which may have BPA in them.**
- **Do not microwave plastics as BPA can leach out into food especially when heated.**
- **Choose fresh produce instead of canned to avoid BPA added to the linings of food cans.**
- **Transfer food and leftovers into airtight glass, stainless steel, or ceramic containers, instead of plastic.**

BPA has been classified as a reproductive toxicant in the European Union. The U.S. Food and Drug Administration maintains that current use of BPA is safe. However, widespread daily human exposure has caused some alarm and spurred current debate. Results from urine testing conducted in 2003-2004 by the Centers for Disease Control and Prevention found detectable levels of BPA in 93% of the samples tested. The Interagency Breast Cancer and Environmental Research Coordinating Committee states that following early life exposure, especially during fetal and nursing stages, animal evidence suggests that "BPA induces not only an elevated susceptibility to carcinogens but also the ability to induce spontaneous tumor development" (report citation below).

### Resources:

Interagency Breast Cancer and Environmental Research Coordinating Committee. *Breast Cancer and the Environment: Prioritizing Prevention*. 2013. Available at: [www.niehs.nih.gov/about/boards/ibcerce/](http://www.niehs.nih.gov/about/boards/ibcerce/)

Durando M, Kass L, Piva J, Sonnenschein C, Soto AM, Luque EH. Prenatal bisphenol A exposure induces preneoplastic lesions in the mammary gland in Wistar rats. *Environ Health Perspect*. 2007;115(1):80-6.

Vandenberg LN, Maffini MV, Schaeberle CM, Ucci AA, Sonnenschein C, Rubin BS. Perinatal exposure to the xenoestrogen bisphenol-A induces mammary intraductal hyperplasias in adult CD-1 mice. *Reprod Toxicol*. 2008;26(3-4):210-9.

Murray TJ, Maffini MV, Ucci AA, Sonnenschein C, Soto AM. Induction of mammary gland ductal hyperplasias and carcinoma in situ following fetal bisphenol A exposure. *Reprod Toxicol*. 2007;23(3):383-90



## DIOXINS

Dioxins are by-products of combustion activities involving material containing both chlorine and carbon, such as polyvinyl chloride plastics. They are also created during chlorine-bleaching processes and are highly toxic, persistent organic pollutants. Dioxins are endocrine disrupting compounds and existing research links exposure with a variety of health consequences including cancer, developmental and reproductive problems, and immune system damage.

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD), one of the most toxic dioxins, is a component of Agent Orange, an herbicide used as a chemical weapon in the Vietnam War. TCDD has been classified by the International Agency for Research on Cancer as carcinogenic to humans. Typically, other dioxins or dioxin-like chemicals are compared in toxicity and carcinogenicity to TCDD for risk assessment and regulatory purposes.

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### Resources:

*International Agency for Research on Cancer. Monographs on the evaluation of carcinogenic risk of chemicals to man: 2,3,7,8-Tetrachlorodibenzo-para-dioxin, 2,3,4,7,8-pentachlorodibenzofuran, and 3,3',4,4',5-pentachlorobinhenyl . 2012: Vol. 100. Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).*

*Manuwald U, Velasco Garrido M, Berger J, Manz A, Baur X. Mortality study of chemical workers exposed to dioxins: follow-up 23 years after chemical plant closure. Occup Environ Med. 2012; 69(9):636-42.*

*Brown NM, Manzillo PA, Zhang JX, Wang J, Lamartiniere CA. Prenatal TCDD and predisposition to mammary cancer in the rat. Carcinogenesis. 1998; 19(9):1623-9.*



## ETHYLENE OXIDE

CAS RN 75-21-8

- > Epoxyethane
- > Dimethylene Oxide
- > Oxacyclopropane

Ethylene oxide is a sterilant, disinfectant and pesticide. It is used to sterilize some consumer products such as foods, clothing, toiletries, cosmetics, medical products/equipment, and more. It is also used in the production of disinfectants, landscaping products and antifreeze and has been found in tobacco smoke and car exhaust.

The International Agency for Research on Cancer lists ethylene oxide as carcinogenic to humans and notes sufficient animal evidence but limited human evidence. Ethylene oxide has been listed by the National Toxicology Program as a known human carcinogen since the 4th Report on Carcinogens was released in 1985. It is also mentioned in the Institute of Medicine report, “Breast Cancer and the Environment: A Life Course Approach,” as one of the three chemicals with the most scientific evidence supporting calls to reduce human exposure.

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### Resources:

International Agency for Research on Cancer, *Monographs on the evaluation of carcinogenic risk of chemicals to man: Ethylene oxide*. 2012: VOL.: 100. Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).

National Toxicology Program. *12th Report on Carcinogens*. 2011. Available at: <http://ntp.niehs.nih.gov/>

Institute of Medicine. *Breast Cancer and the Environment: A Life Course Approach*. 2011. Available at [www.iom.edu/Reports](http://www.iom.edu/Reports).

Silent Spring Institute. *Mammary Carcinogen Database*. Available at: [www.sciencereview.silent.spring.org/mamm\\_about.cfm](http://www.sciencereview.silent.spring.org/mamm_about.cfm).



## FLAME RETARDANTS

Synthetic flame retardant chemicals are added to a number of consumer products including upholstered furniture and bedding, electronics, and children's pajamas. These chemicals can leach from products and settle in house dust, sometimes at levels above federal guidelines according to research conducted by Silent Spring Institute. One type which has gained a lot of attention is brominated flame retardants, especially polybrominated diphenyl ethers (PBDEs). These endocrine disrupting compounds have been linked with cancer and altered reproductive and brain development.

Various different flame retardant chemicals have been banned or phased out of certain uses. However, humans are still exposed on a daily basis due to residues which linger inside homes. Several flame retardants were nominated for in-depth toxicological evaluation in the 12th Report on Carcinogens from the U.S. National Toxicology Program.

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### Resources:

Interagency Breast Cancer and Environmental Research Coordinating Committee. *Breast Cancer and the Environment: Prioritizing Prevention*. 2013. Available at: [www.niehs.nih.gov/about/boards/ibcercc/](http://www.niehs.nih.gov/about/boards/ibcercc/).

National Toxicology Program. 12th Report on Carcinogens. 2011 Available at: <http://ntp.niehs.nih.gov/>

Robin E. Dodson, Laura J. Perovich, Adrian Covaci, Nele Van den Eede, Alin C. Ionas, Alin C. Dirtu, Julia Green Brody, and Ruthann A. Rudel. After the PBDE Phase-Out: A Broad Suite of Flame Retardants in Repeat House Dust Samples from California. *Environ Sci & Tech*, 2012; 46(24), 13056-13066.

Talsness CE, Kuriyama SN, Sterner-Kock A, Schnitker P, Grande SW, Shakibaei M. In utero and lactational exposures to low doses of polybrominated diphenyl ether-47 alter the reproductive system and thyroid gland of female rat offspring. *Environ Health Perspect*. 2008; 116(3):308-14.



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**> These chemicals can leach from furniture and settle in house dust. To reduce exposure, individuals should keep dust levels low by using a vacuum fitting with a HEPA filter and cleaning with a wet rag/mop or microfiber cloth that traps dust and dirt naturally without the use of chemical additives. Individuals should also read labels and look for furniture labeled as “flame retardant free” or “not flame resistant.”**

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**> Look for children's pajamas with a bright yellow tag that says the garment must be snug fitting as it is not flame resistant.**

## FORMALDEHYDE

CAS RN 50-00-0

- > Methyl aldehyde
- > Methylene glycol
- > Methylene oxide
- > Formalin
- > Formol

Formaldehyde is an industrial chemical used in the production of resins for molded products like appliances, electric controls, and telephones. It is also in particle-board, plywood, and surface coatings and has been detected as a contaminant in personal care products including children's and adult's bath products, nail polish, salon hair styling products, and more.



Formaldehyde was classified as a known human carcinogen in the National Toxicology Program's 12th Report on Carcinogens. It has also been classified as a known human carcinogen by the International Agency for Research on Cancer and the U.S. Environmental Protection Agency.

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### Resources:

National Toxicology Program  
12th Report on Carcinogens.  
2011. Available at: <http://ntp.niehs.nih.gov/>

International Agency for  
Research on Cancer, Mono-  
graphs on the evaluation of  
carcinogenic risk of chemicals  
to man: Formaldehyde. 2012:  
VOL.: 100. Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).

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**> Formaldehyde has been detected as in many nail products. Due to the efforts of many environmental health and consumer product groups, major U.S. nail product manufacturers are now marketing formaldehyde-free nail polish.**

### > Dichloromethane

Methylene chloride is an industrial solvent used as a paint stripper and component of some aerosols and pesticides. It is also a component of indoor air pollution due to its use in consumer products including fabric cleaners, furniture polish, auto products, wood finishing products (sealants, stains, varnishes, etc.), paint products (spray paints, paint thinners, strippers and removers), adhesives and adhesive removers, art supplies, and insecticides.

According to an analysis of Massachusetts industry carcinogen use/release reporting by Toxics Use Reduction Institute, methylene chloride was the third highest breast carcinogen used and the highest breast carcinogen released by MA industries in 2013. The International Agency for Research on Cancer classifies methylene chloride as possibly carcinogenic to humans with sufficient evidence in animals at multiple tumor sites but inadequate evidence in humans. Similarly, the U.S. Environmental Protection Agency lists methylene chloride as probably carcinogenic to humans and the U.S. National Toxicology Program's 12th Report on Carcinogens lists it as a reasonably anticipated human carcinogen citing clear evidence of carcinogenicity in mice and rats of both sexes.



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#### Resources:

International Agency for Research on Cancer, *Monographs on the evaluation of carcinogenic risk of chemicals to man: Dichloromethane*. 1999: VOL.: 71. Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).

National Toxicology Program. 12th Report on Carcinogens. 2011. Available at: <http://ntp.niehs.nih.gov/>

Silent Spring Institute. Mammary Carcinogens Database. Available at: [www.sciencereview.silent.spring.org/mamm\\_about.cfm](http://www.sciencereview.silent.spring.org/mamm_about.cfm)

Toxics Use Reduction Institute. *Opportunities for Cancer Prevention: Trends in the Use and Release of Carcinogens in Massachusetts*. 2013. Available at: [www.turi.org/Our Work/Toxic Chemicals](http://www.turi.org/Our_Work/Toxic_Chemicals).

## PARABENS

Parabens are a family of endocrine disrupting compounds widely used as preservatives and antimicrobials in food, pharmaceuticals, personal care products and cosmetics, and adhesives. Concern over paraben exposure results from the chemicals' mildly estrogenic properties; however, research on health impacts is lacking. Parabens are not currently regulated or classified by the International

Agency for Research on Cancer, U.S. National Toxicology Program, or the U.S. Environmental Protection Agency.



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### Resources:

*Kang KS, Che JH, Ryu DY, Kim TW, Li GX, Lee YS. Decreased sperm number and motile activity on the F1 offspring maternally exposed to butyl p-hydroxybenzoic acid (butyl paraben). J Vet Med Sci. 2002; 64(3):227-235.*

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**> Paraben exposure can be reduced by checking the labels of personal care products, cosmetics, and over-the-counter medications and/or choosing products labeled “paraben-free.”**



## PERFLUORINATED COMPOUNDS

Perfluorinated compounds are a family of chemicals used in stain-resistant and waterproof coatings in clothing and carpets, fire-fighting foams, electronics, and nonstick coatings such as Teflon for pots and pans. They are endocrine disrupting compounds and have been linked with altered mammary gland development and changes in puberty. In 2004, the U.S. Centers for Disease Control and Prevention released results of bio-monitoring studies showing four different perfluorinated compounds in nearly all study participants.

Perfluorooctanoic acid and other perfluorinated compounds have been nominated as high priority for evaluation by the International Agency for Research on Cancer. Perfluorinated compounds have also been nominated by the U.S. Environmental Protection Agency to the U.S. National Toxicology Program for further study.

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### Resources:

National Institute of Environmental Health Sciences. Perfluorinated Chemicals Fact Sheet. Available at: [www.niehs.nih.gov/health/materials](http://www.niehs.nih.gov/health/materials)

Environmental Protection Agency. Emerging Contaminants Fact Sheet – PFOS and PFOA. 2012. Available at: [http://www.epa.gov/fedfac/documents/emerging\\_contaminants.htm](http://www.epa.gov/fedfac/documents/emerging_contaminants.htm).

White SS, Fenton SE, Hines EP. Endocrine disrupting properties of perfluorooctanoic acid. *J Steroid Biochem Mol Biol.* 2011; 127(1-2):16-

Lopez-Espinosa MJ, Fletcher T, Armstrong B, Genser B, Dhatariya K, Mondal D. Association of Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) with age of puberty among children living near a chemical plant. *Environ Sci Technol.* 2011;45(19):8160-6.



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**> Anyone wishing to avoid exposure to perfluorinated compounds should choose cast iron or steel clad pots and pans instead of nonstick (like Teflon).**



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**> Also try to avoid stain resistant and waterproof coatings on clothing and carpeting.**



## PHTHALATES

Phthalates are endocrine disrupting compounds used to make plastics soft and pliable, especially in the production of polyvinyl chloride (PVC) products (see page 32). They can be found in a variety of consumer products including plastic shower curtains, medical devices and children's toys (the use of some phthalates has recently been restricted in children's toys). Phthalates have also been detected in food packaging, toiletries, and cosmetics especially nail polish, hair spray, and any fragranced products. Exposure can occur from inhalation, skin absorption, or ingestion. Research has linked phthalate exposure with altered reproductive development, cancer, birth defects, and infertility especially following in utero or early life exposure.

Phthalates are metabolized quickly inside the body but according to biomonitoring studies conducted by the Centers for Disease Control and Prevention, exposure is widespread. Other studies have detected them in human breast milk. In 2011, the International Agency for Research on Cancer listed di (2-ethylhexyl) phthalate (DEHP) as possibly carcinogenic to humans citing sufficient experimental evidence in animals.

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***> The “Store Food Safely” and “Buy Fresh & Organic” sections of the patient brochure both offer suggestions for reducing exposure to phthalates from plastics and food containers:***

- *Transfer food and leftovers into airtight glass, stainless steel, or ceramic containers, instead of plastic.*
- *Avoid plastic food and beverage containers which may have phthalates in them.*
- *Do not microwave plastics as phthalates can leach out into food especially when heated.*

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***> Avoiding the use of commercial air fresheners and other fragranced products can avoid exposure to certain phthalates added to these products.***



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**> Opt for cloth shower curtains instead of vinyl as phthalates may leach from the vinyl curtains (and other vinyl products such as pillow protectors).**

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*Sources:*

International Agency for Research on Cancer, Monographs on the evaluation of carcinogenic risk of chemicals to man: Di (2-ethylhexyl) phthalate. 2012: VOL.101. Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).

Rudel, R. A., J. M. Gray, C. L. Engel, T. W. Rawsthorne, R. E. Dodson, J. M. Ackerman, J. Rizzo, J. L. Nudelman, et al. Food packaging and bisphenol A and bis(2-ethylhexyl) phthalate exposure: Findings from a dietary intervention. *Environ Health Perspect.* 2011; 119(7):914–920.

Sathyanarayana, S., C. J. Karr, P. Lozano, E. Brown, A. M. Calafat, F. Liu, and S. H. Swan. Baby care products: Possible sources of infant phthalate exposure. *Pediatrics.* 2008; 121(2):e260–e268.

Lopez-Carrillo, L., R. U. Hernandez-Ramirez, A. M. Calafat, L. Torres-Sanchez, M. Galvan-Portillo, L. L. Needham, R. Ruiz-Ramos, and M. E. Cebrian. Exposure to phthalates and breast cancer risk in northern Mexico. *Environ Health Perspect.* 2010; 118(4):539–544.

Lee, K. Y., M. Shibutani, H. Takagi, N. Kato, S. Takigami, C. Uneyama, and M. Hirose. Diverse developmental toxicity of di-n-butyl phthalate in both sexes of rat offspring after maternal exposure during the period from late gestation through lactation. *Toxicology.* 2004; 203(1–3):221–238.

## POLYCHLORINATED BIPHENYLS

Polychlorinated biphenyls, or PCBs, are persistent, dioxin-like compounds. Though most uses of PCBs were banned by the U.S. Environmental Protection Agency in 1979, PCBs can still be released into the environment from landfills or incinerators. Human exposure can also occur from demolition of old buildings in which PCBs were used, specifically in the caulking around doors and windows. During demolition or construction, PCBs can be released from the caulking into the air and travel as dust particles, posing an inhalation risk.

PCBs, TDCC (see page 19), and other dioxin-like compounds are reviewed together by the International Agency for Research on Cancer based on their similarities. Classifications range from “carcinogenic to humans” to “limited evidence for carcinogenicity to humans” based on the specific compound. The U.S. National Toxicology Program lists PCBs as reasonably anticipated human carcinogens in the 12th Report on Carcinogens.

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### *Resources:*

*International Agency for Research on Cancer, Monographs on the evaluation of carcinogenic risk of chemicals to man: 2,3,7,8-Tetrachlorodibenzo-para-dioxin, 2,3,4,7,8-pentachlorodibenzofuran, and 3,3',4,4',5-pentachlorobiphenyl. 2012: Vol. 100. Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).*

*National Toxicology Program. 12th Report on Carcinogens. 2011. Available at: <http://ntp.niehs.nih.gov/>*

*Dorgan JF, Brock JW, Rothman N, Needham LL, Miller R, Stephenson HE, Jr.. Serum organochlorine pesticides and PCBs and breast cancer risk: results from a prospective analysis (USA). Cancer Causes Control. 1999; 10(1):1-11.*

*Hoyer AP, Gerdes AM, Jorgensen T, Rank F, Hartvig HB. Organochlorines, p53 mutations in relation to breast cancer risk and survival. A Danish cohort-nested case-controls study. Breast Cancer Res Treat. 2002; 71(1):59-65.*

## POLYCYCLIC AROMATIC HYDROCARBONS

Polycyclic aromatic hydrocarbons (PAHs) are produced as a result of the incomplete combustion of hydrocarbons. Common exposure sources include fireplaces, tobacco smoke, car exhaust, and charred meats. PAH exposure has been linked to cancer, reproductive problems, and impaired immune systems.

One common example, benzo[a]pyrene, is classified as carcinogenic to humans by the International Agency for Research on Cancer. The U.S. Environmental Protection Agency classifies benzo[a]pyrene as probably carcinogenic to humans and notes that while animal evidence supports this link, human evidence is lacking. The U.S. National Toxicology Program's 12th Report on Carcinogens lists 15 different PAHs and classifies them each as reasonably anticipated to be human carcinogens.

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### Resources:

International Agency for Research on Cancer. *Monographs on the evaluation of carcinogenic risk of chemicals to man: Some Non-Heterocyclic Polycyclic Aromatic Hydrocarbons and Some Related Exposures*. 2010: VOL. 92. Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).

National Toxicology Program. *12th Report on Carcinogens, Polycyclic Aromatic Hydrocarbons, 15 Listings*. 2011. Available at <http://ntp.niehs.nih.gov/>



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**> The patient brochure offers the following suggestion to reduce exposure to PAHs from charred meats: when grilling, minimize char by using marinades, reducing the heat level, and avoiding prolonged cooking times.**

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**> Try to avoid exposure from air pollution, try avoid high traffic areas during rush hour, never smoke or allow smoking inside your home and reduce the amount of time spent at or around gas stations. To help reduce the burden of air pollution, try to reduce car use as much as possible and always turn your car off instead of idling (especially when dropping off or picking up children from school).**

## RADIATION

Prolonged or frequent exposure to radiation from natural, medical, and other sources has long been suspected in contributing to negative health outcomes, especially cancer. Radiation can be ionizing or non-ionizing. Based on existing research, the clearest evidence for negative impacts exists for ionizing radiation. Sources of exposure to ionizing radiation include medical scans and equipment, nuclear power generation and accidents, nuclear weapon use, and radon. Specific emphasis is placed on childhood exposure, as radiation exposure is considered to be cumulative over the life course. Exposure has been linked to many forms of cancer.

Radiation exposure from radon, x-rays, and gamma rays is listed by the U.S. National Toxicology Program as known to be a human carcinogen in the 12th Report on Carcinogens based on sufficient human evidence. The International Agency for Research on Cancer's monograph on the effects of radiation exposure concludes that x-radiation (x-rays) is carcinogenic to humans based on sufficient human and animal evidence.

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### Resources:

*International Agency for Research on Cancer, Monographs on the evaluation of carcinogenic risk of chemicals to man: Radiation. 2012: VOL.100 D. Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).*

*National Toxicology Program. 12th Report on Carcinogens. 2011. Available at: <http://ntp.niehs.nih.gov/>*

### Terms Commonly Used to Describe Medical Radiation Exposure

**Absorbed Dose:** The physical quantity describing energy deposited per unit mass. Expressed in Grays [Gy].

**Organ Dose:** Energy absorbed by an organ being studied or directly in the primary radiation beam; a measure of risk associated with radiation to that organ. Usually expressed in Gy.

**Effective Dose:** A calculated (not measured) age- and sex-averaged value that is used as a robust measure to estimate detriment from cancer and hereditary effects due to various procedures involving ionizing radiation. Among the limitations in its use, however, is about a  $\pm 40$  percent uncertainty for a "reference" patient (i.e., a hypothetical individual defined in terms of gender, ethnicity, height, and weight). Expressed in Sieverts [Sv].

**Collective Effective Dose:** The total estimated amount of radiation to all members of a population over a specified period of time. Expressed in Sv.

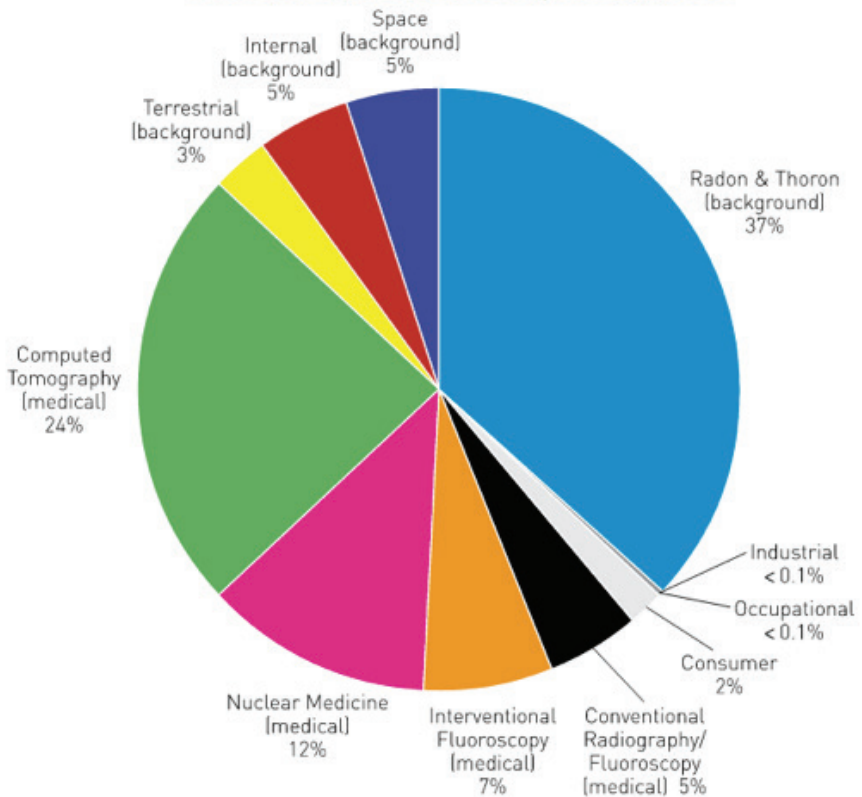
#### Sources:

Mettler FA Jr., et al. Effective doses in radiology and diagnostic nuclear medicine: a catalog. *Radiology* 2008;248(1):254-63.

Brenner DJ, Hall EJ. Computed tomography—an increasing source of radiation exposure. *N Engl J Med*. 2007;357(22):51-8.

Martin CJ. Effective dose; how should it be applied to medical exposures? *Br J Rad* 2007;80(956): 639-47.

### All Exposure Categories Collective Effective Dose (percent), 2006



**> “While ionizing radiation exposures from radon, occupational, and other sources have remained essentially stable over the past 30 years, Americans now are estimated to receive nearly half (48 percent) of their total radiation exposure from medical imaging and other medical sources, compared with only 15 percent in the early 1980s”**

- President’s Cancer Panel



## VINYL CHLORIDE

CAS RN 75-01-4

- > Chloroethene
- > Chloroethylene



***Within the past decade, hospital networks, including Catholic Healthcare West and Kaiser Permanente, have switched to only PVC-free intravenous tubing and bags.***

- ***Patients wishing to reduce exposure can find safer alternatives to vinyl products like shower curtains and pillow protectors, which can leach toxic chemicals like phthalates (see page 26).***

The use of vinyl chloride, in aerosol products was banned in the U.S. in 1974. However, as an industrial chemical, it is still widely used in the production of polyvinyl chloride plastics (PVC). PVC is used for a wide variety of products including medical supplies and equipment, building and construction materials (pipes, flooring, windows etc.), electronic wire insulation, furniture, and more.

Both the U.S. Environmental Protection Agency and International Agency for Research on Cancer classify vinyl chloride as carcinogenic to humans. In the 12th Report on Carcinogens of the National Toxicology

Program, vinyl chloride is listed as a reasonably anticipated human carcinogen based on animal evidence.

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### Resources:

International Agency for Research on Cancer, *Monographs on the evaluation of carcinogenic risk of chemicals to man: Vinyl Chloride. 2012: VOL.: 100.* Available at: [www.monographs.iarc.fr/ENG/Monographs/PDFs](http://www.monographs.iarc.fr/ENG/Monographs/PDFs).

National Toxicology Program 12th Report on Carcinogens: Vinyl Chloride. 2011. Available at: <http://ntp.niehs.nih.gov/>

Silent Spring Institute. Mammary Carcinogens Database. Available at: [www.sciencereview.silent.spring.org/mamm\\_about.cfm](http://www.sciencereview.silent.spring.org/mamm_about.cfm).



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## ADDITIONAL RESOURCES

Agency for Toxic Substances & Disease Registry (ATSDR)

Case Studies in Environmental Medicine (self-instructional online education program for health professional regarding toxic substances and health): [www.atsdr.cdc.gov/csem/csem.html](http://www.atsdr.cdc.gov/csem/csem.html)

Pediatric Environmental Health Training Module: [www.atsdr.cdc.gov/emes/health\\_professionals/pediatrics.html](http://www.atsdr.cdc.gov/emes/health_professionals/pediatrics.html)

Promoting Environmental Health in Communities: [www.atsdr.cdc.gov/emes/public/promoting\\_environmental\\_health.html](http://www.atsdr.cdc.gov/emes/public/promoting_environmental_health.html)

International Agency for Research on Cancer: [www.iarc.fr](http://www.iarc.fr)

Institute of Medicine on Environmental Health: [www.iom.edu/Global/Topics/Environmental-Health.aspx](http://www.iom.edu/Global/Topics/Environmental-Health.aspx)

Massachusetts Breast Cancer Coalition: [www.mbcc.org](http://www.mbcc.org)

National Institute for Environmental Health Sciences: [www.niehs.nih.gov](http://www.niehs.nih.gov)

National Toxicology Program: <http://ntp.niehs.nih.gov/>

Physicians for Social Responsibility: [www.psr.org](http://www.psr.org)

Pediatric Environmental Health Toolkit: [www.psr.org/resources/pediatric-toolkit.html](http://www.psr.org/resources/pediatric-toolkit.html)

Silent Spring Institute: [www.silentspring.org](http://www.silentspring.org)

Mammary Carcinogens Review Database: [www.sciencereview.silentspring.org/mamm\\_about.cfm](http://www.sciencereview.silentspring.org/mamm_about.cfm)

Epidemiology Reviews Database: [www.sciencereview.silentspring.org/epid\\_about.cfm?new=1](http://www.sciencereview.silentspring.org/epid_about.cfm?new=1)

World Health Association: [www.who.int](http://www.who.int)

Guidelines on the Prevention of Toxic Exposures: Education and Public Awareness Activities: <http://apps.who.int/iris/handle/10665/42714>



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***Primary prevention measures include activities that help avoid a given health care problem. Because successful primary prevention helps avoid the suffering, cost, and burden associated with disease, it is typically considered the most cost-effective form of health care.***

U.S. Preventive Services Task Force  
(quoted in Interagency Breast Cancer and  
Environmental Research Coordinating Committee report)

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*The Massachusetts Breast Cancer Coalition is dedicated to preventing environmental causes of breast cancer through community education, research advocacy, and changes to public policy.*