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Known and Probable Human Carcinogens

In general, the American Cancer Society does not determine if something causes cancer (that is, if it is a carcinogen). Instead, we rely on the determinations of other respected agencies, such as the International Agency for Research on Cancer (IARC) and the US National Toxicology Program (NTP).

The lists below are from IARC and NTP, and more information on each of these known and probable human carcinogens can be found on their websites.

To learn more about these agencies and how they study and classify cancer causes, see [Determining if Something Is a Carcinogen](#).

What you should know

- The IARC and NTP act independently. Many known or suspected carcinogens appear on both organization's lists; however, **if a substance or exposure is only on one agency's list, this it does not necessarily mean there is a controversy**, as one agency may not have evaluated it.
- These lists are alphabetical, but **many of the substances and exposures here can go by different names**. This can make it hard to find a particular substance on one or both of these lists.
- **These lists include only those agents that have been evaluated by the agencies**. These agencies tend to focus on substances and exposures most likely to cause cancer, but there are many others that have not been fully studied yet.
- **These lists include agents that have been classified as *known* and *probable* human carcinogens. The lists do not include substances that have been classified as *possible* carcinogens, for which the evidence is not as strong.** These lists also do not include substances evaluated as "not classifiable as to its carcinogenicity in humans."
- **Most of the agents on the lists have been linked only with certain kinds of cancer, not all cancer types.** See each agency's website for more details about the substances and exposures on their lists.
- **The lists describe the level of evidence that something can cause cancer, not how likely it is that something will cause cancer in any person (or how much it might raise your risk).** For example, IARC considers there to be strong evidence that both tobacco smoking and eating processed meat can cause cancer, so both are listed as "carcinogenic to humans." But smoking is much more likely to cause cancer than eating processed meat, even though both are in the same category.
- **Carcinogens do not cause cancer at all times, under all circumstances.** In other words, a carcinogen does not always cause cancer in every person, every time there is any kind of exposure. Some may only be carcinogenic if a person is exposed in a certain way (for example, swallowing it as opposed to touching it). Some may only cause cancer in people who have a certain genetic makeup. Some of these agents may lead to cancer after only a very small exposure, while others might require intense exposure over many years. Again, refer to the agencies' reports for specifics.

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- **Even if a substance or exposure is known or suspected to cause cancer, this does not necessarily mean that it can or should be avoided at all costs.** For example, sunlight is a major source of ultraviolet (UV) rays, which are a known cause of skin cancer, but it's not practical (or advisable) to completely avoid the sun. (See [How to Interpret News About Cancer Causes](#) for more about this.)
- **These lists also include many commonly used medicines, particularly some hormones and drugs used to treat cancer.** For example, tamoxifen increases the risk of certain kinds of uterine cancer, but it can be very useful in treating some breast cancers, which may be more important for some women. If you have questions about a medicine that appears on one of these lists, be sure to ask your doctor.

Known human carcinogens


International Agency for Research on Cancer Group 1: Carcinogenic to humans

Learn more about the topics in this list in the IARC monographs at https://monographs.iarc.fr/cards_page/publications-monographs/.


- Acetaldehyde (from consuming alcoholic beverages)
- Acheson process, occupational exposure associated with
- Acid mists, strong inorganic
- Aflatoxins
- Alcoholic beverages
- Aluminum production
- 4-Aminobiphenyl
- Areca nut
- Aristolochic acid (and plants containing it)
- Arsenic and inorganic arsenic compounds
- Asbestos (all forms) and mineral substances (such as talc or vermiculite) that contain asbestos
- Auramine production
- Azathioprine
- Benzene
- Benzidine and dyes metabolized to benzidine
- Benzo[a]pyrene
- Beryllium and beryllium compounds
- Betel quid, with or without tobacco
- Bis(chloromethyl)ether and chloromethyl methyl ether (technical-grade)
- Busulfan
- 1,3-Butadiene
- Cadmium and cadmium compounds
- Chlorambucil
- Chlornaphazine
- Chromium (VI) compounds

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- *Clonorchis sinensis* (infection with), also known as the Chinese liver fluke
- Coal, indoor emissions from household combustion
- Coal gasification
- Coal-tar distillation
- Coal-tar pitch
- Coke production
- Cyclophosphamide
- Cyclosporine (ciclosporin)
- 1,2-Dichloropropane
- Diethylstilbestrol (DES)
- Engine exhaust, diesel
- Epstein-Barr virus (EBV) (infection with)
- Erionite
- Estrogen-only menopausal therapy
- Estrogen-progestogen menopausal therapy (combined)
- Estrogen-progestogen oral contraceptives (combined) (Note: There is also convincing evidence in humans that these agents confer a protective effect against cancer in the endometrium and ovary)
- Ethanol in alcoholic beverages
- Ethylene oxide
- Etoposide
- Etoposide in combination with cisplatin and bleomycin
- Fission products, including strontium-90
- Fluoro-edenite fibrous amphibole
- Formaldehyde
- Haematite mining (underground)
- *Helicobacter pylori* (infection with)
- Hepatitis B virus (chronic infection with)
- Hepatitis C virus (chronic infection with)
- Human immunodeficiency virus type 1 (HIV-1) (infection with)
- Human papilloma virus (HPV) types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59 (infection with) (Note: The HPV types that have been classified as carcinogenic to humans can differ by an order of magnitude in risk for cervical cancer)
- Human T-cell lymphotropic virus type I (HTLV-1) (infection with)
- Ionizing radiation (all types)
- Iron and steel founding (workplace exposure)
- Isopropyl alcohol manufacture using strong acids
- Kaposi sarcoma herpesvirus (KSHV), also known as human herpesvirus 8 (HHV-8) (infection with)
- Leather dust
- Lindane

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- Magenta production
- Melphalan
- Methoxsalen (8-methoxypsoralen) plus ultraviolet A radiation, also known as PUVA
- Methyl-CCNU
- 4,4'-Methylenebis(chloroaniline) (MOCA)
- Mineral oils, untreated or mildly treated
- MOPP and other combined chemotherapy including alkylating agents
- 2-Naphthylamine
- Neutron radiation
- Nickel compounds
- N'-Nitrosornicotine (NNN) and 4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)
- *Opisthorchis viverrini* (infection with), also known as the Southeast Asian liver fluke
- Outdoor air pollution (and the particulate matter in it)
- Painter (workplace exposure as a)
- 3,4,5,3',4'-Pentachlorobiphenyl (PCB-126)
- 2,3,4,7,8-Pentachlorodibenzofuran
- Pentachlorophenol
- Phenacetin (and mixtures containing it)
- Phosphorus-32, as phosphate
- Plutonium
- Polychlorinated biphenyls (PCBs), dioxin-like, with a Toxicity Equivalency Factor according to WHO (PCBs 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189)
- Processed meat (consumption of)
- Radioiodines, including iodine-131
- Radionuclides, alpha-particle-emitting, internally deposited (Note: Specific radionuclides for which there is sufficient evidence for carcinogenicity to humans are also listed individually as Group 1 agents)
- Radionuclides, beta-particle-emitting, internally deposited (Note: Specific radionuclides for which there is sufficient evidence for carcinogenicity to humans are also listed individually as Group 1 agents)
- Radium-224 and its decay products
- Radium-226 and its decay products
- Radium-228 and its decay products
- Radon-222 and its decay products
- Rubber manufacturing industry
- Salted fish (Chinese-style)
- *Schistosoma haematobium* (infection with)
- Semustine (methyl-CCNU)
- Shale oils
- Silica dust, crystalline, in the form of quartz or cristobalite
- Solar radiation


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- Soot (as found in workplace exposure of chimney sweeps)
- Sulfur mustard
- Talc containing asbestiform fibres
- Tamoxifen (Note: There is also conclusive evidence that tamoxifen reduces the risk of contralateral breast cancer in breast cancer patients)
- 2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD); "dioxin"
- Thiotepa
- Thorium-232 and its decay products
- Tobacco, smokeless
- Tobacco smoke, secondhand
- Tobacco smoking
- ortho-Toluidine
- Treosulfan
- Trichloroethylene
- Ultraviolet (UV) radiation, including UVA, UVB, and UVC rays
- Ultraviolet-emitting tanning devices
- Vinyl chloride
- Welding fumes
- Wood dust
- X- and Gamma-radiation


National Toxicology Program 14th Report on Carcinogens “Known to be human carcinogens”

Learn more about the topics in this list in the NTP's Report on Carcinogens at <https://ntp.niehs.nih.gov/pubhealth/roc/index-1.html>.

- Aflatoxins
- Alcoholic beverage consumption
- 4-Aminobiphenyl
- Analgesic mixtures containing phenacetin
- Aristolochic acids
- Arsenic and inorganic arsenic compounds
- Asbestos
- Azathioprine
- Benzene
- Benzidine
- Beryllium and beryllium compounds
- Bis(chloromethyl) ether and technical-grade chloromethyl methyl ether
- 1,3-Butadiene

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- 1,4-Butanediol dimethylsulfonate (also known as busulfan)
- Cadmium and cadmium compounds
- Chlorambucil
- 1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (MeCCNU)
- Chromium hexavalent compounds
- Coal tar pitches
- Coal tars
- Coke oven emissions
- Cyclophosphamide
- Cyclosporin A
- Diethylstilbestrol (DES)
- Dyes metabolized to benzidine
- Epstein-Barr virus (EBV)
- Erionite
- Estrogens, steroidal
- Ethylene oxide
- Formaldehyde
- Hepatitis B virus
- Hepatitis C virus
- Human immunodeficiency virus type 1 (HIV-1)
- Human papilloma viruses (HPVs): some genital-mucosal types
- Human T-cell lymphotropic virus type 1 (HTLV-1)
- Kaposi sarcoma-associated herpesvirus (KSHV) (also known as human herpesvirus 8, or HHV-8)
- Melphalan
- Merkel cell polyomavirus (MCV)
- Methoxsalen with ultraviolet A therapy (PUVA)
- Mineral oils (untreated and mildly treated)
- Mustard gas
- 2-Naphthylamine
- Neutrons
- Nickel compounds
- Radon
- Silica, crystalline (respirable size)
- Solar radiation
- Soots
- Strong inorganic acid mists containing sulfuric acid
- Sunlamps or sunbeds, exposure to
- Tamoxifen

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- 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD); "dioxin"
- Thiotepa
- Thorium dioxide
- Tobacco smoke, environmental
- Tobacco, smokeless
- Tobacco smoking
- o-Toluidine
- Trichloroethylene (TCE)
- Ultraviolet (UV) radiation, broad spectrum
- Vinyl chloride
- Wood dust
- X-radiation and gamma radiation

Probable carcinogens


International Agency for Research on Cancer Group 2A: Probably carcinogenic to humans

Learn more about the topics in this list in the IARC monographs at https://monographs.iarc.fr/cards_page/publications-monographs/.

- Acrylamide
- Adriamycin (doxorubicin)
- Androgenic (anabolic) steroids
- Art glass, glass containers, and press ware (manufacture of)
- Azacitidine
- Biomass fuel (primarily wood), emissions from household combustion
- Bitumens, occupational exposure to oxidized bitumens and their emissions during roofing
- Bischloroethyl nitrosourea (BCNU), also known as carmustine
- Captafol
- Carbon electrode manufacture
- Chloral
- Chloral hydrate
- Chloramphenicol
- alpha-Chlorinated toluenes (benzal chloride, benzotrichloride, benzyl chloride) and benzoyl chloride (combined exposures)
- 1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU)
- 4-Chloro-ortho-toluidine
- Chlorozotocin
- Cisplatin

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- Cobalt metal with tungsten carbide
- Creosotes
- Cyclopenta[cd]pyrene
- DDT (4,4'-Dichlorodiphenyltrichloroethane)
- Diazinon
- Dibenz[a,j]acridine
- Dibenz[a,h]anthracene
- Dibenzo[a,l]pyrene
- Dichloromethane (methylene chloride)
- Dieldrin, and aldrin metabolized to dieldrin
- Diethyl sulfate
- Dimethylcarbamoyl chloride
- N,N-Dimethylformamide
- 1,2-Dimethylhydrazine
- Dimethyl sulfate
- Epichlorohydrin
- Ethyl carbamate (urethane)
- Ethylene dibromide
- N-Ethyl-N-nitrosourea
- Frying, emissions from high-temperature
- Glycidol
- Glyphosate
- Hairdresser or barber (workplace exposure as)
- Human papillomavirus (HPV) type 68 (infection with)
- Hydrazine
- Indium phosphide
- IQ (2-Amino-3-methylimidazo[4,5-f]quinoline)
- Lead compounds, inorganic
- Malaria (caused by infection with *Plasmodium falciparum*)
- Malathion
- 2-Mercaptobenzothiazole
- Merkel cell polyomavirus (MCV)
- 5-Methoxypsoralen
- Methyl methanesulfonate
- N-Methyl-N'-nitro-N-nitrosoguanidine (MNNG)
- N-Methyl-N-nitrosourea
- Nitrate or nitrite (ingested) under conditions that result in endogenous nitrosation
- 6-Nitrochrysene


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- Nitrogen mustard
- 1-Nitropyrene
- N-Nitrosodiethylamine
- N-Nitrosodimethylamine
- 2-Nitrotoluene
- Non-arsenical insecticides (workplace exposures in spraying and application of)
- Petroleum refining (workplace exposures in)
- Pioglitazone
- Polybrominated biphenyls (PBBs)
- Procarbazine hydrochloride
- 1,3-Propane sultone
- Red meat (consumption of)
- Shiftwork that involves circadian disruption
- Silicon carbide whiskers
- Styrene
- Styrene-7,8-oxide
- Teniposide
- Tetrabromobisphenol A
- 3,3',4,4'-Tetrachloroazobenzene
- Tetrachloroethylene (perchloroethylene)
- Tetrafluoroethylene
- 1,2,3-Trichloropropane
- Tris(2,3-dibromopropyl) phosphate
- Very hot beverages (above 65 degrees Celsius)
- Vinyl bromide (Note: For practical purposes, vinyl bromide should be considered to act similarly to the human carcinogen vinyl chloride.)
- Vinyl fluoride (Note: For practical purposes, vinyl fluoride should be considered to act similarly to the human carcinogen vinyl chloride.)


National Toxicology Program 14th Report on Carcinogens “Reasonably anticipated to be human carcinogens”

Learn more about the topics in this list in the NTP's Report on Carcinogens at <https://ntp.niehs.nih.gov/pubhealth/roc/index-1.html>.


- Acetaldehyde
- 2-Acetylaminofluorene
- Acrylamide
- Acrylonitrile
- Adriamycin (doxorubicin hydrochloride)
- 2-Aminoanthraquinone

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- o-Aminoazotoluene
- 1-Amino-2,4-dibromoanthraquinone
- 1-Amino-2-methylantraquinone
- 2-Amino-3,4-dimethylimidazo[4,5-f]quinoline (MeIQ)
- 2-Amino-3,8-dimethylimidazo[4,5-f]quinoxaline (MeIQx)
- 2-Amino-3-methylimidazo[4,5-f]quinoline (IQ)
- 2-Amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (PhIP)
- Amitrole
- o-Anisidine and its hydrochloride
- Azacitidine (5-Azacytidine, 5-AzaC)
- Basic Red 9 Monohydrochloride
- Benz[a]anthracene
- Benzo[b]fluoranthene
- Benzo[j]fluoranthene
- Benzo[k]fluoranthene
- Benzo[a]pyrene
- Benzotrichloride
- 2, 2-bis-(bromoethyl)-1,3-propanediol (technical grade)
- Bromodichloromethane
- 1-Bromopropane
- Butylated hydroxyanisole (BHA)
- Captafol
- Carbon tetrachloride
- Ceramic fibers (respirable size)
- Chloramphenicol
- Chlorendic acid
- Chlorinated paraffins (C₁₂, 60% chlorine)
- Chloroform
- 1-(2-chloroethyl)-3-cyclohexyl-1-nitrosourea
- Bis(chloroethyl) nitrosourea
- 3-Chloro-2-methylpropene
- 4-Chloro-o-phenylenediamine
- Chloroprene
- p-Chloro-o-toluidine and p-chloro-o-toluidine hydrochloride
- Chlorozotocin
- Cisplatin
- Cobalt and cobalt compounds that release cobalt ions *in vivo*
- Cobalt-tungsten carbide: powders and hard metals

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- p-Cresidine
- Cumene
- Cupferron
- Dacarbazine
- Danthron (1,8-dihydroxyanthraquinone)
- 2,4-Diaminoanisole sulfate
- 2,4-Diaminotoluene
- Diazoaminobenzene
- Dibenz[a,h]acridine
- Dibenz[a,j]acridine
- Dibenz[a,h]anthracene
- 7H-Dibenzo[c,g]carbazole
- Dibenzo[a,e]pyrene
- Dibenzo[a,h]pyrene
- Dibenzo[a,i]pyrene
- Dibenzo[a,l]pyrene
- 1,2-Dibromo-3-chloropropane
- 1,2-Dibromoethane (ethylene dibromide)
- 2,3-Dibromo-1-propanol
- 1,4-Dichlorobenzene
- 3,3'-Dichlorobenzidine and 3,3'-dichlorobenzidine dihydrochloride
- Dichlorodiphenyltrichloroethane (DDT)
- 1,2-Dichloroethane (ethylene dichloride)
- Dichloromethane (methylene chloride)
- 1,3-Dichloropropene (technical grade)
- Diepoxybutane
- Diesel exhaust particulates
- Di(2-ethylhexyl) phthalate
- Diethyl sulfate
- Diglycidyl resorcinol ether
- 3,3'-Dimethoxybenzidine
- 4-Dimethylaminoazobenzene
- 3,3'-Dimethylbenzidine
- Dimethylcarbamoyl chloride
- 1,1-Dimethylhydrazine
- Dimethyl sulfate
- Dimethylvinyl chloride
- 1,6-Dinitropyrene

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- 1,8-Dinitropyrene
- 1,4-Dioxane
- Disperse blue 1
- Dyes metabolized to 3,3'-dimethoxybenzidine
- Dyes metabolized to 3,3'-dimethylbenzidine
- Epichlorohydrin
- Ethylene thiourea
- Ethyl methanesulfonate
- Furan
- Glass wool fibers (inhalable)
- Glycidol
- Hexachlorobenzene
- Hexachloroethane
- Hexamethylphosphoramide
- Hydrazine and hydrazine sulfate
- Hydrazobenzene
- Indeno[1,2,3-cd]pyrene
- Iron dextran complex
- Isoprene
- Kepone (chlordecone)
- Lead and lead compounds
- Lindane, hexachlorocyclohexane (technical grade), and other hexachlorocyclohexane isomers
- 2-Methylaziridine (propyleneimine)
- 5-Methylchrysene
- 4,4'-Methylenebis(2-chloroaniline)
- 4,4'-Methylenebis(*N,N*-dimethyl)benzenamine
- 4,4'-Methylenedianiline and its dihydrochloride salt
- Methyleugenol
- Methyl methanesulfonate
- N-methyl-N'-nitro-N-nitrosoguanidine
- Metronidazole
- Michler's ketone [4,4'-(dimethylamino) benzophenone]
- Mirex
- Naphthalene
- Nickel, metallic
- Nitrilotriacetic acid
- o-Nitroanisole
- Nitrobenzene

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- 6-Nitrochrysene
- Nitrofen (2,4-dichlorophenyl-p-nitrophenyl ether)
- Nitrogen mustard hydrochloride
- Nitromethane
- 2-Nitropropane
- 1-Nitropyrene
- 4-Nitropyrene
- N-nitrosodi-n-butylamine
- N-nitrosodiethanolamine
- N-nitrosodiethylamine
- N-nitrosodimethylamine
- N-nitrosodi-n-propylamine
- N-nitroso-N-ethylurea
- 4-(N-nitrosomethylamino)-1-(3-pyridyl)-1-butanone
- N-nitroso-N-methylurea
- N-nitrosomethylvinylamine
- N-nitrosomorpholine
- N-nitrosornicotine
- N-nitrosopiperidine
- N-nitrosopyrrolidine
- N-nitrososarcosine
- o-Nitrotoluene
- Norethisterone
- Ochratoxin A
- 4,4'-Oxydianiline
- Oxymetholone
- Pentachlorophenol and by-products of its synthesis
- Phenacetin
- Phenazopyridine hydrochloride
- Phenolphthalein
- Phenoxybenzamine hydrochloride
- Phenytoin and phenytoin sodium
- Polybrominated biphenyls (PBBs)
- Polychlorinated biphenyls (PCBs)
- Polycyclic aromatic hydrocarbons (PAHs)
- Procarbazine and its hydrochloride
- Progesterone
- 1,3-Propane sultone

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- beta-Propiolactone
- Propylene oxide
- Propylthiouracil
- Reserpine
- Riddelliine
- Safrole
- Selenium sulfide
- Streptozotocin
- Styrene
- Styrene-7,8-oxide
- Sulfallate
- Tetrachloroethylene (perchloroethylene)
- Tetrafluoroethylene
- Tetranitromethane
- Thioacetamide
- 4,4'-Thiodianiline
- Thiourea
- Toluene diisocyanates
- Toxaphene
- 2,4,6-Trichlorophenol
- 1,2,3-Trichloropropane
- Tris(2,3-dibromopropyl) phosphate
- Ultraviolet A (UVA) radiation
- Ultraviolet B (UVB) radiation
- Ultraviolet C (UVC) radiation
- Urethane
- Vinyl bromide
- 4-Vinyl-1-cyclohexene diepoxide
- Vinyl fluoride

Additional resources

Along with the American Cancer Society, other sources of information include:

International Agency for Research on Cancer (IARC)

Website: www.iarc.fr

IARC Carcinogen Monographs: <http://monographs.iarc.fr>

National Toxicology Program (NTP)

Website: <http://ntp.niehs.nih.gov>

Report on Carcinogens: <http://ntp.niehs.nih.gov/pubhealth/roc/index-1.html>

Environmental Protection Agency (EPA)

Website: www.epa.gov

Integrated Risk Information System: www.epa.gov/iris

Food and Drug Administration (FDA)

Website: www.fda.gov

National Cancer Institute

Website: www.cancer.gov

Cancer Causes and Risk Factors: www.cancer.gov/cancertopics/causes

National Institute for Occupational Safety and Health (NIOSH)

Website: www.cdc.gov/niosh

NIOSH Safety and Health Topic – Occupational Cancer: www.cdc.gov/niosh/topics/cancer

NIOSH Carcinogen List: www.cdc.gov/niosh/topics/cancer/npotocca.html

**Inclusion on this list does not imply endorsement by the American Cancer Society.*

No matter who you are, we can help. Contact us anytime, day or night, for information and support. Call us at **1-800-227-2345** or visit www.cancer.org.

References


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