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, part of the World Health Organization) and the US National Toxicology Program (NTP).

The lists below are from IARC and NTP. **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[1].

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* or *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 iS59 groFosed io htoch ng iS5q

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/[3].

- 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
- *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

- 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'-Nitrosonornicotine (NNN) and 4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)
- *Opisthorchis viverrini* (infection with), also known as the Southeast Asian liver fluke
- Opium consumption
- 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
- Perfluorooctanoic acid (PFOA)
- 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
- 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

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National Toxicology Program 15th 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/whatwestudy/assessments/cancer/roc/index.html*[4]

- 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

- 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
- 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD); "dioxin"
- Thiotepa
- Thorium dioxide
- Tobacco smoke, environmental
- Tobacco, smokeless
- Tobacco smoking
- oToluidine
- 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/[5].

- Acrolein
- Acrylamide
- Adriamycin (doxorubicin)
- Androgenic (anabolic) steroids
- Aniline and aniline hydrochloride
- ortho-Anisidine and ortho-anisidine hydrochloride

- 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
- 2-Bromopropane
- 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
- Cobalt metal (without tungsten carbide or other metal alloys)
- 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
- Glycidyl methacrylate
- Glyphosate
- Hairdresser or barber (workplace exposure as)
- Human papillomavirus (HPV) type 68 (infection with)

- Styrene
- Styrene-7,8-oxide
- Teniposide
- Tetrabromobisphenol A
- 3,3,4,4-Tetrachloroazobenzene
- Tetrachloroethylene (perchloroethylene)
- Tetrafluoroethylene
- 1,1,1-Trichloroethane
- 1,2,3-Trichloropropane
- Tris(2,3-dibromopropyl) phosphate
- Trivalent antimony
- 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 15th Report on Carcinogens “Reasonably anticipated to be human carcinogens”

- o-Anisidine and its hydrochloride
- Antimony trioxide
- 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)
- Bromochloroacetic acid (BCA)
- Bromodichloroacetic acid (BDCA)
- Bromodichloromethane
- 1-Bromopropane
- Butylated hydroxyanisole (BHA)
- Captafol
- Carbon tetrachloride
- Ceramic fibers (respirable size)
- Chloramphenicol
- Chlorendic acid
- Chlorinated paraffins (C_{12}, 60% chlorine)
- Chlorodibromoacetic acid (CDBA)
- 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
- p-Cresidine
- Cumene
- Cupferron
- Dacarbazine

- 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
- 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-nitrosonornicotine
- 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
- beta-Propiolactone

- Propylene oxide
- Propylthiouracil
- Reserpine
- Riddelliine
- Safrole
- Selenium sulfide
- Streptozotocin
- Styrene
- Styrene-7,8-oxide
- Sulfallate
- Tetrachloroethylene (perchloroethylene)
- Tetrafluoroethylene
- Tetranitromethane
- Thioacetamide
- 4,4'-Thiodianaline
- Thiourea
- Toluene diisocyanates
- Toxaphene
- Tribromoacetic acid (TBA)
- 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

Hyperlinks

cause-cancer.html
3. monographs.iarc.fr/cards_page/publications-monographs/
4. ntp.niehs.nih.gov/whatwestudy/assessments/cancer/roc/index.html
5. monographs.iarc.fr/cards_page/publications-monographs/
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10. ntp.niehs.nih.gov/pubhealth/roc/index-1.html
11. www.epa.gov
12. www.epa.gov/iris
13. www.fda.gov/
14. www.cancer.gov/
15. www.cancer.gov/cancertopics/causes
16. www.cdc.gov/niosh
17. www.cdc.gov/niosh/topics/cancer
18. www.cdc.gov/niosh/npg/nengapdxa.html
19. www.cancer.org

Additional resources

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

International Agency for Research on Cancer (IARC) Website: [7]www.iarc.fr[8] IARC Carcinogen Monographs: http://monographs.iarc.fr[9]

National Toxicology Program (NTP) Website: http://ntp.niehs.nih.gov[10] Report on Carcinogens: http://ntp.niehs.nih.gov/pubhealth/roc/index-1.html[11]

Environmental Protection Agency (EPA) Website: www.epa.gov[12] Integrated Risk Information System: www.epa.gov/iris[13]

Food and Drug Administration (FDA) Website: www.fda.gov[14]

National Cancer Institute Website: www.cancer.gov[15] Cancer Causes and Risk Factors: www.cancer.gov/cancertopics/causes[16]

National Institute for Occupational Safety and Health (NIOSH)

Website: www.cdc.gov/niosh[17] NIOSH Safety and Health Topic – Occupational Cancer: www.cdc.gov/niosh/topics/cancer[18] NIOSH Carcinogen List: www.cdc.gov/niosh/npg/nengapdxa.html[19]

**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[20].

References

International Agency for Research on Cancer (IARC). Agents Classified by the IARC Monographs, Volumes 1–132. 2022. Accessed at https://monographs.iarc.who.int/agents-classified-by-the-iarc/ on July 8, 2022.

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