

What is a carcinogen?

A carcinogen is any substance, agent, or organism that has the potential to cause cancer.

Some carcinogens, such as UV rays from sunlight, occur naturally. Others originate from artificial sources, such as cigarette smoke.

Most carcinogens cause cancer by producing mutations in a cell's DNA. Different carcinogens can cause different types of cancer.

Carcinogens do not necessarily cause cancer every time someone interacts with them. However, exposure to a carcinogen can raise a person's risk of developing certain cancers.

Types of carcinogens

Researchers divide carcinogens into three main categories. These include:

- **Chemical carcinogens:** These are carcinogens that people release into the environment through pollution, such as through car exhaust fumes, industrial by-products, and cigarette smoke.
- **Physical or environmental carcinogens:** These carcinogens come from the environment. UV rays from sunlight and radiation from X-rays or other radioactive materials are examples of physical carcinogens.
- **Oncogenic viruses:** These are viruses that can cause cancer. include human papillomavirus (HPV), Epstein-Barr, and hepatitis B.

Common examples

This section looks at common examples of carcinogens that the IARC and the NTP list.

Alcohol

Both the IARC and NTP classify alcoholic beverages as known carcinogens. According to the IARC, alcoholic beverages can cause multiple cancers, including oral cancer, colon cancer, liver cancer, and more.

Asbestos

Asbestos is known by the IARC to cause mesothelioma, a type of aggressive cancer, and stomach, colon, lung, and ovarian cancers. The NTP also classifies asbestos as a known carcinogen.

Engine exhaust

According to the NTP, diesel exhaust particulates are known carcinogens. The IARC states that engine exhaust fumes may cause bladder cancer, but there is inconclusive evidence for this in humans.

Formaldehyde

Formaldehyde can cause multiple different types of leukemia, according to the IARC.

Processed meat

Consuming processed meat is known to increase the risk of cancers of the rectum and colon, according to the IARC. It may also cause stomach cancer.

Processed meats are any meat products manufacturers preserve by smoking, curing, or adding chemical preservatives.

Examples of processed meats include:

- deli meats
- bacon
- sausages

- beef jerky
- canned meats

Radon

Radon is a radioactive gas that occurs naturally in the environment. Both the IARC and NTP classify radon as a known human carcinogen.

Tobacco

The IARC and the NTP classify all tobacco products as carcinogens.

Tobacco smoke and tobacco products can cause many types of cancer, including:

- oral cancer
- throat cancer
- colon cancer
- liver cancer
- bile duct cancer
- pancreatic cancer
- nasal cancer

UV rays

UV rays from tanning devices and welding can cause skin cancer and eye cancer. Solar radiation from the sun can also cause melanoma.

Other examples

The NTP's *15th Report on Carcinogens* lists 256 substances that are known or probable carcinogens. The IARC classifies 215 agents as known or probable carcinogens.

The following examples may be present in either the IARC, the , or both.

Some examples of carcinogens include:

- arsenic
- chloroform
- coal dust and emissions
- cobalt
- Epstein-Barr virus
- estrogen-progestogen combined oral contraceptives
- estrogen therapy for menopause
- hepatitis B
- hepatitis C
- HPV
- HIV type 1
- mineral oils
- nickel
- outdoor air pollution
- red meat consumption
- X-rays and gamma rays

Exposure in the workplace

Many people regularly come into contact with carcinogens due to their occupation.

Some occupations can expose a person to more carcinogens than usual.

These include firefighters, painters, and people working in industrial and manufacturing settings.

Carcinogen exposure in the workplace can be more harmful than everyday exposure. This is because a person who works with carcinogens may come into contact with them more regularly, which may increase their risk of developing cancer.

The Agency for Toxic Substance and Disease Registry associates the following cancers with various workplace carcinogens.

Cancer	Substances, occupations, or processes
bladder	<ul style="list-style-type: none"> • aluminum production • rubber industry

	<ul style="list-style-type: none"> • leather industry • 4-aminobiphenyl • benzidine
larynx	<ul style="list-style-type: none"> • asbestos • mustard gas • isopropyl alcohol
lip	<ul style="list-style-type: none"> • sunlight
liver	<ul style="list-style-type: none"> • arsenic • vinyl chloride
lung	<ul style="list-style-type: none"> • asbestos • arsenic • coal fumes • foundry substances • nickel refining • cadmium • coke oven fumes • nickel refining • radon • soot, tars, and oils • <u>silica</u>
lymphatic and hematopoietic	<ul style="list-style-type: none"> • ethylene oxide • herbicides • benzene • X-radiation
mesothelioma	<ul style="list-style-type: none"> • asbestos
nasal cavity and sinuses	<ul style="list-style-type: none"> • isopropyl alcohol • mustard gas • nickel refining • formaldehyde • wood dust • leather dust
pharynx	<ul style="list-style-type: none"> • formaldehyde • mustard gas

skin	<ul style="list-style-type: none"> • arsenic • coal tars • mineral oils • sunlight
soft-tissue sarcoma	<ul style="list-style-type: none"> • chlorophenols • chlorophenoxy • herbicides

Lowering the risk

In the United States, workplaces must follow legal regulations to reduce their employees' exposure to known carcinogens. They may take safety measures such as supplying protective gear and monitoring a person's exposure.

People can also take steps to limit their exposure to carcinogens outside of the workplace. These include:

- quitting smoking, if applicable
- wearing sunscreen and limiting sun exposure
- avoiding processed meats
- avoiding alcohol
- receiving HPV and hepatitis B vaccinations when appropriate

What are the three groups of carcinogens?

The IARC break down carcinogens into groups 1–3, depending on their risk levels.

Group	Group description	Number of agents
1	known to cause cancer in humans	122
2A	probably causes cancer in humans	93

2B	possibly causes cancer in humans	319
3	researchers are unable to classify its carcinogenicity in humans	501

Is nicotine a carcinogen?

Neither the IARC nor the NTP lists nicotine alone as a known or probable carcinogen.

However, they both list N-Nitrosornicotine (NNN), a nicotine derivative, as a known carcinogen. NNN is present in a variety of tobacco products.

A 2015 study also found evidence that nicotine may be a potential carcinogen. The authors suggested that the substance may cause a type of DNA damage that could increase the risk of developing cancer.