

Tobacco Smoke Components: Carcinogens

A carcinogen is defined as an agent that causes a series of genetic alterations to occur, leading to the formation of cancerous growths.ⁱ

Cancerous growths may develop many years, even decades, after exposure to the carcinogenic agent.

A chemical is labeled a carcinogen once human, animal or cellular research has concluded the statistical probability that exposure to the chemical will lead to cancerous growth.

In 1989, the United States Surgeon General released a reportⁱⁱ listing 43 carcinogenic agents found in tobacco smoke. Those carcinogens and their classification according to the International Agency for Research on Cancer (IARC) are listed in the tables at right and on the following page.

It is possible for a chemical to show limited carcinogenicity – for example, exposure to the chemical may have lead to cancerous growth in one species but not in another, or an insufficient number of tests may have lead to inconclusive evidence. Therefore, a chemical may be labeled “probably” or “possibly” carcinogenic to humans (it is rare that a carcinogen would be tested directly on humans).

Tobacco smoke has long been recognized as a chemical carcinogen.ⁱⁱⁱ

Tobacco smoke also contains some of the most deadly carcinogenic chemicals known.

Some of these cancer-causing chemicals, such as the tobacco-specific nitrosamines NNN, NNK, NAT and NAB, are formed from natural components of the tobacco plant.

All forms of tobacco produce cancer-causing smoke.

Carcinogens in Tobacco Smoke

(According to International Agency for Research on Cancer, unless otherwise noted)

Group 1: Carcinogenic to Humans

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|-----------------------------|
| Tobacco Smoke |
| Tobacco Products, Smokeless |
| 4-Aminobiphenyl |
| Benzene |
| Cadmium |
| Chromium |
| 2-Naphthylamine |
| Nickel |
| Polonium-210 (Radon) |
| Vinyl Chloride |
| |

Group 2A: Probably Carcinogenic to Humans

| |
|------------------------|
| Acrylonitrile |
| Benzo[a]anthracene |
| Benzo[a]pyrene |
| 1,3-Butadiene |
| Dibenz(a,h)anthracene |
| Formaldehyde |
| N-Nitrosodiethylamine |
| N-Nitrosodimethylamine |
| |

Group 2B: Possibly Carcinogenic to Humans

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|--|
| Acetaldehyde |
| Benzo[<i>b</i>]fluoranthene |
| Benzo[<i>j</i>]fluoranthene |
| Benzo[<i>k</i>]fluoranthene |
| Dibenz[<i>a,h</i>]acridine |
| Dibenz[<i>a,j</i>]acridine |
| 7 <i>H</i> -Dibenz[<i>c,g</i>]carbazole |
| Dibenzo(<i>a,i</i>)pyrene |
| Dibenzo(<i>a,l</i>)pyrene |
| 1,1-Dimethylhydrazine |
| Hydrazine |
| Indeno[1,2,3- <i>cd</i>]pyrene |
| Lead |
| 5-Methylchrysene |
| 4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) |
| 2-Nitropropane |
| <i>N</i> -Nitrosodiethanolamine |
| <i>N</i> -Nitrosomethylethylamine |
| <i>N</i> -Nitrosomorpholine |
| <i>N</i> -Nitrosornicotine (NNN) |
| <i>N</i> -Nitrosopyrrolidine |
| Quinoline ^{iv} |
| <i>ortho</i> -Toluidine |
| Urethane (Ethyl Carbamate) |

Group 3: Unclassifiable as to Carcinogenicity to Humans (Limited Evidence)

| |
|----------------------------------|
| Chrysene |
| Crotonaldehyde |
| <i>N</i> -Nitrosoanabasine (NAB) |
| <i>N</i> -Nitrosoanatabine (NAT) |

ⁱ William, G.; Weisburger, J.; Casarett and Doull's Toxicology, Chapter 5.

Editors: Klaassen, C, Amdur, M., Doull, J. Pergamon Press, New York, 1996.

ⁱⁱ U.S. Dept. of Health and Human Services. Reducing the Health Consequences of Smoking: 25 Years of Progress. A Report of the Surgeon General. U.S. Dept. of Health and Human Services, Public Health Service, Centers for Disease Control, Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. DHHS Publication No. (CDC) 89-8411, 1989.

ⁱⁱⁱ International Agency For Research on Cancer (IARC)

<http://www.iarc.fr>

^{iv} Environmental Protection Agency (EPA) designated Group C, Possible Human Carcinogen of Low Carcinogenic Hazard.