

**List of Classifications by cancer sites with *sufficient* or *limited evidence* in humans, updated from JNCI Table 4 to include Volumes 1 to 103\***

| <b>Cancer site</b>                   | <b><i>Carcinogenic agents with sufficient evidence in humans</i></b>   | <b><i>Agents with limited evidence in humans</i></b>  |
|--------------------------------------|--|---|
| <b>Lip, oral Cavity, and pharynx</b> |  |   |
| Lip                                  |  | Solar radiation   |
| Oral cavity                          | Alcoholic beverages<br>Betel quid with tobacco<br>Betel quid without tobacco<br>Human papillomavirus type 16<br>Tobacco, smokeless<br>Tobacco smoking  | Human papillomavirus type 18  |
| Salivary gland                       | X-radiation, gamma-radiation   | Radioiodines, including Iodine-131  |
| Tonsil                               | Human papillomavirus type 16   |   |
| Pharynx                              | Alcoholic beverages<br>Betel quid with tobacco<br>Human papillomavirus type 16<br>Tobacco smoking  | Asbestos (all forms)<br>Mate drinking, hot<br>Printing processes<br>Tobacco smoke, secondhand   |
| Nasopharynx                          | Epstein-Barr virus<br>Formaldehyde<br>Salted fish, Chinese-style<br>Wood dust  |   |
| Digestive tract, upper               | Acetaldehyde associated with consumption of alcoholic beverages  |   |
| <b>Digestive organs</b>              |  |   |
| Esophagus                            | Acetaldehyde associated with consumption of alcoholic beverages<br>Alcoholic beverages<br>Betel quid with tobacco<br>Betel quid without tobacco<br>Tobacco, smokeless<br>Tobacco smoking<br>X-radiation, gamma-radiation | Dry cleaning<br>Mate drinking, hot<br>Pickled vegetables (traditional Asian)<br>Rubber production industry<br>Tetrachloroethylene   |
| Stomach                              | <i>Helicobacter pylori</i><br>Rubber production industry<br>Tobacco smoking<br>X-radiation, gamma-radiation  | Asbestos (all forms)<br>Epstein-Barr virus<br>Lead compounds, inorganic<br>Nitrate or nitrite (ingested) under conditions that result in endogenous nitrosation<br>Pickled vegetables (traditional Asian)<br>Salted fish, Chinese-style |
| Colon and rectum                     | Alcoholic beverages<br>Tobacco smoking<br>X-radiation, gamma-radiation   | Asbestos (all forms)<br><i>Schistosoma japonicum</i>  |

| <b>Cancer site</b>               | <b><i>Carcinogenic agents with sufficient evidence in humans</i></b>  | <b><i>Agents with limited evidence in humans</i></b>   |
|----------------------------------|---|--|
| Anus                             | Human immunodeficiency virus type 1<br>Human papillomavirus type 16   | Human papillomavirus types 18, 33  |
| Liver and bile duct              | Aflatoxins<br>Alcoholic beverages<br><i>Clonorchis sinensis</i><br>Estrogen-progestogen contraceptives<br>Hepatitis B virus<br>Hepatitis C virus<br><i>Opisthorchis viverrini</i><br>Plutonium<br>Thorium-232 and its decay products<br>Tobacco smoking (in smokers and in smokers' children)<br>Vinyl chloride | Androgenic (anabolic) steroids<br>Arsenic and inorganic arsenic compounds<br>Betel quid without tobacco<br>Human immunodeficiency virus type 1<br>Polychlorinated biphenyls<br><i>Schistosoma japonicum</i><br>Trichloroethylene<br>X-radiation, gamma-radiation |
| Gall bladder                     | Thorium-232 and its decay products  |  |
| Pancreas                         | Tobacco, smokeless<br>Tobacco smoking   | Alcoholic beverages<br>Thorium-232 and its decay products<br>X-radiation, gamma-radiation  |
| Digestive tract, unspecified     |   | Radioiodines, including Iodine-131   |
| <b>Respiratory organs</b>        |   |  |
| Nasal cavity and paranasal sinus | Isopropyl alcohol production<br>Leather dust<br>Nickel compounds<br>Radium-226 and its decay products<br>Radium-228 and its decay products<br>Tobacco smoking<br>Wood dust  | Carpentry and joinery<br>Chromium(VI) compounds<br>Formaldehyde<br>Textile manufacturing   |
| Larynx                           | Acid mists, strong inorganic<br>Alcoholic beverages<br>Asbestos (all forms)<br>Tobacco smoking  | Human papillomavirus type 16<br>Mate drinking, hot<br>Rubber production industry<br>Sulfur mustard<br>Tobacco smoke, secondhand  |

| <b>Cancer site</b>   | <b><i>Carcinogenic agents with sufficient evidence in humans</i></b>  | <b><i>Agents with limited evidence in humans</i></b>  |
|--|---|---|
| Lung   | Aluminum production<br>Arsenic and inorganic arsenic compounds<br>Asbestos (all forms)<br>Beryllium and beryllium compounds<br>Bis(chloromethyl)ether; chloromethyl methyl ether (technical grade)<br>Cadmium and cadmium compounds<br>Chromium(VI) compounds<br>Coal, indoor emissions from household combustion<br>Coal gasification<br>Coal-tar pitch<br>Coke production<br>Hematite mining (underground)<br>Iron and steel founding<br>MOPP (vincristine-prednisone-nitrogen mustard-procarbazine mixture)<br>Nickel compounds<br>Painting<br>Plutonium<br>Radon-222 and its decay products<br>Rubber production industry<br>Silica dust, crystalline<br>Soot<br>Sulfur mustard<br>Tobacco smoke, secondhand<br>Tobacco smoking<br>X-radiation, gamma-radiation | Acid mists, strong inorganic<br>Art glass, glass containers and pressed ware (manufacture of)<br>Biomass fuel (primarily wood), indoor emissions from household combustion of<br>Bitumens, oxidized, and their emissions during roofing<br>Bitumens, hard, and their emissions during mastic asphalt work<br>Carbon electrode manufacture<br><i>alpha</i> -Chlorinated toluenes and benzoyl chloride (combined exposures)<br>Cobalt metal with tungsten carbide<br>Creosotes<br>Engine exhaust, diesel<br>Frying, emissions from high-temperature<br>Insecticides, non-arsenical (occupational exposures in spraying and application)<br>Printing processes<br>2,3,7,8-Tetrachlorodibenzo- <i>para</i> -dioxin<br>Welding fumes |
| <b>Bone, skin, and mesothelium, endothelium, and soft tissue</b> |   |   |
| Bone   | Plutonium<br>Radium-224 and its decay products<br>Radium-226 and its decay products<br>Radium-228 and its decay products<br>X-radiation, gamma-radiation  | Radioiodines, including iodine-131  |
| Skin (melanoma)  | Solar radiation<br>Ultraviolet-emitting tanning devices   |   |
| Skin (other malignant neoplasms)                                 | Arsenic and inorganic arsenic compounds<br>Azathioprine<br>Coal-tar distillation<br>Coal-tar pitch<br>Cyclosporine<br>Methoxsalen plus ultraviolet A<br>Mineral oils, untreated or mildly treated<br>Shale oils<br>Solar radiation<br>Soot<br>X-radiation, gamma-radiation  | Creosotes<br>Human immunodeficiency virus type 1<br>Human papillomavirus types 5 and 8 (in patients with <i>epidermodysplasia verruciformis</i> )<br>Nitrogen mustard<br>Petroleum refining (occupational exposures)<br>Ultraviolet-emitting tanning devices  |

| <b>Cancer site</b>                      | <b><i>Carcinogenic agents with sufficient evidence in humans</i></b>   | <b><i>Agents with limited evidence in humans</i></b>  |
|---|--|---|
| Mesothelium (pleura and peritoneum)     | Asbestos (all forms)<br>Erionite<br>Painting   |   |
| Endothelium (Kaposi sarcoma)            | Human immunodeficiency virus type 1<br>Kaposi sarcoma herpes virus   |   |
| Soft tissue                             |  | Polychlorophenols or their sodium salts (combined exposures)<br>Radioiodines, including Iodine-131<br>2,3,7,8-Tetrachlorodibenzo- <i>para</i> -dioxin |
| <b>Breast and female genital organs</b> |  |   |
| Breast                                  | Alcoholic beverages<br>Diethylstilbestrol<br>Estrogen-progestogen contraceptives<br>Estrogen-progestogen menopausal therapy<br>X-radiation, gamma-radiation  | Estrogen menopausal therapy<br>Ethylene oxide<br>Shiftwork that involves circadian disruption<br>Tobacco smoking                                      |
| Vulva                                   | Human papillomavirus type 16   | Human immunodeficiency virus type 1<br>Human papillomavirus types 18, 33  |
| Vagina                                  | Diethylstilbestrol (exposure in utero)<br>Human papillomavirus type 16   | Human immunodeficiency virus type 1   |
| Uterine cervix                          | Diethylstilbestrol (exposure in utero)<br>Estrogen-progestogen contraceptives<br>Human immunodeficiency virus type 1<br>Human papillomavirus types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59<br>Tobacco smoking | Human papillomavirus types 26, 53, 66, 67, 68, 70, 73, 82<br>Tetrachloroethylene  |
| Endometrium                             | Estrogen menopausal therapy<br>Estrogen-progestogen menopausal therapy<br>Tamoxifen  | Diethylstilbestrol  |
| Ovary                                   | Asbestos (all forms)<br>Estrogen menopausal therapy<br>Tobacco smoking   | Talc-based body powder (perineal use)<br>X-radiation, gamma-radiation   |
| <b>Male genital organs</b>              |  |   |
| Penis                                   | Human papillomavirus type 16   | Human immunodeficiency virus type 1<br>Human papillomavirus type 18   |

| <b>Cancer site</b>                            | <b><i>Carcinogenic agents with sufficient evidence in humans</i></b>   | <b><i>Agents with limited evidence in humans</i></b>   |
|---|--|--|
| Prostate                                      |  | Androgenic (anabolic) steroids<br>Arsenic and inorganic arsenic compounds<br>Cadmium and cadmium compounds<br>Rubber production industry<br>Thorium-232 and its decay products<br>X-radiation, gamma-radiation     |
| Testis  |  | Diethylstilbestrol (exposure in utero)   |
| <b>Urinary tract</b>                          |  |  |
| Kidney  | Tobacco smoking<br>X-radiation, gamma-radiation  | Arsenic and inorganic arsenic compounds<br>Cadmium and cadmium compounds<br>Printing processes   |
| Renal pelvis and ureter                       | Aristolochic acid, plants containing Phenacetin<br>Phenacetin, analgesic mixtures containing<br>Tobacco smoking  | Aristolochic acid  |
| Urinary bladder                               | Aluminum production<br>4-Aminobiphenyl<br>Arsenic and inorganic arsenic compounds<br>Auramine production<br>Benzidine<br>Chlornaphazine<br>Cyclophosphamide<br>Magenta production<br>2-Naphthylamine<br>Painting<br>Rubber production industry<br><i>Schistosoma haematobium</i><br>Tobacco smoking<br><i>ortho</i> -Toluidine<br>X-radiation, gamma-radiation | 4-Chloro- <i>ortho</i> -toluidine<br>Coal-tar pitch<br>Coffee<br>Dry cleaning<br>Engine exhaust, diesel<br>Hairdressers and barbers (occupational exposure)<br>Printing processes<br>Soot<br>Textile manufacturing |
| <b>Eye, brain, and central nervous system</b> |  |  |
| Eye   | Human immunodeficiency virus type 1<br>Ultraviolet-emitting tanning devices<br>Welding   | Solar radiation  |
| Brain and central nervous system              | X-radiation, gamma-radiation   | Radiofrequency electromagnetic fields (including from wireless phones)   |

| Cancer site  | <b><i>Carcinogenic agents with sufficient evidence in humans</i></b>  | <b><i>Agents with limited evidence in humans</i></b>  |
|--|---|---|
| <b>Endocrine glands</b>  |   |   |
| Thyroid  | Radioiodines, including Iodine-131<br>X-radiation, gamma-radiation  |   |
| <b>Lymphoid, hematopoietic, and related tissue</b>   |   |   |
| Leukemia and/or lymphoma   | Azathioprine<br>Benzene<br>Busulfan<br>1,3-Butadiene<br>Chlorambucil<br>Cyclophosphamide<br>Cyclosporine<br>Epstein-Barr virus<br>Etoposide with cisplatin and bleomycin<br>Fission products, including Strontium-90<br>Formaldehyde<br><i>Helicobacter pylori</i><br>Hepatitis C virus<br>Human immunodeficiency virus type 1<br>Human T-cell lymphotropic virus type 1<br>Kaposi sarcoma herpes virus<br>Melphalan<br>MOPP (vincristine-prednisone-nitrogen mustard-procarbazine mixture)<br>Phosphorus-32<br>Rubber production industry<br>Semustine (methyl-CCNU)<br>Thiotepa<br>Thorium-232 and its decay products<br>Tobacco smoking<br>Tresulfan<br>X-radiation, gamma-radiation | Bischloroethyl nitrosourea (BCNU)<br>Chloramphenicol<br>Ethylene oxide<br>Etoposide<br>Hepatitis B virus<br>Magnetic fields, extremely low frequency (childhood leukemia)<br>Mitoxantrone<br>Nitrogen mustard<br>Painting (childhood leukemia from maternal exposure)<br>Petroleum refining (occupational exposures)<br>Polychlorophenols or their sodium salts (combined exposures)<br>Radioiodines, including Iodine-131<br>Radon-222 and its decay products<br>Styrene<br>Teniposide<br>Tetrachloroethylene<br>Trichloroethylene<br>2,3,7,8-Tetrachlorodibenzo- <i>para</i> -dioxin<br>Tobacco smoking (childhood leukemia in smokers' children) |
| <b>Multiple or unspecified sites</b>   |   |   |
| Multiple sites (unspecified)   | Cyclosporine<br>Fission products, including Strontium-90<br>X-radiation, gamma-radiation (exposure in utero)  | Chlorophenoxy herbicides<br>Plutonium   |
| All cancer sites (combined)  | 2,3,7,8-Tetrachlorodibenzo- <i>para</i> -dioxin   |   |
| * This table does not include factors not covered in the IARC Monographs, notably genetic traits, reproductive status, and some nutritional factors. |   |   |