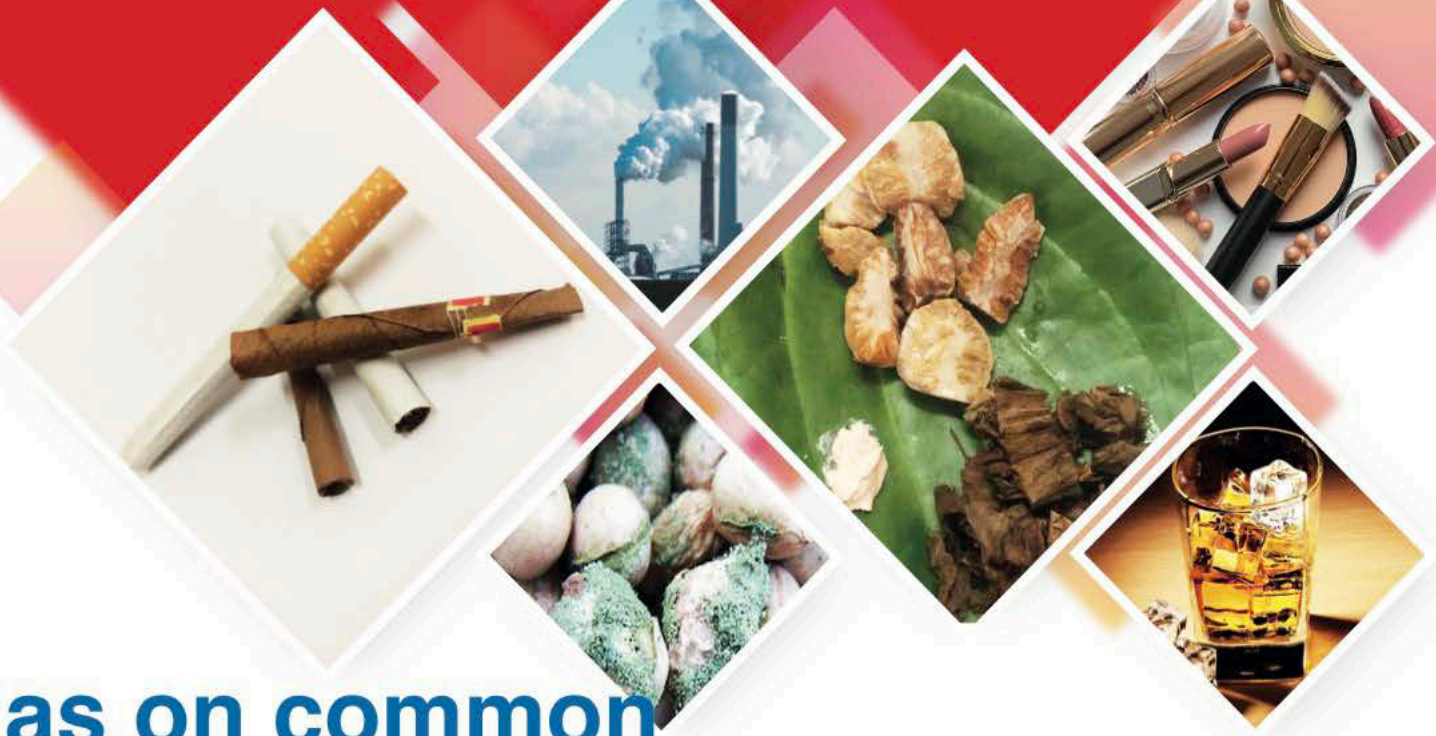


Atlas on common Human Carcinogens in Sri Lanka

National Cancer Control programme
Ministry of Health
2024

Atlas on common
HUMAN CARCINOGENS
in Sri Lanka

National Cancer Control Programme
Ministry of Health

First Edition – 2023

National Cancer Control Programme
Ministry of Health
Public Health Complex
No. 555/5, Elvitigala Mawatha
Colombo 05
Sri Lanka.
+94 11 2368627

Team of experts

Prof. Ajith de Alwis
Professor of Chemical & Process Engineering
Department of Chemical & Process Engineering
University of Moratuwa

Prof. Nirmalie Wickramaratne
Dean
Faculty of Medicine
University of Sabaragamuwa

Dr. Renuka Jayatissa
Head, Department of Nutrition
Consultant Medical Nutritionist & Consultant Community Physician
Medical Research Institute, Ministry of Health
Visiting Consultant Clinical Nutritionist
National Hospital of Sri Lanka

Dr. Inoka Suraweera
Consultant Community Physician
Directorate of Environmental & Occupational Health
Ministry of Health

Mr. Chathura Malwaana
Director
Chemical & Hazardous Waste Management Unit
Central Environmental Authority

Dr. Nirmalie Champika
Director General
National Institute of Occupational Safety & Health

Dr. Nurad Joseph
Clinical Oncologist
Ministry of Health
Sri Lanka

Dr. Anoma Basnayake
Consultant Community Physician
Nutrition Division
Ministry of Health

Dr. Lakshan Abeynayake
Clinical Oncologist
Ministry of Health
Sri Lanka

Dr. Charith Hettiarchchi
Consultant Community Physician

Dr. Eshani Fernando
Director
National Cancer Control programme

Dr. Hasarali Fernando
Consultant Community Physician

Dr. Suraj Perera
Consultant Community Physician

Dr. U. Usgodaarachchi
Consultant Community Dentistry

Dr. Irosha Nilaweera
Consultant Community Physician

Dr. Muzrif Munaz
Consultant Community Physician

Editorial Committee

Dr. Hasarali Fernando, Consultant Community Physician

Dr. Saddharma Weerakoon, Senior Registrar in Community Medicine

Dr. Nadisha Rathnasekara, Senior Registrar in Community Dentistry

Dr. Thusitha Kahaduwa, Medical Officer

Dr. Kalumi Leelarathna, Medical officer

Dr. Dulanjali Laxamana, Medical Officer

Dr. Percy Rajiv Sylvester, Medical Officer

Mrs. Niroshini Rajakaruna, Public Health Nursing Sister

Message from the Director General of Health Services

In a context where cancer is one of the leading causes of premature deaths in the world as well as in sri lanka, I would like congratulate the National Cancer Control Programme for embarking on developing an 'atlas' on confirmed carcinogens. This is a timely intervention where proper knowledge of carcinogens will enable us to take measures in reducing the exposure I wish to acknowledge the valuable contribution made by all the experts who lavishly offered their time and expertise. Thope this will be a turning point in preventing can cers in Sri Lanka.

Dr. Asela Gunawardena
Director General of Health Services
Ministry of Health

Message from the Deputy Director General
Non-Communicable Diseases

Dr. Champika Wickramasinghe
Deputy Director General
Non-Communicable Diseases
Ministry of Health

In spite of all the efforts taken inpreventing and controlling cancer, Sri Lanka is experiencing an increasing trend in cancer cases. One main strategy to address this trend would be to increase awarness on carcinogens among professionals as well as the public. Althought the international Agency for Research on Cancer, published 127 carcinogens already, this document is highly scientific and printed only in English. This has limited access to the general public in sri lanka.

Therefore, being the national focal point in preventing and controlling cancers in Sri Lanka, National Cancer Control Programme has developed this 'atlas' in all three languages which is highly reader friendly.

While i express my heartiest congratulation to the National Cancer Control Programme, I would like to extend my gratitude to all the eminent experts who supported this worthy cause right from the beginning. I wish that this atlas would enlighten our public with regard to carcinogens and empower all to take action to reduse the exposure to carcinogens.

Message from the Director
National Cancer Control Programme

Out of all the measures taken to prevent and control cancers in Sri Lanka,Identifying the possible carcinogens and increasing awareness about them among the public could be considered as one of the best strategies that National Cancer Control has embarked on. This 'atlas' was based on the scientific publication by the International Agency for Research an Cancer

This exercise involved an array of experts without whom this product wouldn't have been a reality. I take this opportunity to thank all the experts for the tremendous guidance they provided during this project. Finally, I hope this 'atlas' would give peoper scientific knowledge on how to minimize the carcinogen exposure and dispel the myths & wrong practices amoung us.

Dr. Eshani Fernando
Director
National Cancer Control Programme

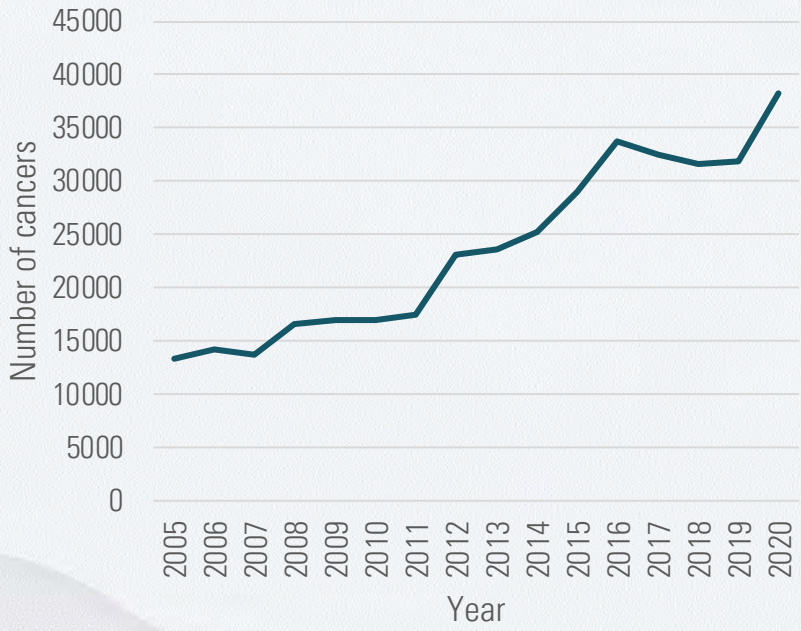
Preface

As the national level focal point, the National Cancer Control Programme (NCCP) is closely monitoring the trend of cancer incidence in Sri Lanka which has become a major public health concern.Inevitably, cancer prevention is a key strategic area when implementing cancer control activities to overcome the increasing disease burden. Cancer prevention is primarily focused on steps which minimize the exposure to carcinogens. Therefore, awareness about carcinogens among the public and healthcare staff is very important. The NCCP has observed that the understanding about carcinogens is not satisfactory among the public. Misconceptions and misbeliefs have made the situation more complicated. The NCCP believes that the dissemination of scientifically confirmed information on carcinogens in native languages may improve the knowledge gap among the public and the health staff. During initial assessments, the NCCP learnt that IARC monographs on carcinogens published by the WHO are the key source of information on carcinogens available globally. These monographs were in English language, and they were highly technical documents. Therefore, the NCCP decided to develop an atlas on human carcinogens in all three languages (Sinhala, Tamil and English) based on those IARC monographs.

Understanding the complexity of the task, the NCCP formed an expert committee including leading experts in different disciplines. During the process, the expert committee decided to exclude some carcinogens which are not relevant to Sri Lanka. After finalizing the initial draft, it was presented to a wider forum which included different levels of stakeholders (e.g.industrial sector) and their comments were obtained.

Based on the comments received, the document was revised and approval was taken from the Director General of Health Services. At the end of this complex process the atlas on common carcinogens in Sri Lanka was published. Finally, the NCCP acknowledges the commitment of the members of the expert committee and the partnership given by the World Health Organization.

Introduction



Cancer trend in Sri Lanka

Incidence of cancer in Sri Lanka is gradually increasing. According to the Sri Lanka Cancer Registry, 17,451 males and 20,197 females were newly diagnosed with cancer in 2020. Oral cancer and breast cancer were the commonest cancers among males and females respectively. Cancer incidence has been increasing over the years, and the number has almost tripled during the last 20 years.

Why bother about carcinogens?

Clear understanding about the factors associated with the origin of cancer is vital in taking actions against cancer and can be considered as the first step in cancer prevention. Cancer cells originate in the body due to genetic mutations which occur spontaneously as well as due to exposure to different types of chemicals, physical or biological agents (carcinogens) or due to ageing. It must be emphasized that exposure to a carcinogen does not necessarily mean that one will get cancer. A number of factors like genetic factors influence the likelihood of developing a cancer once exposed to carcinogens. However, according to research, knowledge about these carcinogens will decrease the risk of developing cancer if we take action to reduce the exposure.

IARC defines carcinogens as “any agent/exposure which is capable of increasing the incidence of malignant neoplasia”. Many research findings are published annually on potential carcinogens. The IARC working group of scientists has classified these agents into several categories based of the strength of evidence available on carcinogenicity (Figure 1). These publications are called IARC monographs. This document is based on “Group 1” containing 127 (Annex I) carcinogens.

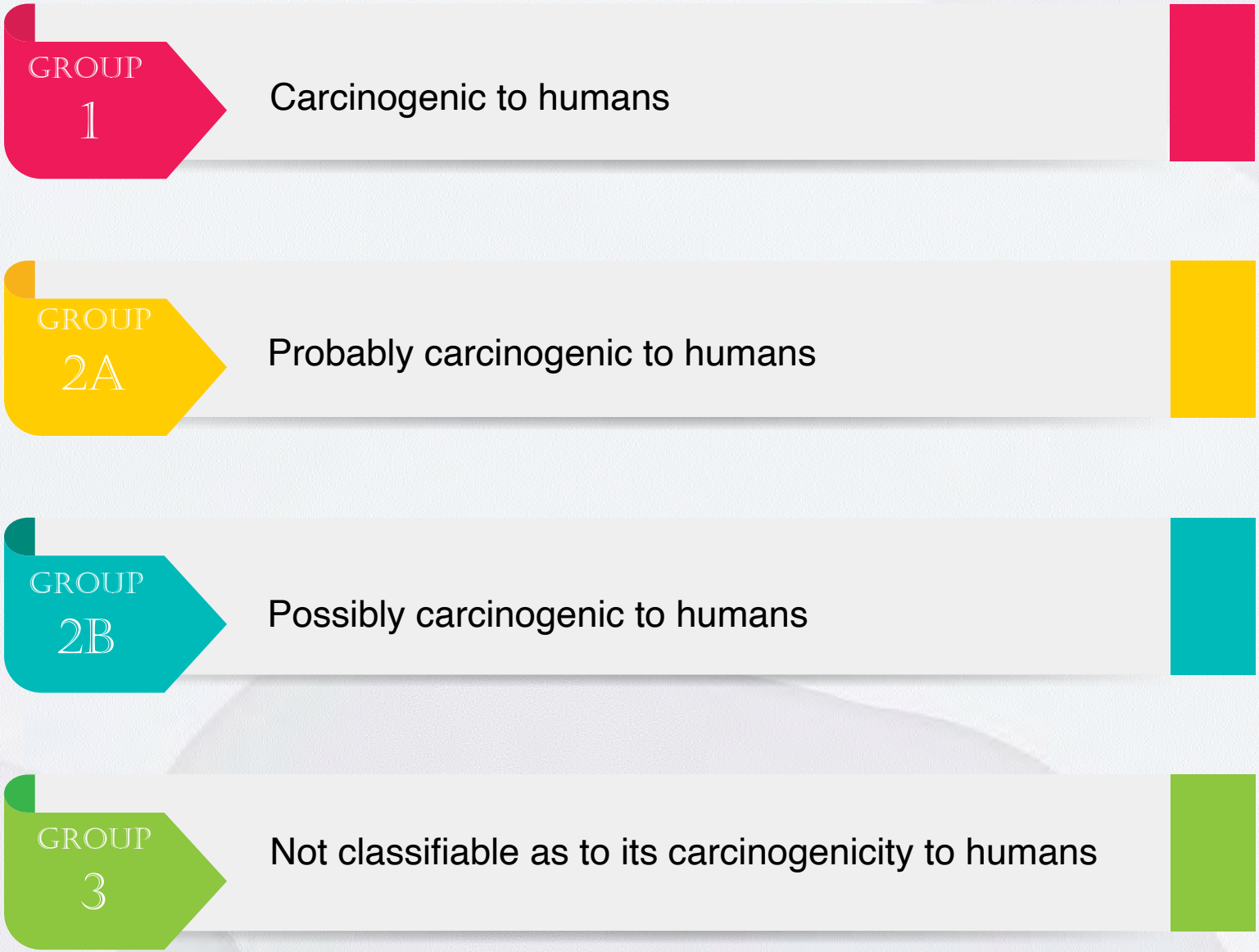


Figure 1- IARC Clasification of carcinogens

Our response

Exposure to some of these carcinogens could be avoided by stopping the usage. However, some of these carcinogens mentioned in this list may not be possible to avoid fully due to its usefulness in some industries. In such situations, there are multiple accepted mechanisms to use them safely. Therefore, this publication has taken extra effort to emphasize correct usage and safety practices in different settings. Based on the recommendations of the expert panel, the most important safety measures which are common to many industrial chemicals has been described separately (Annex II).

Way forward

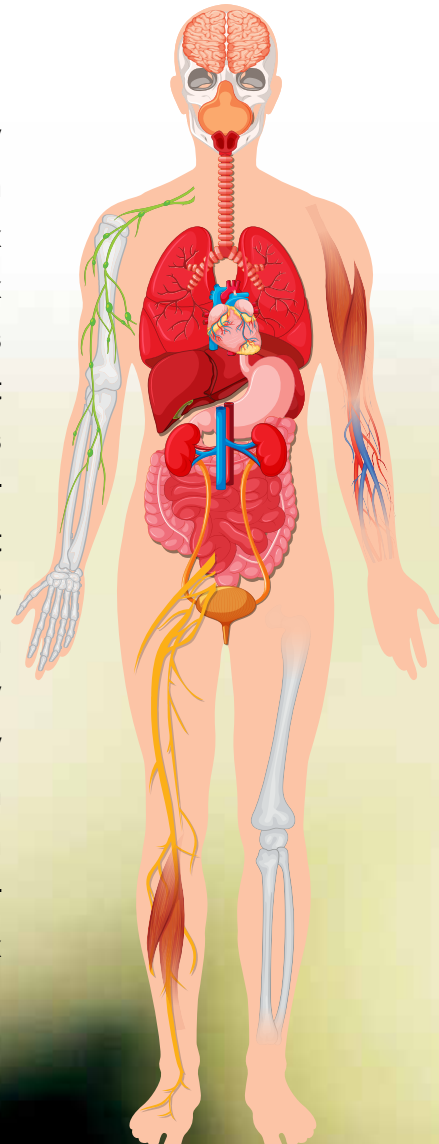
This is the first step of increasing awareness of the community on carcinogens.Based on the information published in this atlas relevant individuals,institutions and authorities can take precautions to reduce exposure to carcinogens in the workplace, environment, and elsewhere. However,legislative, or regulatory mechanisms against these agents could not be implemented based on the content of this atlas. This is an extremely simplified version which was purely developed for educational purposes. Appropriate regulatory mechanisms should be developed by relevant institutions.

Tobacco

Smoking
Passive smoking and
smokeless tobacco Tobacco
chewing
can cause cancer

Cancer site

Nasal cavity
Mouth
Pharynx
Larynx
Oesophagus
Breast
Lungs
Liver
Bile duct
Pancreas
Stomach
Kidney
Ovary
Colon
Rectum
Urinary bladder
Uterine cervix

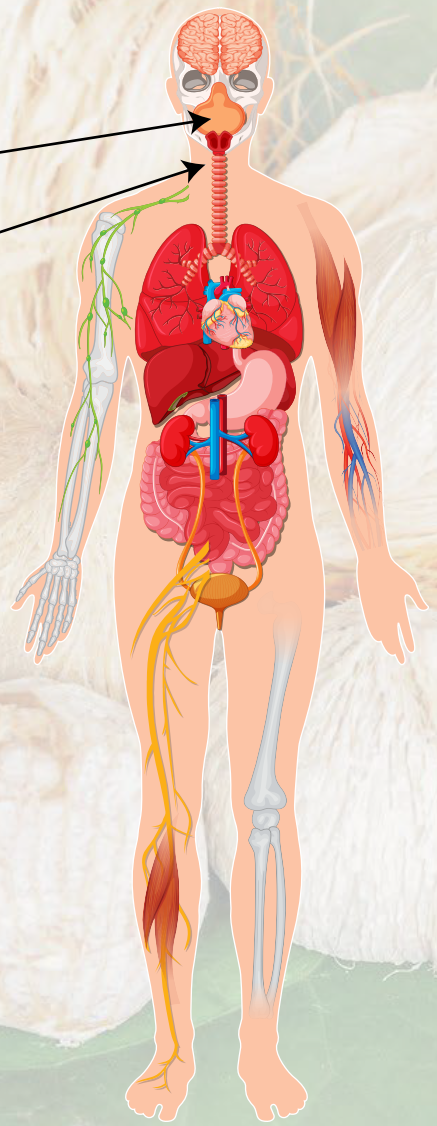


- Stop consumption of any form of tobacco
- Help line to Quit : 1948

Tobacco containing products

Areca nut

Cancer site



Health tip

- Avoid the habit of frequent betel quid chewing containing areca nut
- Be aware of the different types of areca nut packets in the market and avoid them.
- Educate children about the hazards of using areca nut packets available in the market.

Areca nut containing preparations

Betel quid

Areca nut packets (e.g. Mawa, Babul)

Alcohol

Cancer site

Mouth

Pharynx

Larynx

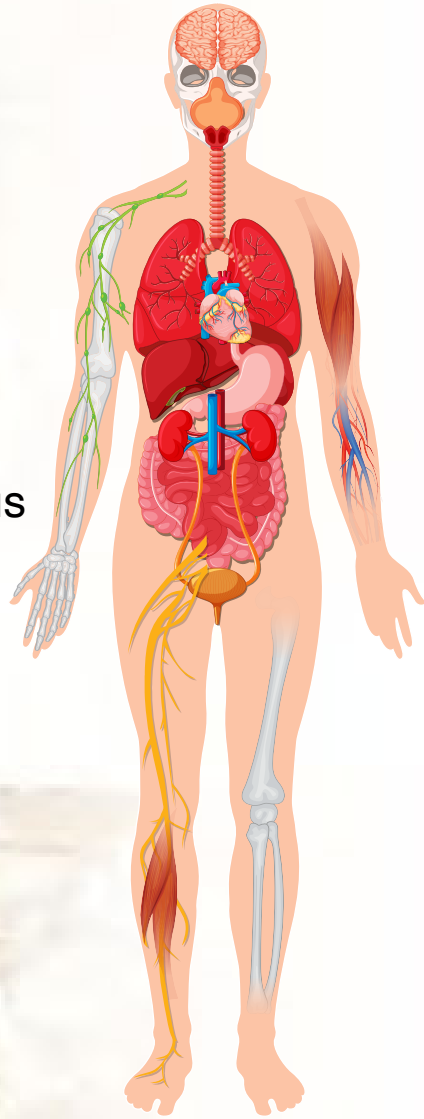
Breast

Oesophagus

Liver

Colon

Rectum



Health tip

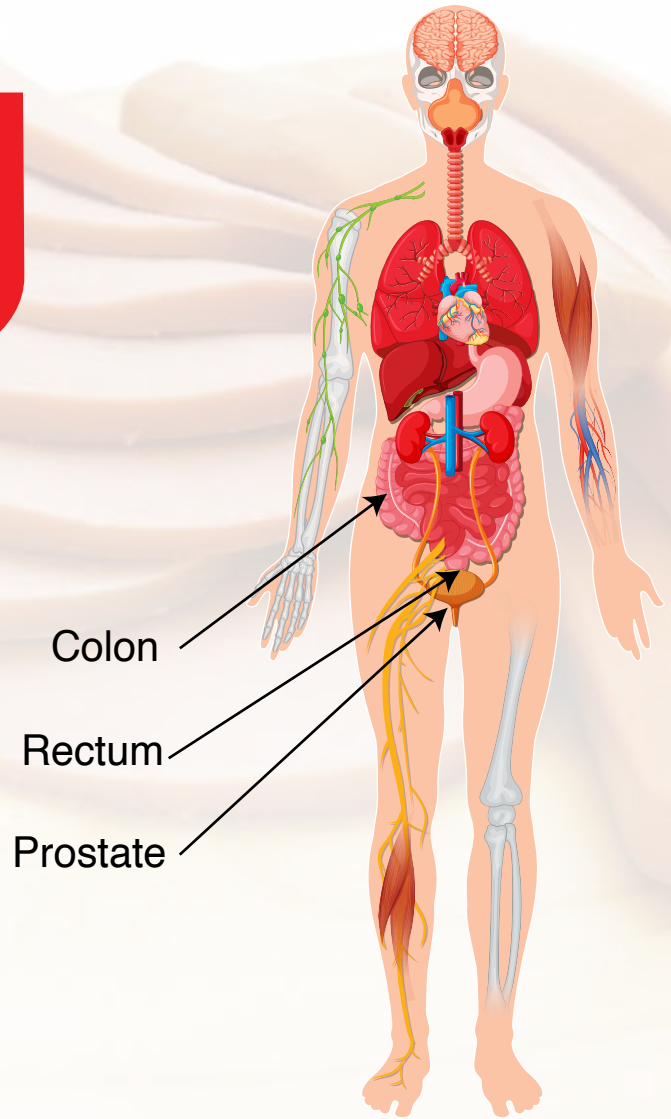
Avoid consumption of all types of alcohol.

Processed meat

Frequent intake of

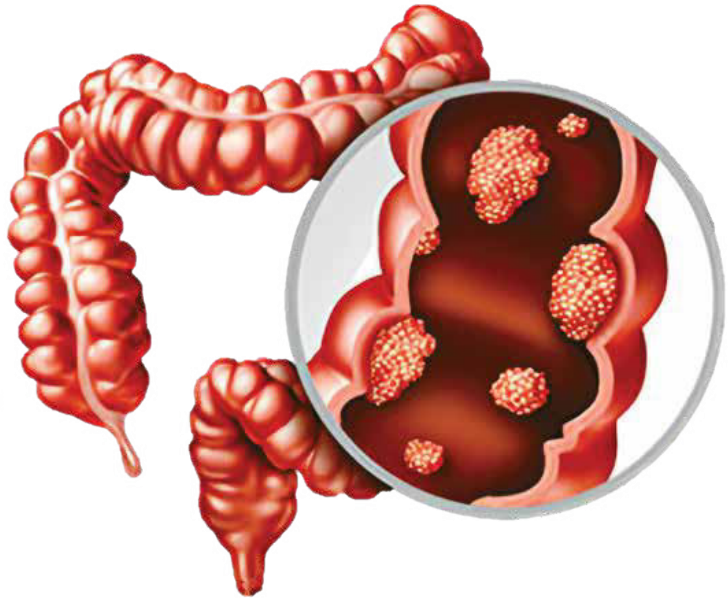
Hot dogs
Salami
Ham
Sausages
Cured bacon
Salted and cured Corned beef
Smoked meat
Dried meat
Beef jerky

Cancer site



Health tip

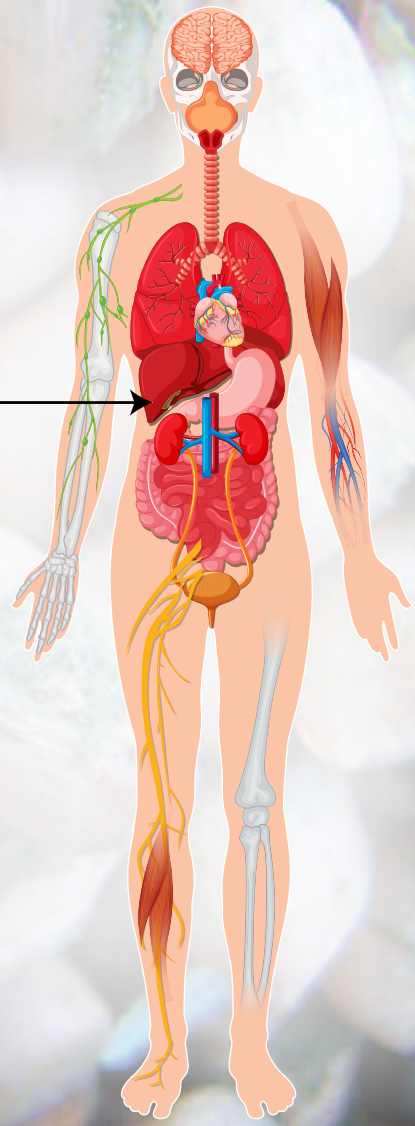
Minimize frequent usage of different forms of processed meat and replace with fresh meat.



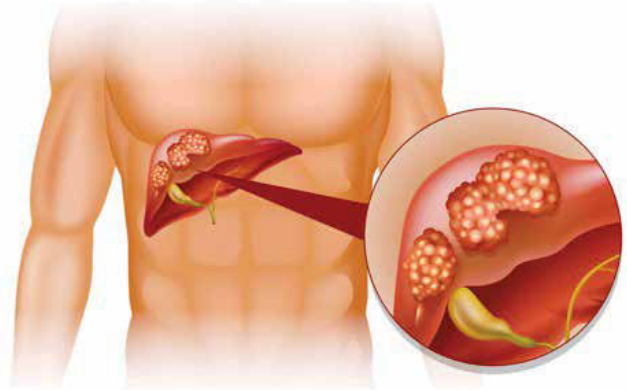
Aflatoxin

A class of toxic compounds produced by certain moulds found in food.

Cancer site



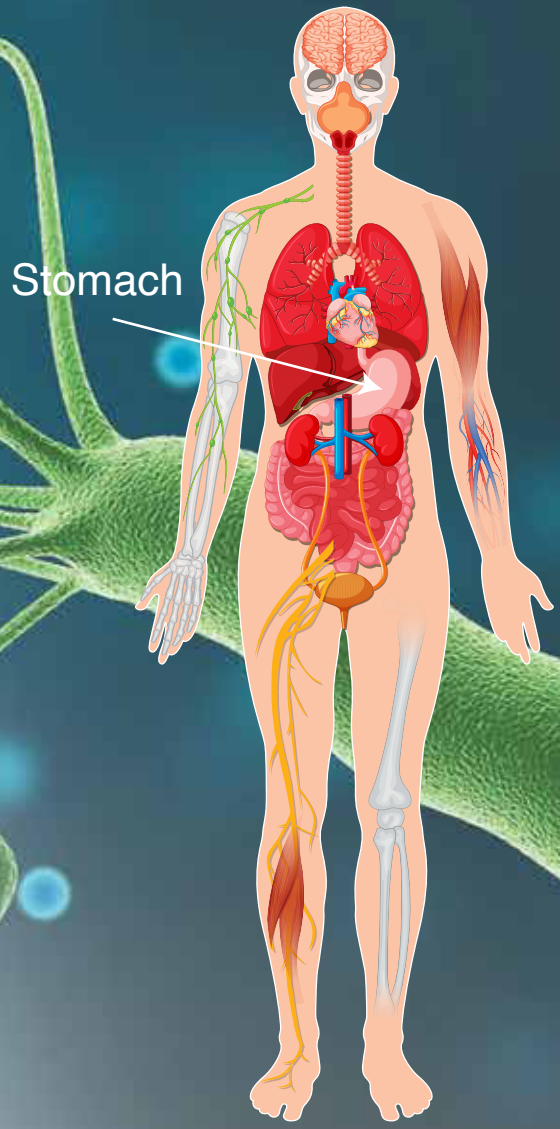
Health tip



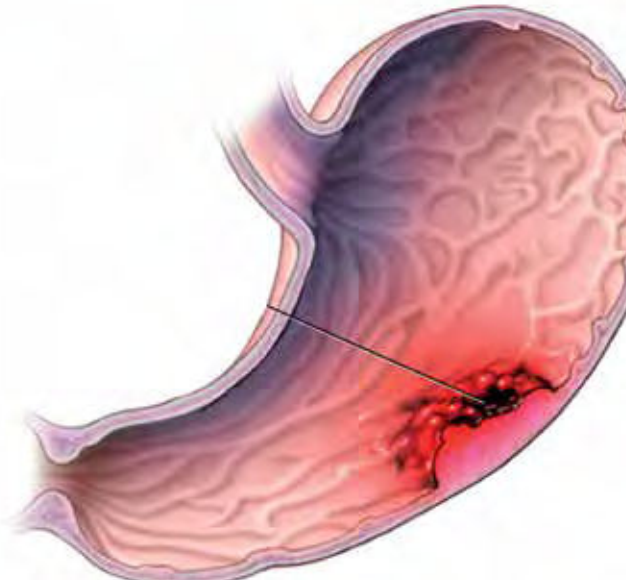
- Discard any food/nuts that looks moldy, damped, shriveled or discoloured
- Proper storage of food in dry and cool conditions.
- Food safety surveillance to identify unsuitable products in the market
- Use safe methods to produce food products

Helicobacter Pylori

Cancer site

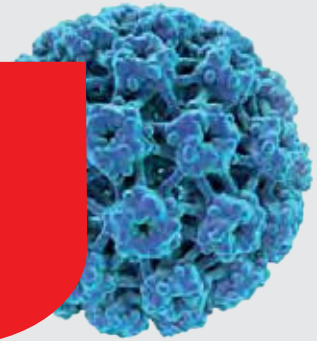


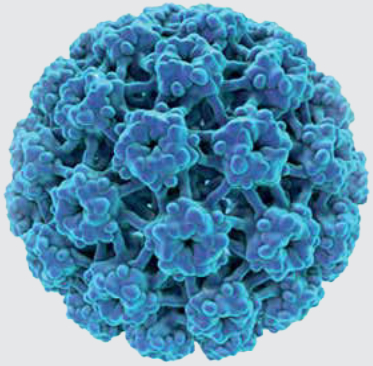
Helicobacter pylori is a bacteria found in stomach. Person to person transmission is possible through direct contact with saliva, vomitus or stools.

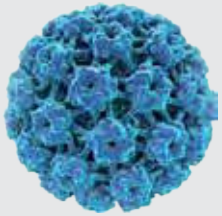


- Drink clean water
- Use clean water during food preparation.
- Wash your hands thoroughly (20 seconds) with soap and water before eating and after using the toilet

Human P apilloma Virus (HPV)







Cancer site

Oral

Oropharynx

Tonsil

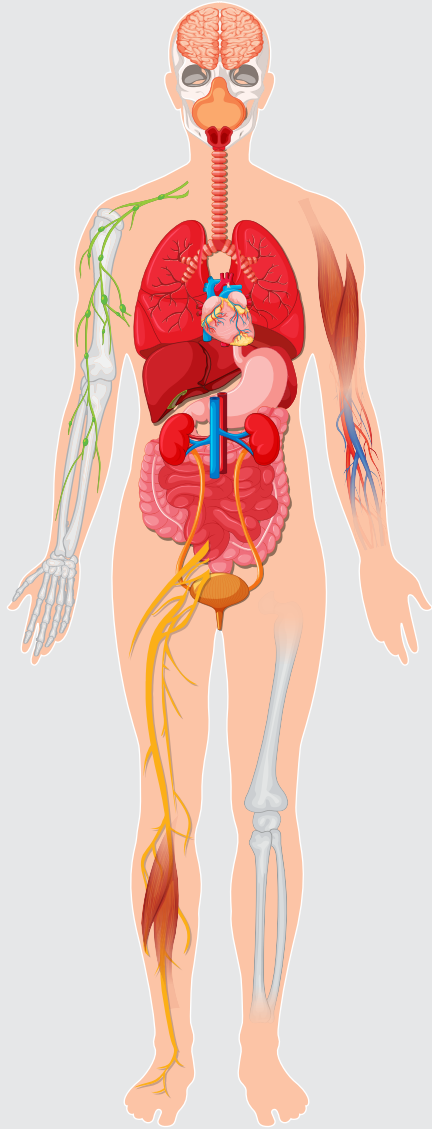
Vulva

Vaginal

Uterine cervix

Penis

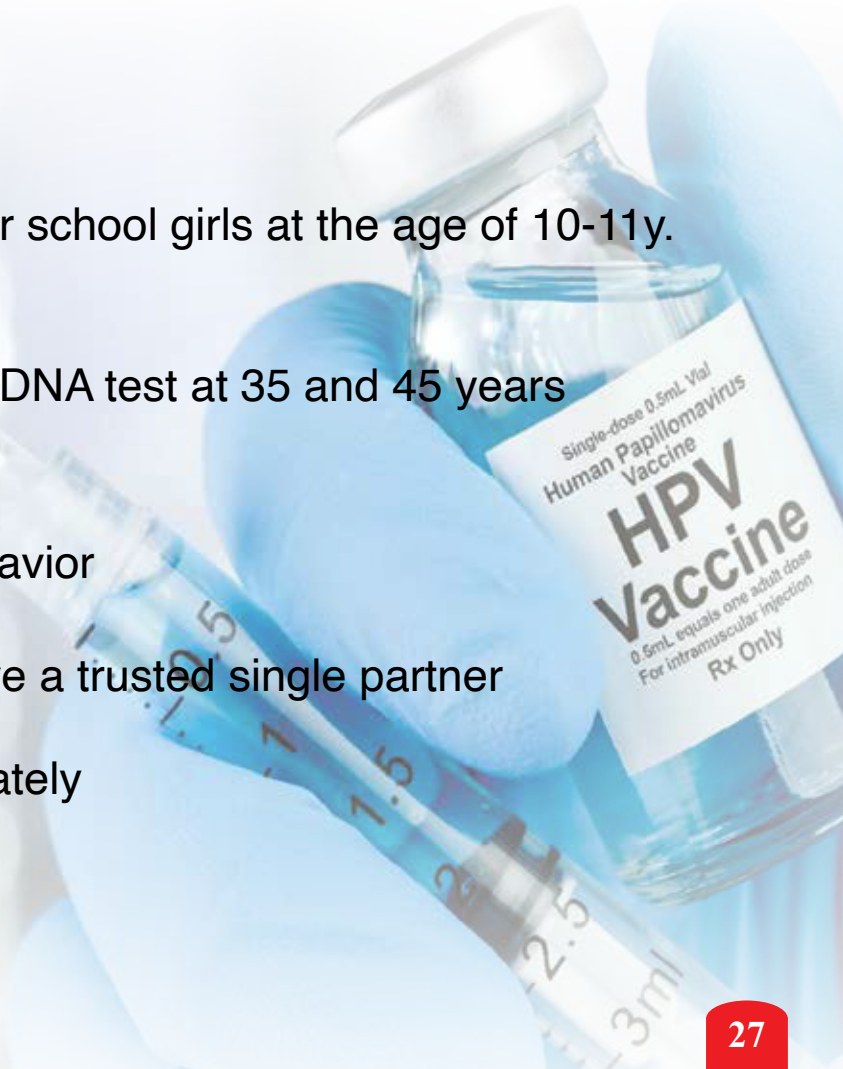
Anus



HPV is a sexually transmitted virus.
Commonest oncogenic genotypes are 16 and 18.
Other genotypes 31, 33, 35, 39, 45, 51, 52, 56, 58, 59 are also reported to be oncogenic.

Health tip

- Get the HPV vaccine: for school girls at the age of 10-11y.
- Do pap - smear or HPV DNA test at 35 and 45 years
- Responsible sexual behavior
- Engage in safe sex (have a trusted single partner
- Use a condom appropriately



Human immunodeficiency virus type 1 (HIV) I

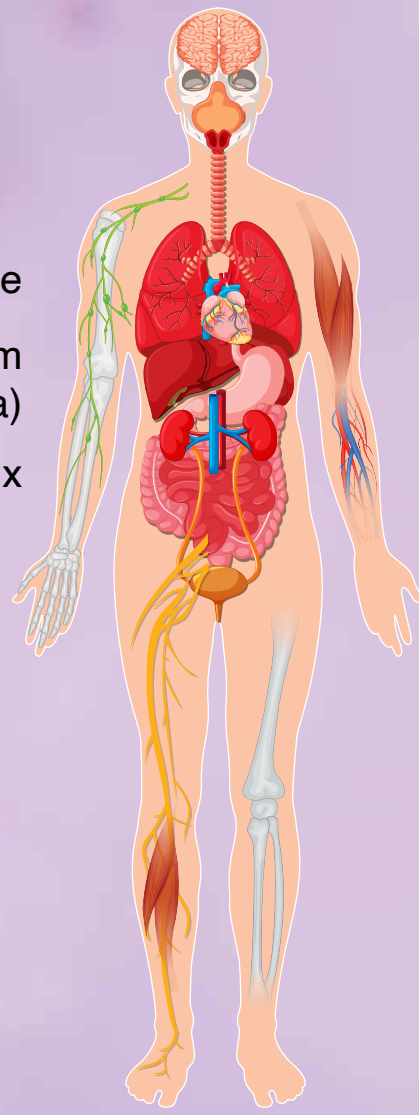
HIV can be transmitted through sexual contact, blood transfusion, and from mother to infant during delivery

Cancer site

Eye

Anus, Endothelium (Kaposi sarcoma)

Uterine cervix



Health tip

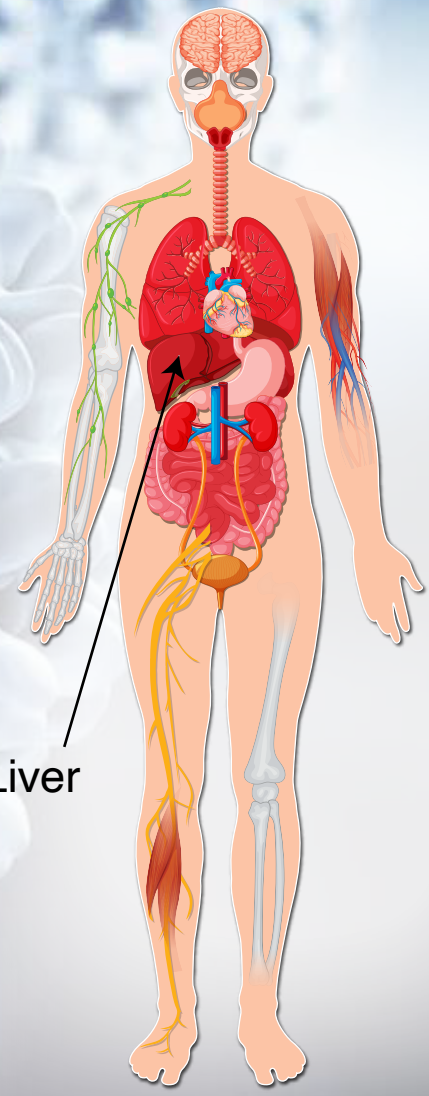
Take proper treatment if you are infected with HIV

- Responsible sexual behavior

- Engage in safe sex (have a trusted single partner)
- Use a condom appropriately

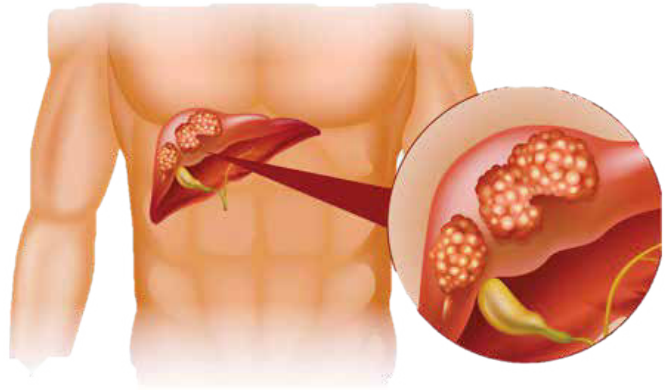
Hepatitis virus B and C

Cancer site



Hepatitis B virus can be transmitted through sexual contact.Both B and C viruses can be transmitted through blood products.

*Hepatitis C virus can cause Non-Hodgkin lymphoma in a ddition to liver cancers.



Health tip

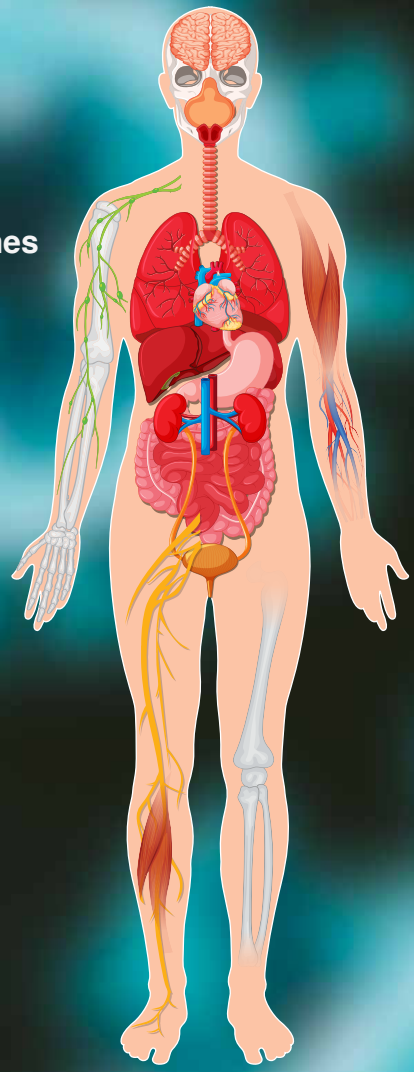
- Intravenous drug users have the highest chance of getting infected with hepatitis C. Therefore, avoid using intravenous drugs and at any instance do not share needles.
- Use protective measures when exposed to human blood or blood products directly.
- Don't share personal care items (Toothbrush, razors)
- Choose hygienic tattoo and piercing parlors.

Human Kaposi Sarcoma Herpesvirus (Human Herpes Virus {HHV8})

Cancer site

Skin

Mucous membranes



Kaposi's sarcoma is the most common cancer in HIV - infected untreated individuals.This is also known as human herpes virus 8 (HHV8).

Health tip

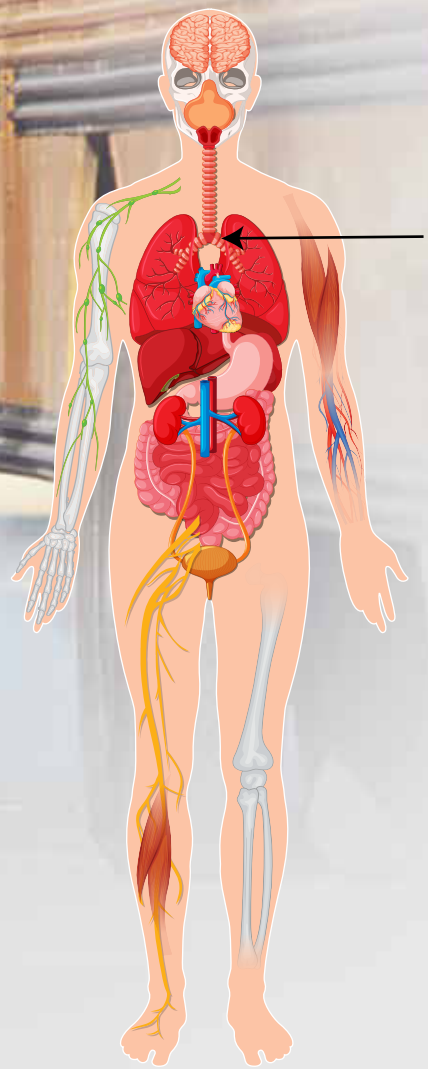
Take proper treatment if you are infected with HIV

Responsible sexual behaviol

- Engage in safe sex (have a trusted single partner)
- Use a condom appropriately

Diesel Engine Exhaust

Cancer site



Exposed occupations

Truck drivers, bus drivers, professional drivers mine workers, railroad workers, fork - lift truck operators traffic police, toll -booth workers

Health tip

- Follow the common instructions (Annex II)
- Turn off engines whenever possible
- Maintain a regular speed as much as possible
- Regularly maintain engines, ventilator systems and filters
- Use public transport whenever possible

X-ray and Gamma - Radiation

Cancer site

Brain and central nervous system

Salivary gland

Thyroid gland

Oesophagus

Breast

Lung

Stomach

Kidney

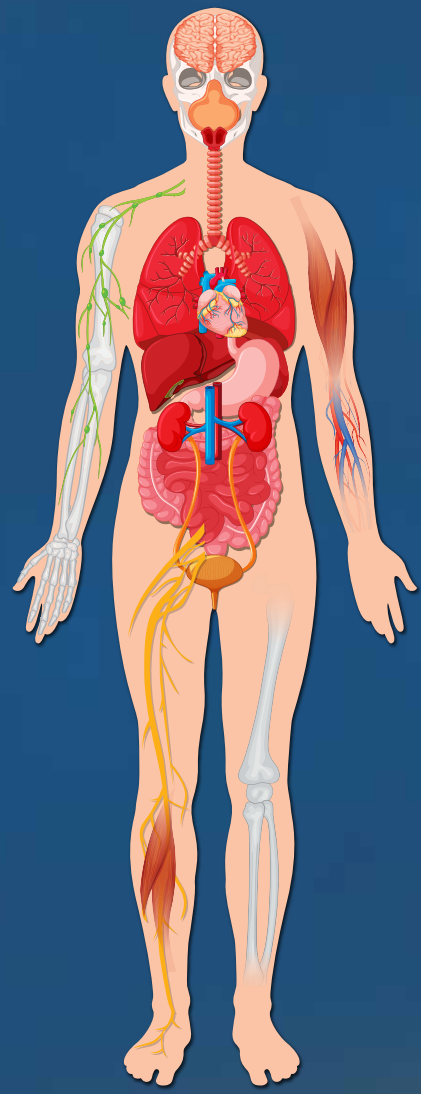
urinary bladderl

Bonel

Skin (non melanoma)

Leukaemia

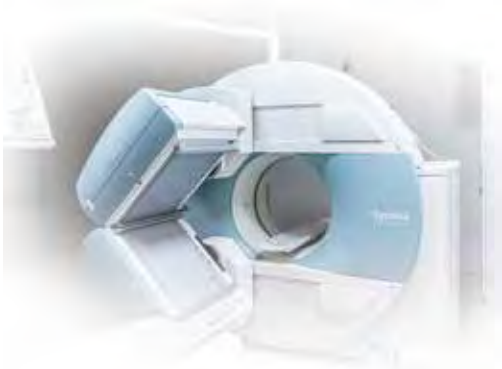
Lymphoma



Health tip

Community

- Ensure that you are obtaining medically ordered radiological investigations only.
- The health authorities have taken the measures to protect you from unnecessary exposure to X-rays.
- Keep to all the advice given by the health authorities.



For heath care workers

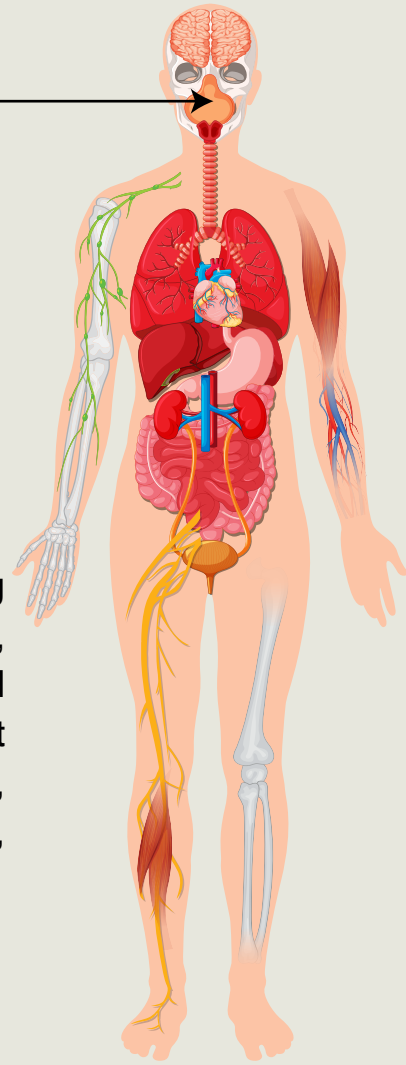
Please referenational guidelines on Radiantion Safty for Heath Sector

https://www.nccp.heath.gov.lk/storage/post/pdfs/RADIATION%20Full.pdf

Formaldehyde

Formaldehyde is a common colourless, strong - smelling chemical When dissolved in water it is called formalin, which is commonly used as an industrial disinfectant and as a preservative in funeral homes and medical labs. It can also be used as a preservative in some products, such as antiseptics, medicines, cosmetics, soaps, shampoos, sunscreens and cleaning products.

Cancer site



Health tip

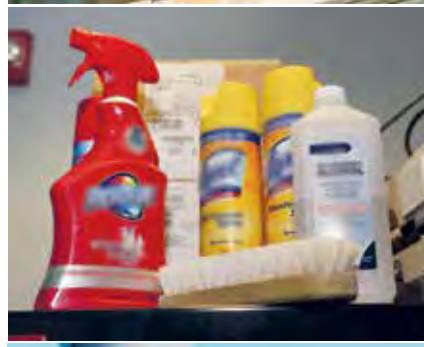
Community

- Maintain good ventilation inside houses

Occupational

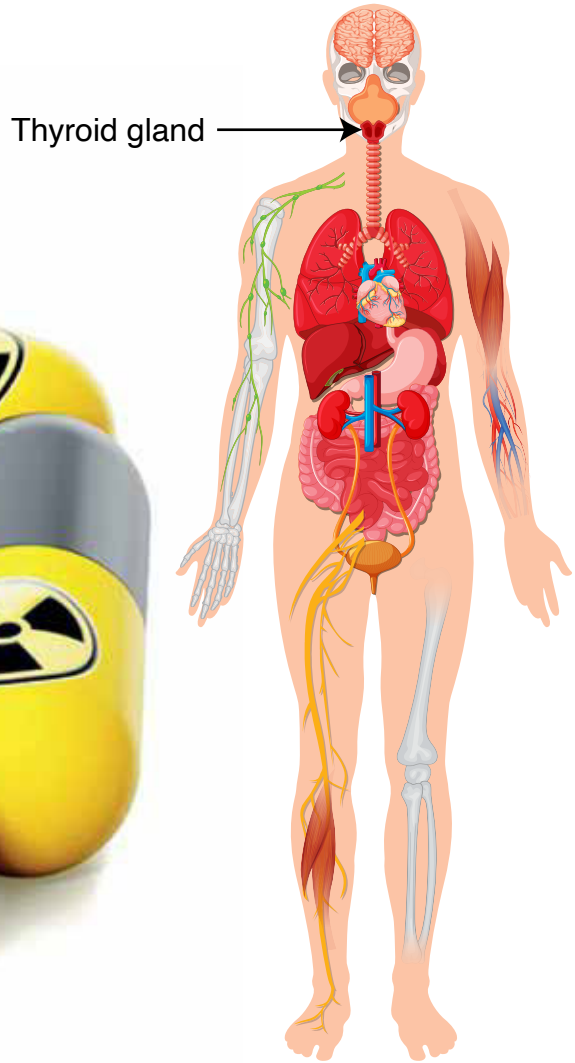
- Follow the common instructions (Annex II)

Exposed occupations - construction of plywood, chipboard, insulation materials, paint, plastic materials, textile industry, carpets, furniture, wall coverings, and household cleaning products. In anatomy, histology and pathology laboratories



Radioiodine including Iodine -13

Cancer site



Health tip

Community

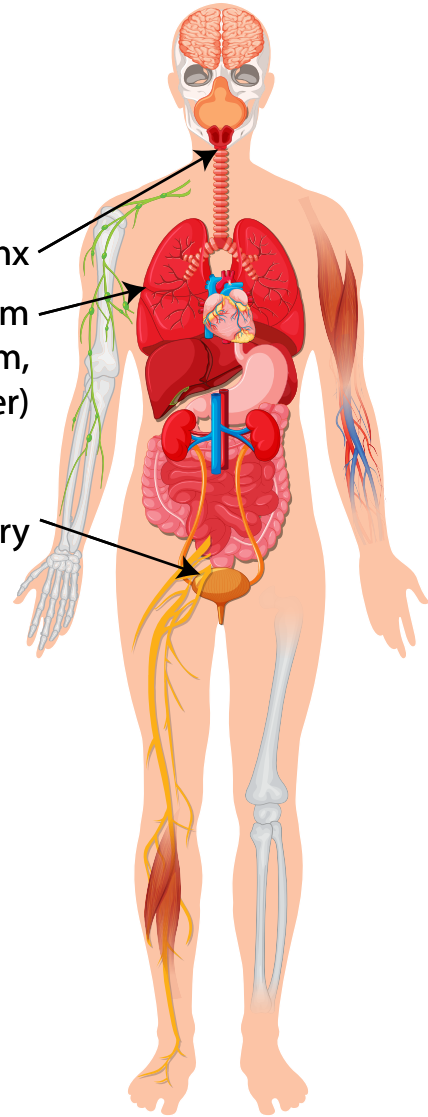
- The health sector has taken the measures to protect you from unnecessary exposure to radiation.
- Keep to all the advice given by the health sector.

Occupational

- Refer to National Guideline on Radiation Safety for health sector
  https://www.nccp.health.gov.lk/storage/post/pdfs/RADIATION%20Full.pdf

Asbestos

Cancer site



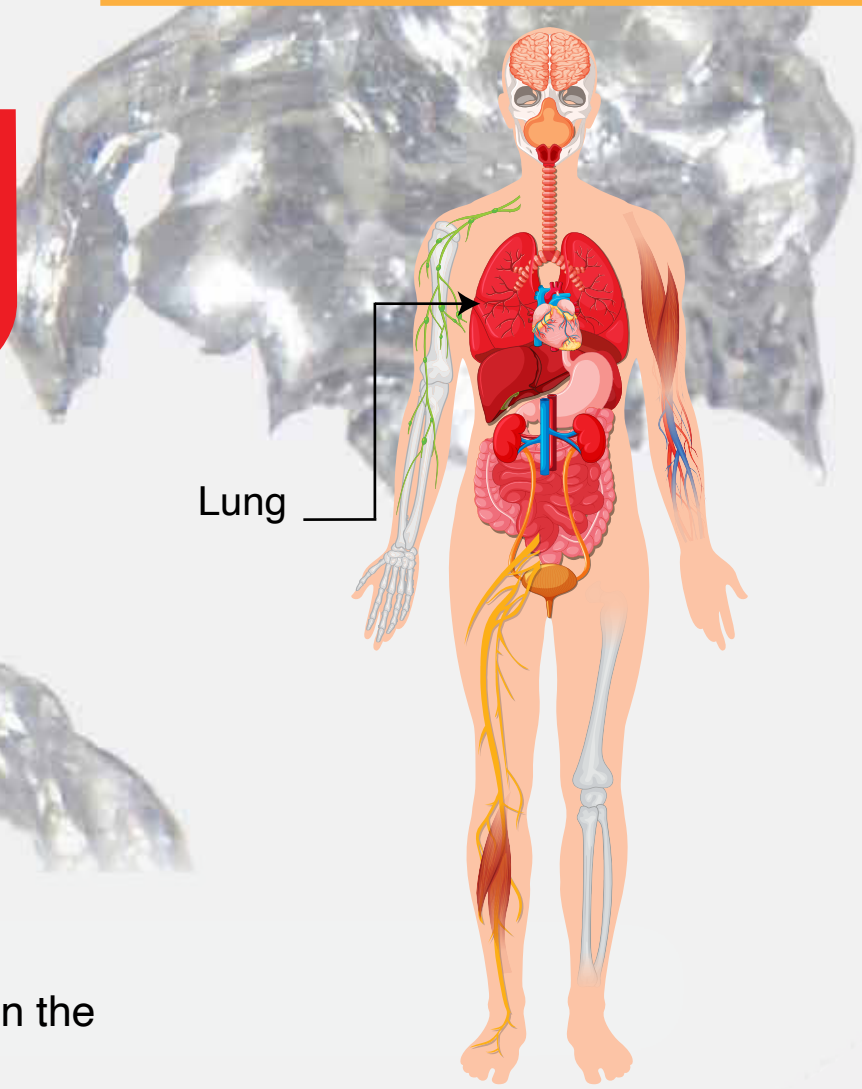
Community

- Minimize usage and use alternatives.
- Keep to all the advice given by the health sector.
- Broken parts should be handed and disposed carefully

Occupational

- Follow the common instructions (Annex II)
- Use protective measures while cutting asbestos.
- Make arrangements for the saf e disposal of any as bestos waste.
- When transporting cover the material and drive slowly

Cadmium and Cadmium compounds



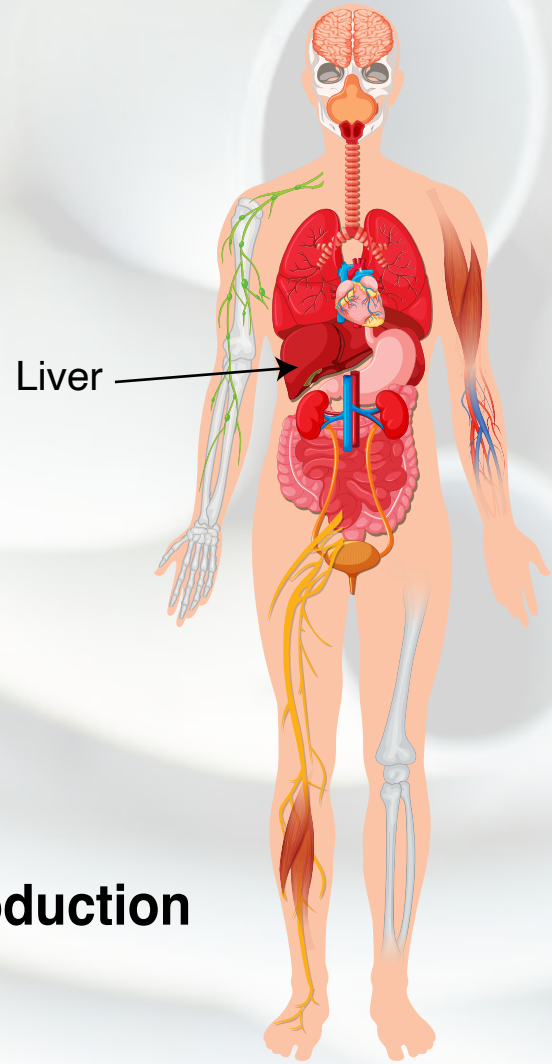
Smoking
Electronic waste
Food is the main source of cadmium intake in the nonsmoking population

- Managing your E-waste is highly important
- Use all your electronic devices carefully
- Reuse as often as possible
- Do not dispose your E-waste with the general household waste.
- Handover E-waste to a registered recycler in the Central Environment Authority

  (https://www.cea.lk/web/images/pdf/wm/WM/E-Waste_List__13.01.2023.pdf)
- Create awareness about E-waste among children

Vinyl chloride

Cancer site



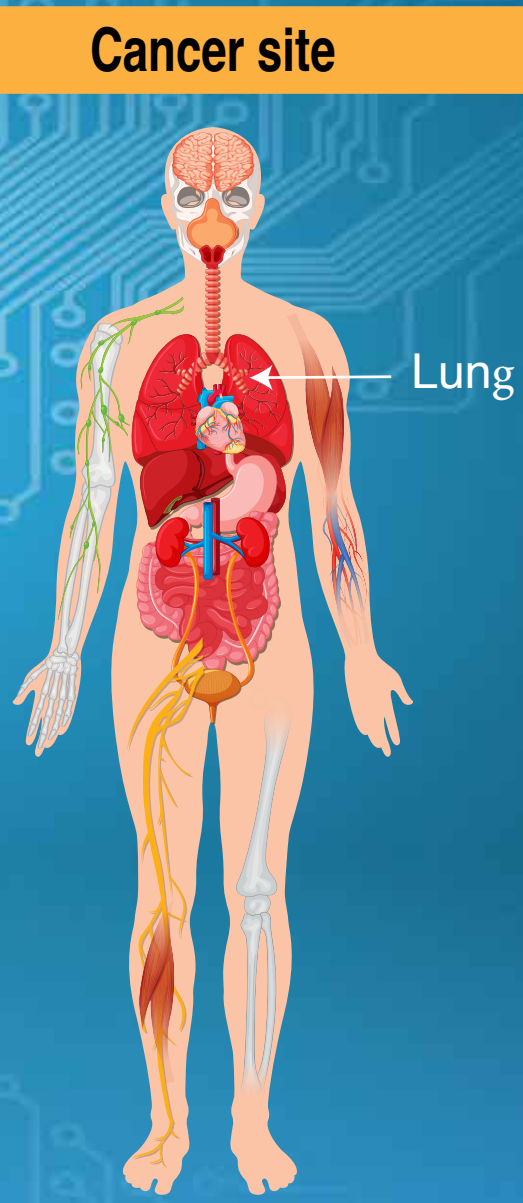
Water supply and irrigation pipes electricity cables and shoe manufactures commonly use Vinyl chloride for their production

Health tip

- Avoid using PVC for food packaging
- Industries which use Vinyl Chloride as an ingredient should follow the common safety instructions (Annex II)

Beryllium and Beryllium compounds

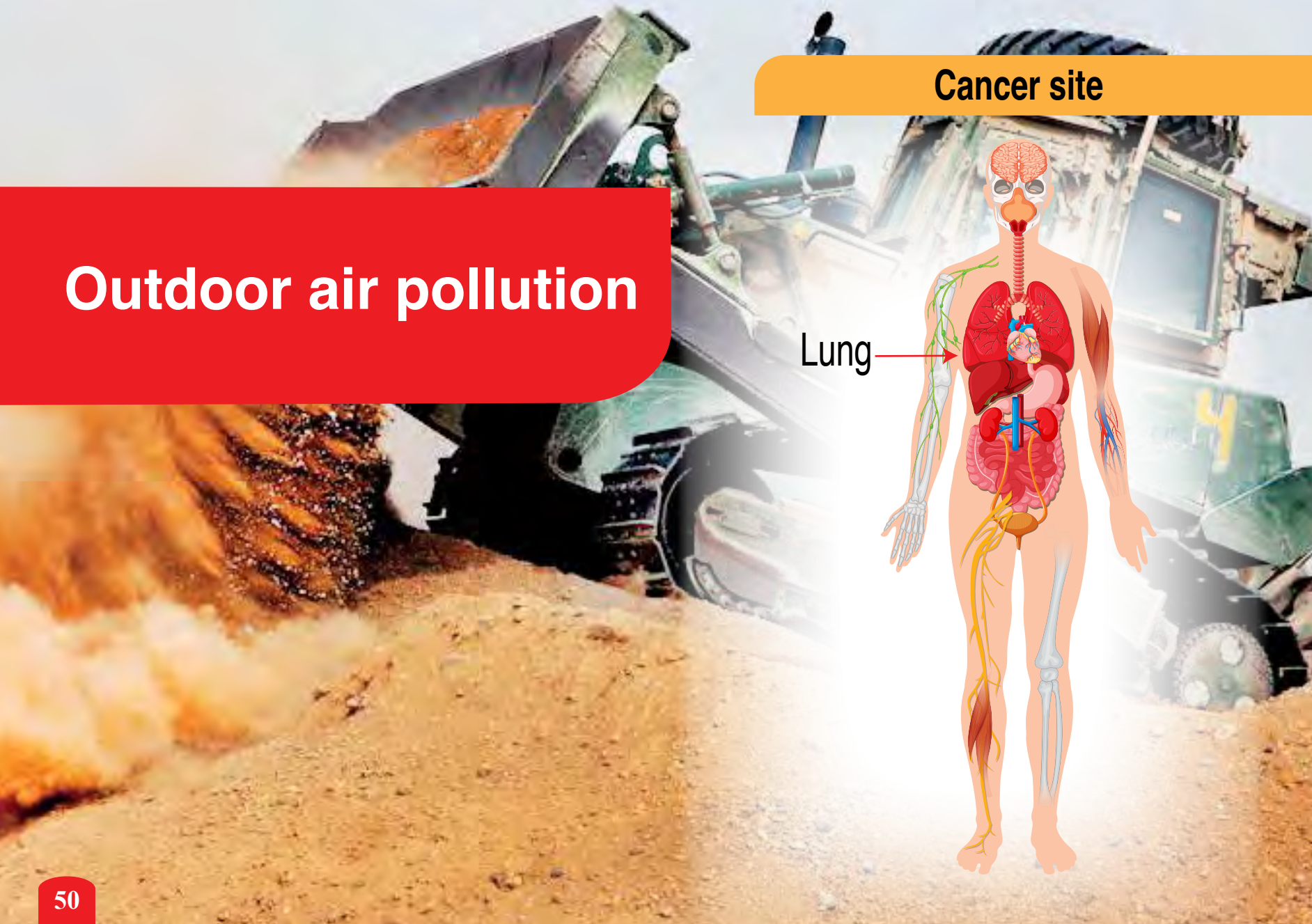
Found in Electronic -waste



Health tip

- Managing your E-waste is highly important
- Use all your electronic devices carefully
- Reuse as often as possible
- Handover E-waste to a registered recycler in the Central Environment Authority
  (https://www.cea.lk/web/images/pdf/wm/WM/E Waste_List_ -_13.01.2023.pdf)
- Create awareness about E-waste among children

Outdoor air pollution

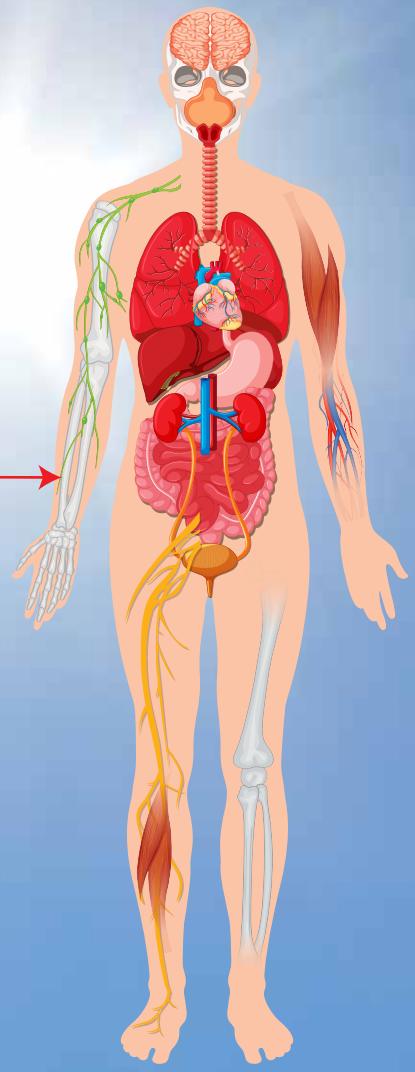


- Adhere to routine maintenance of vehicles
- Reduce the usage of vehicles and instead walk or ride bicycles
- Use public transportation as much as possible
- Avoid open burning of waste materials (eg. polythene, rubber etc.)

Solar radiation

(Wavelengths 100 l 400 nm, encompassing UVA,UVB, and UVC)

Cancer site



People who live in tropical countries like Sri Lanka have a reduced risk.

For people who have lesser amount of melanin are recommended to follow these instructions

Wear sunglasses that block both UVA and UVB rays.

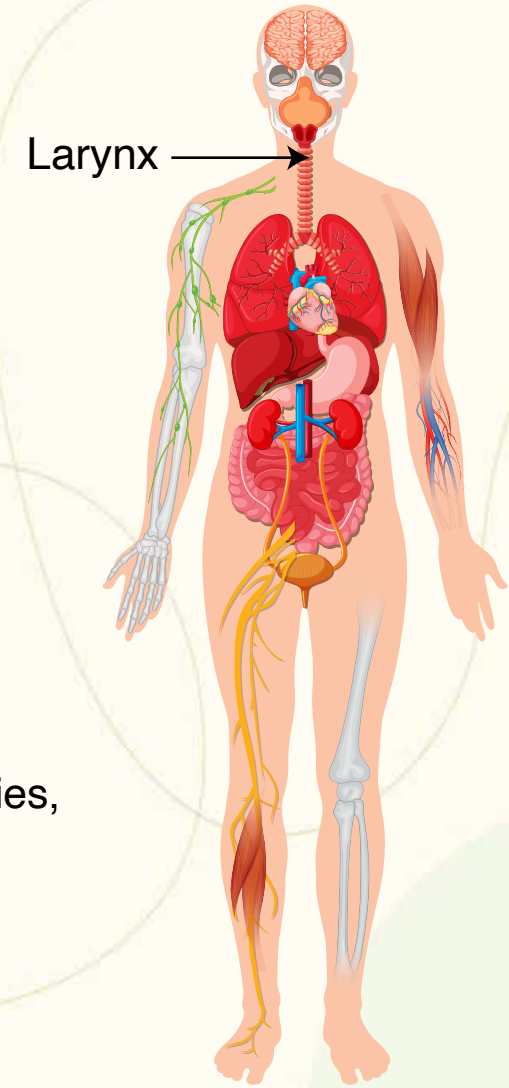
Use sunscreen with sun protection factor (SPF) 15 or higher, for protection from both UVA and UVB rays.

Acid mist

Exposed occupations

- Metal degreasing, galvanizing, battery manufacturing

- Isopropanol, synthetic ethanol phosphate fertilizers, lead batteries, soap and detergents industries

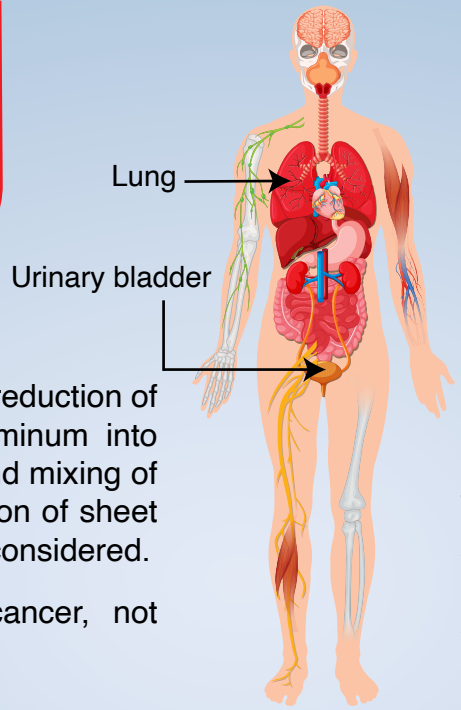


Cancer site

Health tip

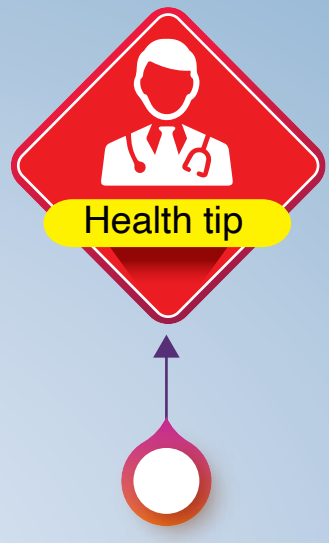
Follow the common safety instructions (Annex II)

Aluminium production



Involves processes such as the electrolytic reduction of alumina to aluminum, and casting of aluminum into ingots. The mining of bauxite, production and mixing of alumina from bauxite, alloying and fabrication of sheet metal, foil and other such products are not considered.

(Only production of aluminum causes cancer, not cutting and handling)



The risk of cancer is only in production of Aluminum and not through handling and cutting of Aluminum products. However Aluminum products can cause other adverse health effects.

Cancer site

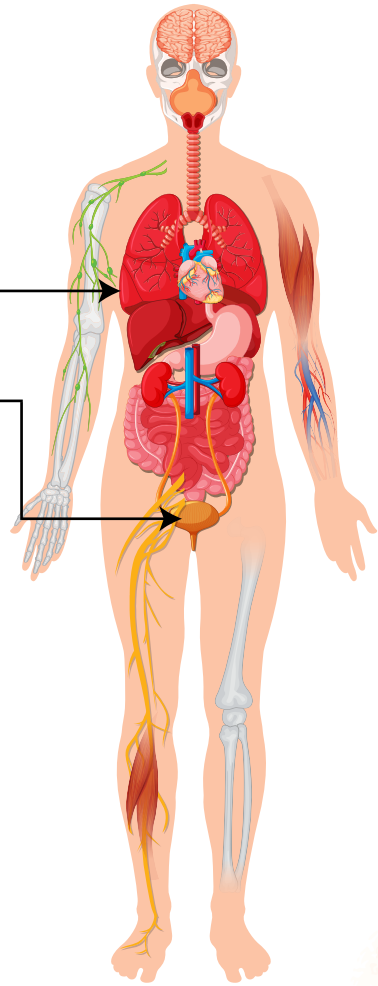
Occupational exposures

Aluminium scrap recycling, ingots production and aluminium kitchen wear production industries

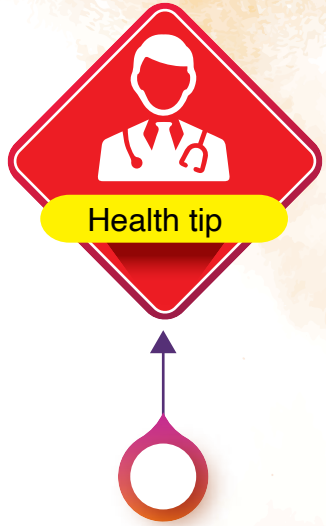
- For occupations involved in Aluminum production/recycling should follow the common safety instructions (Annex II)

Rubber manufacturing industry

The risk of cancer in the natural rubber production is minimal. However in the industries which use rubber for production of tires, carpets, gloves etc. have a risk of cancer due to the chemicals involved.



Cancer site



Follow the common safety instructions (Annex II)

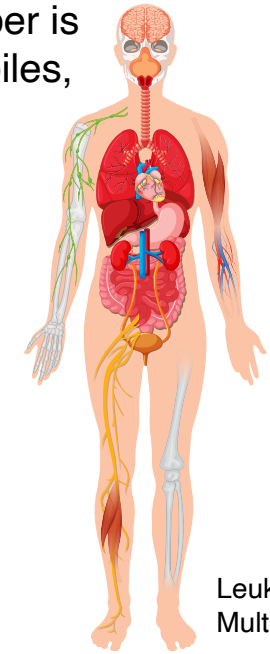
Regularly monitor lung functions of the workers

1,3-Butadiene

Butadiene is used primarily in the production of synthetic rubbers and polymers. Butadiene based rubber is commonly used in the production of automobiles, construction materials and appliances

Exposed occupations

- Cable manufacturing industries in Sri Lanka



Leukaemia
Multiple myeloma

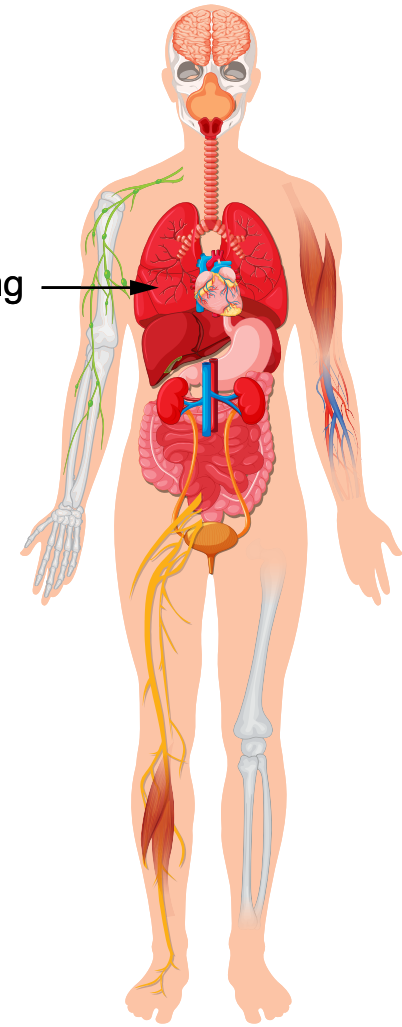
Cancer site

Follow the common safety instructions (Annex II)

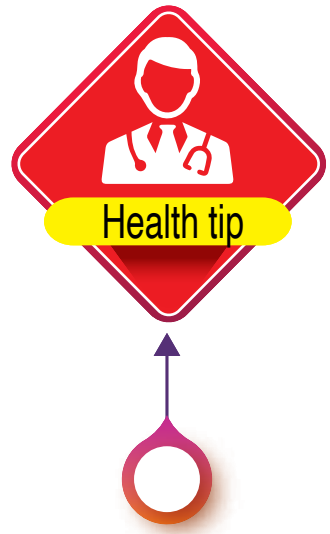
Iron and steel founding

Exposed occupations

- Cocupations related to iron and steel founding (Moulding and melting).



Cancer site

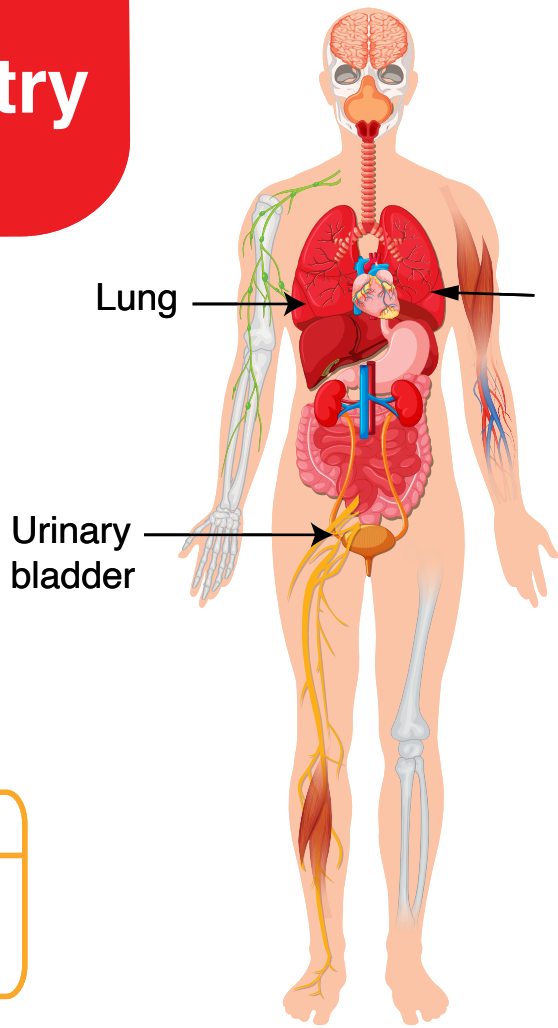


Follow the common safety instructions (Annex II)

Painting Industry

Exposed occupations

- Paint manufacturers
- Painters



Cancer site

Health tip

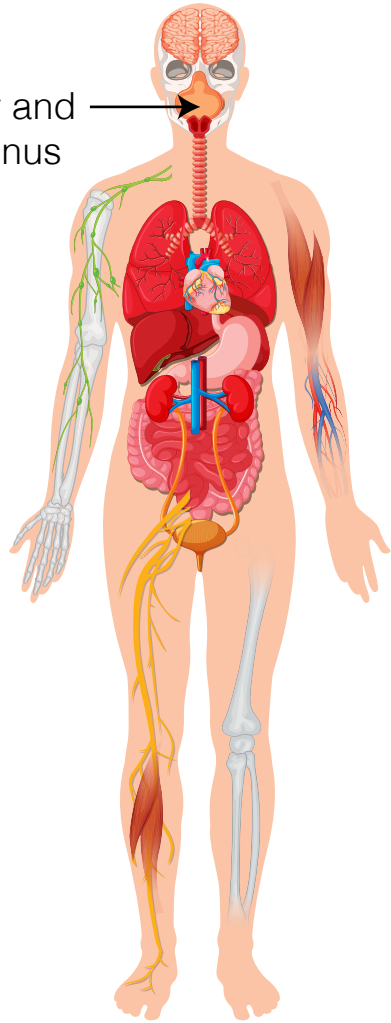
Mesothelium (pleura, peritoneum, and other)

Follow the common safety instructions (Annex II)

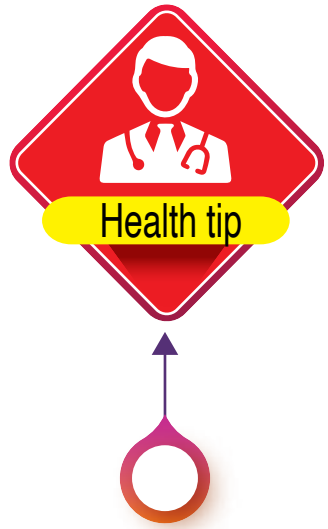
Wood dust

Exposed occupations

- Carpenters
- Mill workers



Cancer site

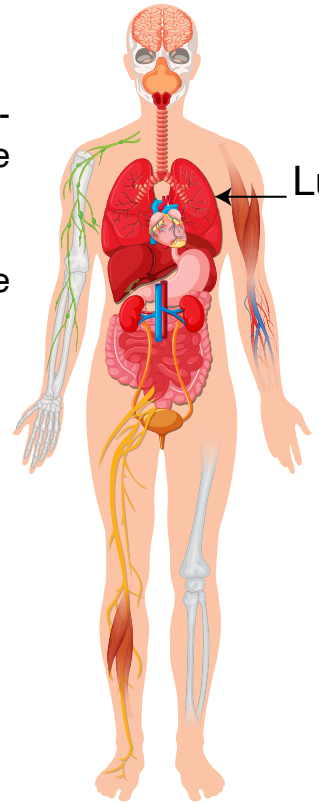


Follow the common safety instructions (Annex II)

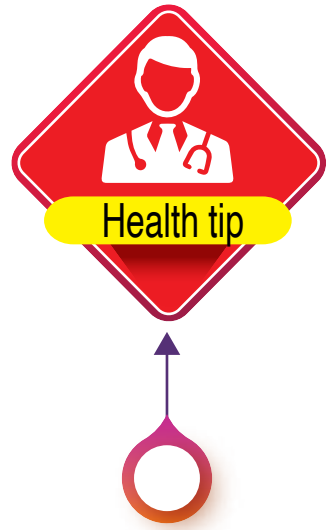
Silica dust & crystalline (in the form of quartz or cristobalite)

Inhalation of crystalline silica during the use of commercial products containing quartz is thought to be the primary route of exposure

Commercial products containing quartz include cleansers, cosmetics, art clays and talcum powder.



Cancer site

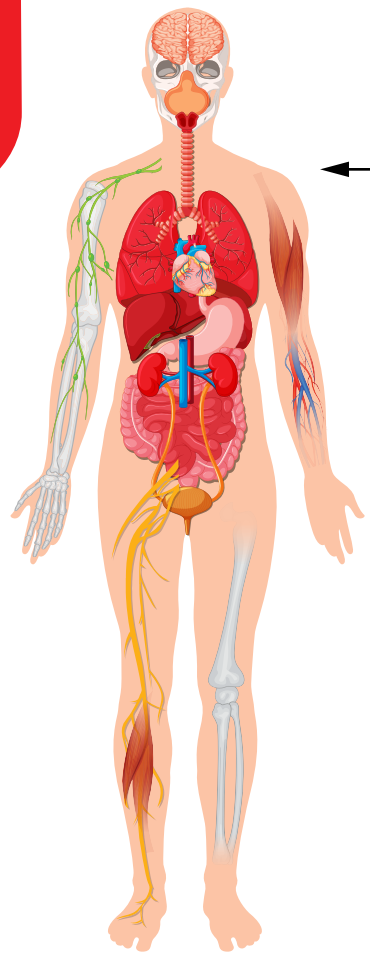


Water should be used at places where dust is released. (Aqueous working - wet method)

Follow the common safety instructions (Annex II)

Mineral oils (Unrefined)

Mineral oils are chemical substances prepared from naturally occurring crude petroleum oil. They are combinations of paraffins, naphthene, and aromatic oils.



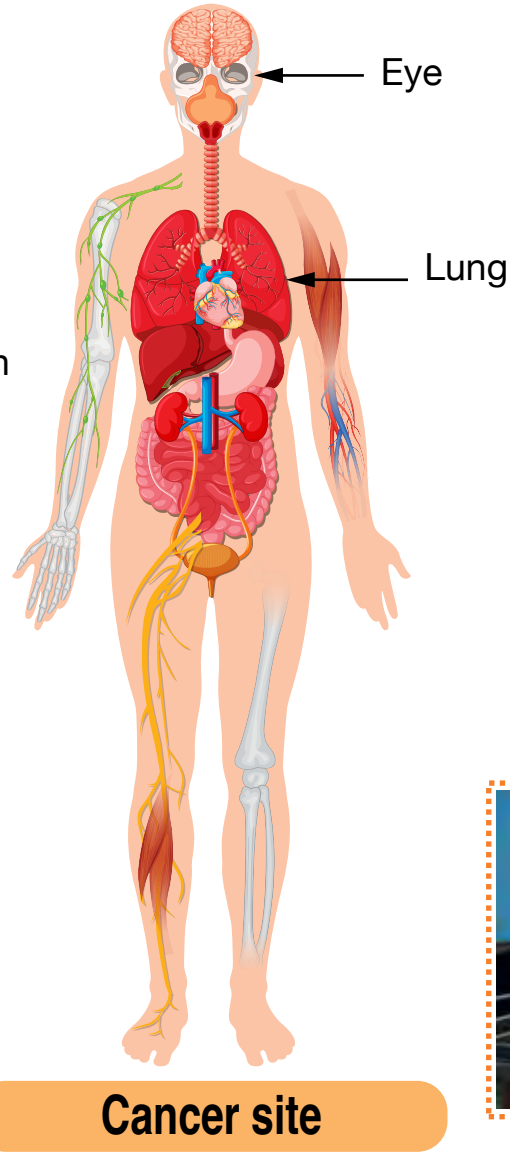
Skin (malignant non melanoma)

Cancer site

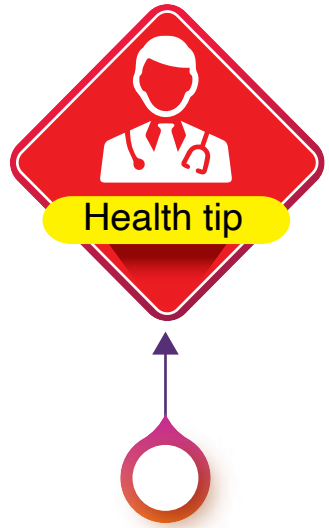
Follow the common safety instructions (Annex II)

Welding fumes

Welders are exposed to a variety of airborne contaminants arising from the welding process and other operations in the workplace.



Cancer site

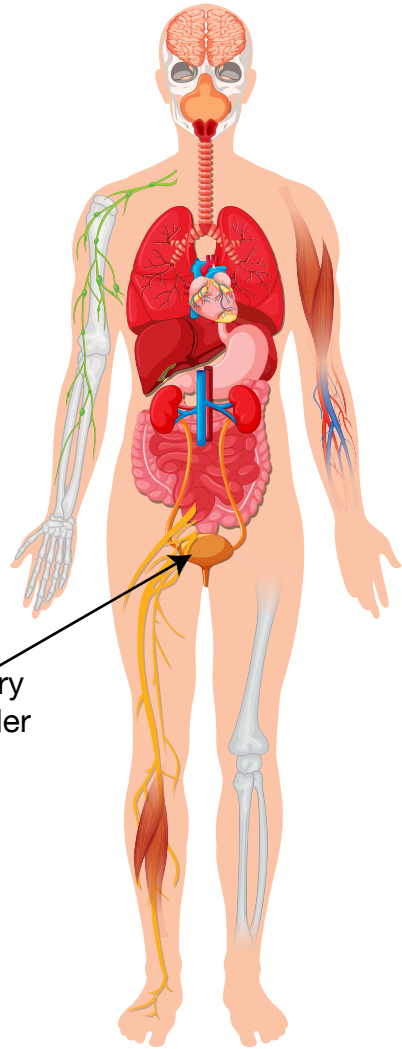


Follow the common safety instructions (Annex II)

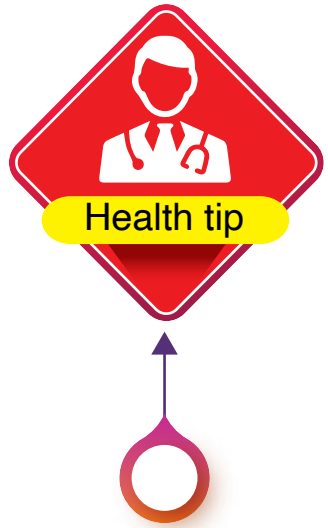
Ortho-Toluidine

Exposed occupations

- Workers who are exposed to certain hair dyes
- Factory workers involved in rubber manufacture
- Cigarette smokers
- Laboratory workers

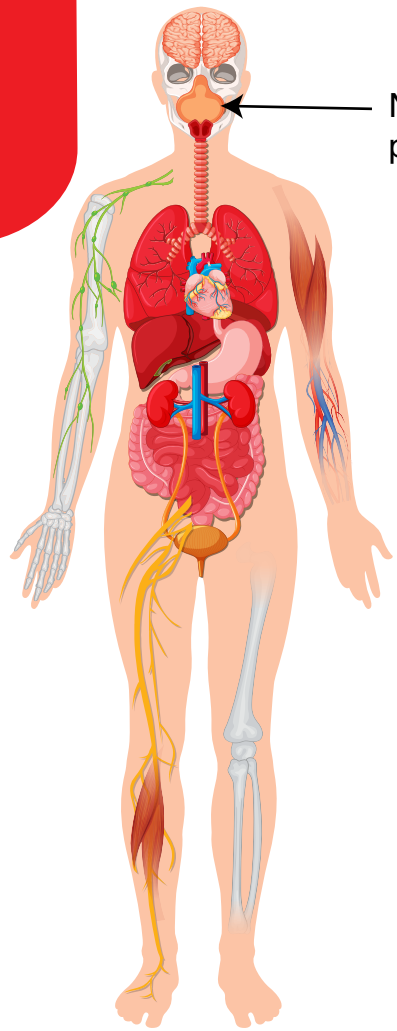


Cancer site



Follow the common safety instructions (Annex II)

Leather dust



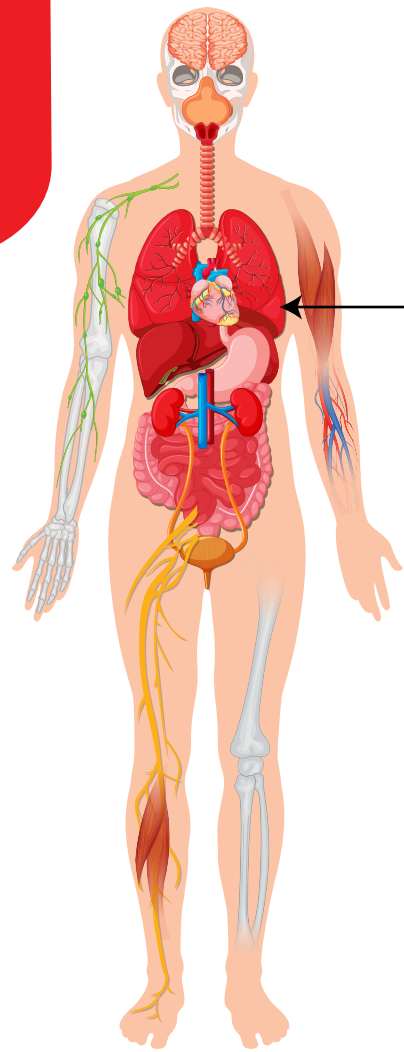
Cancer site

Health tip

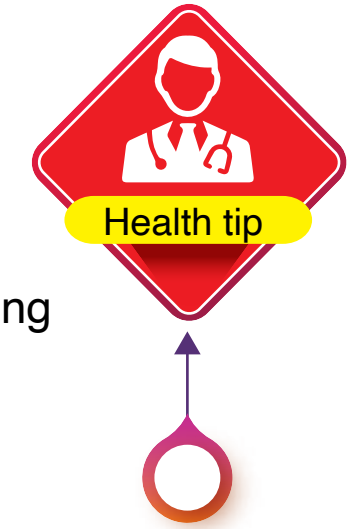
Follow the common safety instructions (Annex II)

Chromium (VI) compounds

Found in many consumer products such as wood treated with copper dichromate, leather tanned with chromic sulfate, and stainless steel cookware. The sources of exposure may include air, food, water, and contaminated soil and groundwater



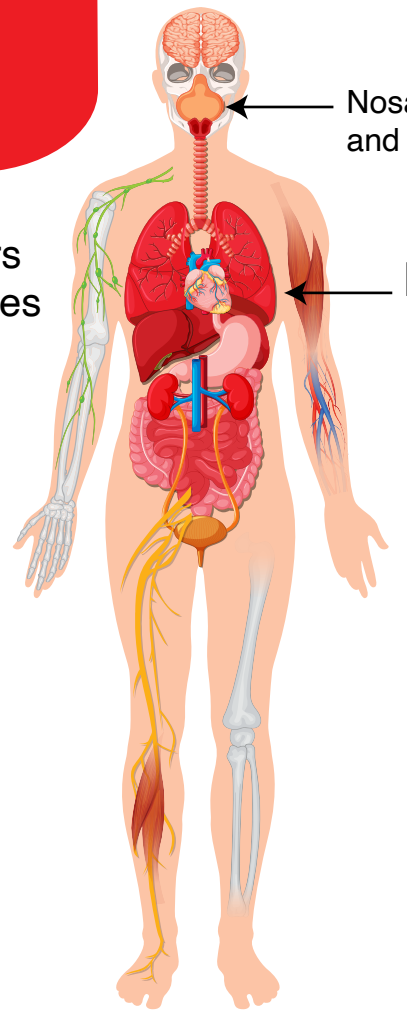
Cancer site



Follow the common safety instructions (Annex II)

Nickel compounds

Occupational exposure to nickel occurs mainly through inhalation of dust particles and fumes or through skin contact.



Cancer site

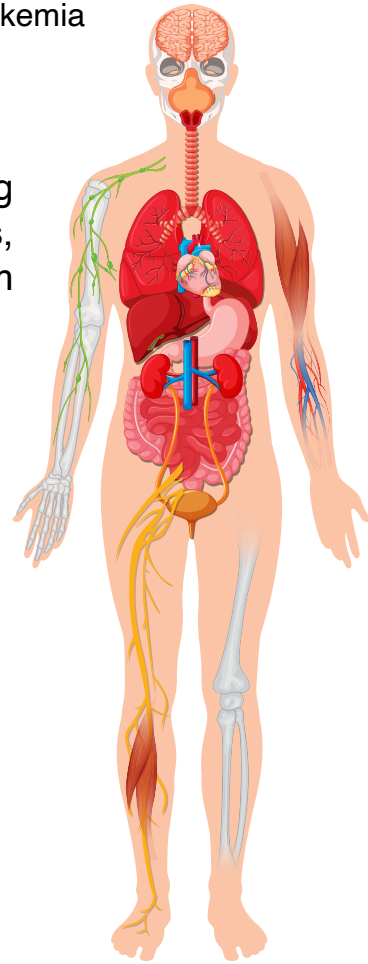
Health tip

Follow the common safety instructions (Annex II) ||

Benzene

Exposure to Benzene occurs in manufacturing of lubricants, rubbers, dyes, detergents drugs, explosives and pesticides. Also by petroleum products,filling stations,styrene plastic production and smoking

Leukemia



Cancer site

Follow the common safety instructions (Annex II)

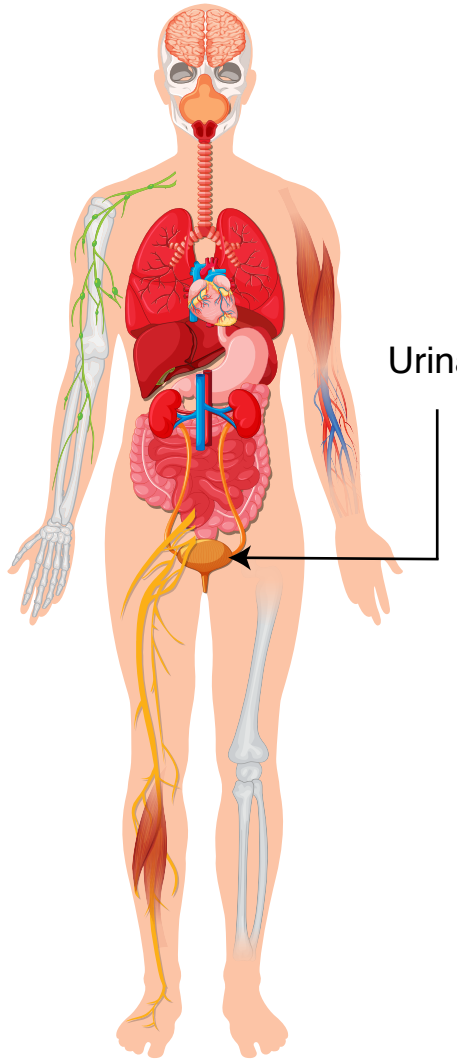
Don't smoke

Avoid exposure to second-hand tobacco smoke.

Try to limit exposure to vehicle fumes

Auramine production

Auramine colourants are used for dyeing of leather, tanned cotton, paints, and as dye components in inking ribbons, ballpoint pastes, oils and waxes, and carbon paper.(paper dyeing)



Urinary bladder.

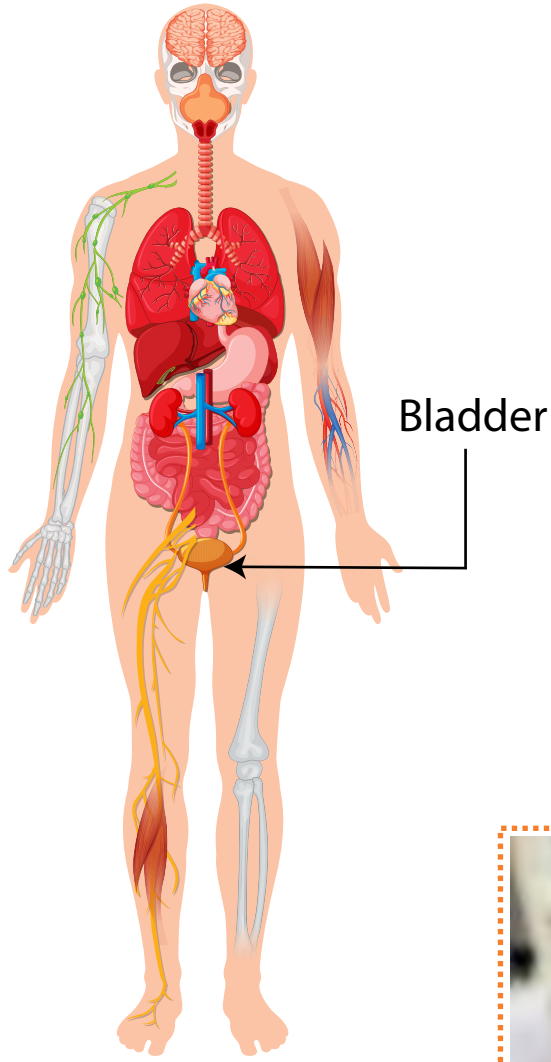
Cancer site

Health tip

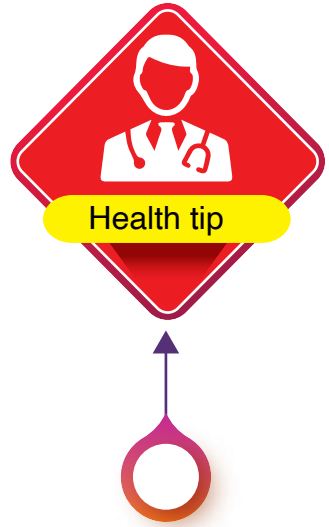
Follow the common safety instructions (Annex II)

Benzidine

Benzidine is used to produce a large number of dyes e.g. textile dyeing, pulp and paper dyeing leather and fur dyeing. Also in water-based inks wood stains, plastics, pigments, hair dyes, soaps and biological stains and indicators



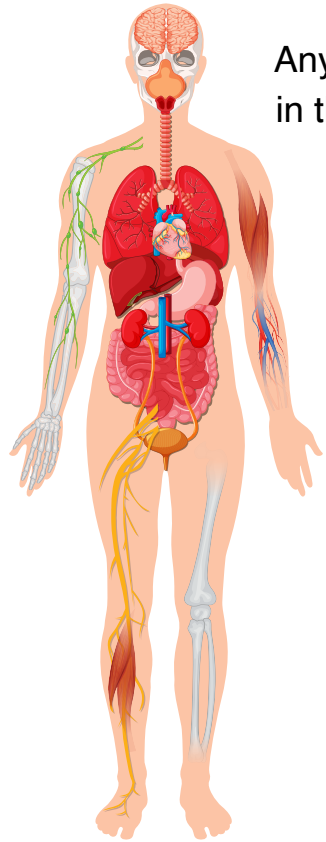
Cancer site



Follow the common safety instructions (Annex II)

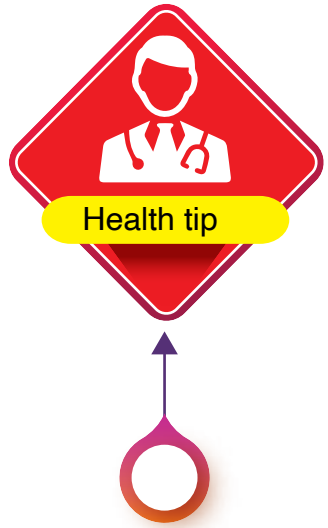
2,3,7,8-Tetrachlorodibenzo paradioxin

It may be released to the environment during the combustion of fossil fuels and wood, and during the incineration of municipal and industrial wastes



Any where in the body

Cancer site



Follow the common safety instructions (Annex II)

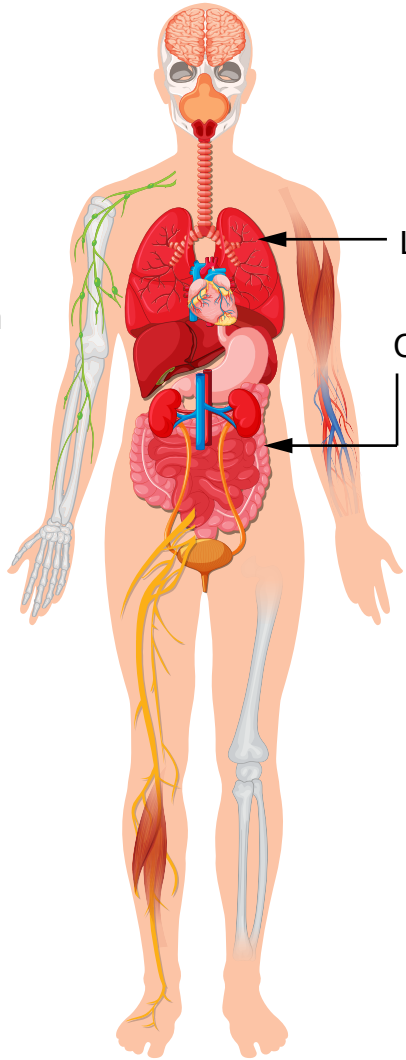
Avoid outdoor open burning

Radon

Radon is a radioactive gas produced from the natural radioactive decay of uranium. Radon is found in all rocks and soils and water.

Radon escapes from the ground into the air, where it decays and produces further radioactive particle:

Radon can be accumulated indoors where ventilation is poor. Can be found more frequently in areas with cold climate.



Cancer site

Health tip

Increase air flow in your house by opening windows and using fans and vents to circulate air.

Seal cracks in floors and walls

Use construction materials properly (e.g. Granite, Sea sand)

Keep proper ventilation in mining activities

Human carcinogens - Group 1

IARC - WHO 2023 / https://monographs.iarc.who.int/list-of-classification

1. Acetaldehyde
2. Acheson process
3. Acid mists
4. Aflatoxins
5. Alcoholic beverages
6. Aluminium production
7. 4-Aminobiphenyl
8. Areca nut
9. Aristolochic acid
10. Aristolochic acid
11. Arsenic and inorganic arsenic compounds
12. Asbestos (all forms)
13. Auramine production
14. Azathioprine
15. Benzene
16. Benzidine
17. Benzidine, dyes metabolized to
18. Benzo[a]pyrene
19. Beryllium and beryllium compounds
20. Betel quid with tobacco
21. Betel quid without tobacco
22. Bis(chloromethyl)ether; chloromethyl methyl ether
23. 1,3-Butadiene
24. Busulfan
25. Cadmium and cadmium compounds
26. Chlorambucil
27. Chlornaphazine
28. Chromium (VI) compounds
29. Clonorchis sinensis (infection with)
30. Coal gasification
31. Coal, indoor emissions from household combustion of
32. Coal-tar distillation
33. Coal-tar pitch
34. Coke production
35. Cyclophosphamide
36. Cyclosporine
37. 1,2-Dichloropropane
38. Diethylstilbestrol
39. Engine exhaust, diesel
40. Epstein-Barr virus
41. Erionite
42. Estrogen therapy, postmenopausal
43. Estrogen-progestogen menopausal therapy (combined)
44. Estrogen-progestogen oral contraceptives (combined)
45. Ethanol in alcoholic beverages
46. Ethylene oxide
47. Etoposide
48. Etoposide in combination with cisplatin and bleomycin
49. Firefighter (occupational exposure)
50. Fission products, including strontium-90
51. Fluoro-edenite fibrous amphibole
52. Formaldehyde
53. Haematite mining (underground)
54. Helicobacter pylori (infection with)
55. Hepatitis B virus (chronic infection with)
56. Hepatitis C virus (chronic infection with)
57. Human immunodeficiency virus type 1 (infection with)
58. Human papillomavirus (HPV) type 16
59. Human papillomavirus (HPV) type 18
60. Human papillomavirus (HPV) type 33
61. Human papillomavirus (HPV) types 31, 35, 39, 45, 51, 52, 56, 58, 59

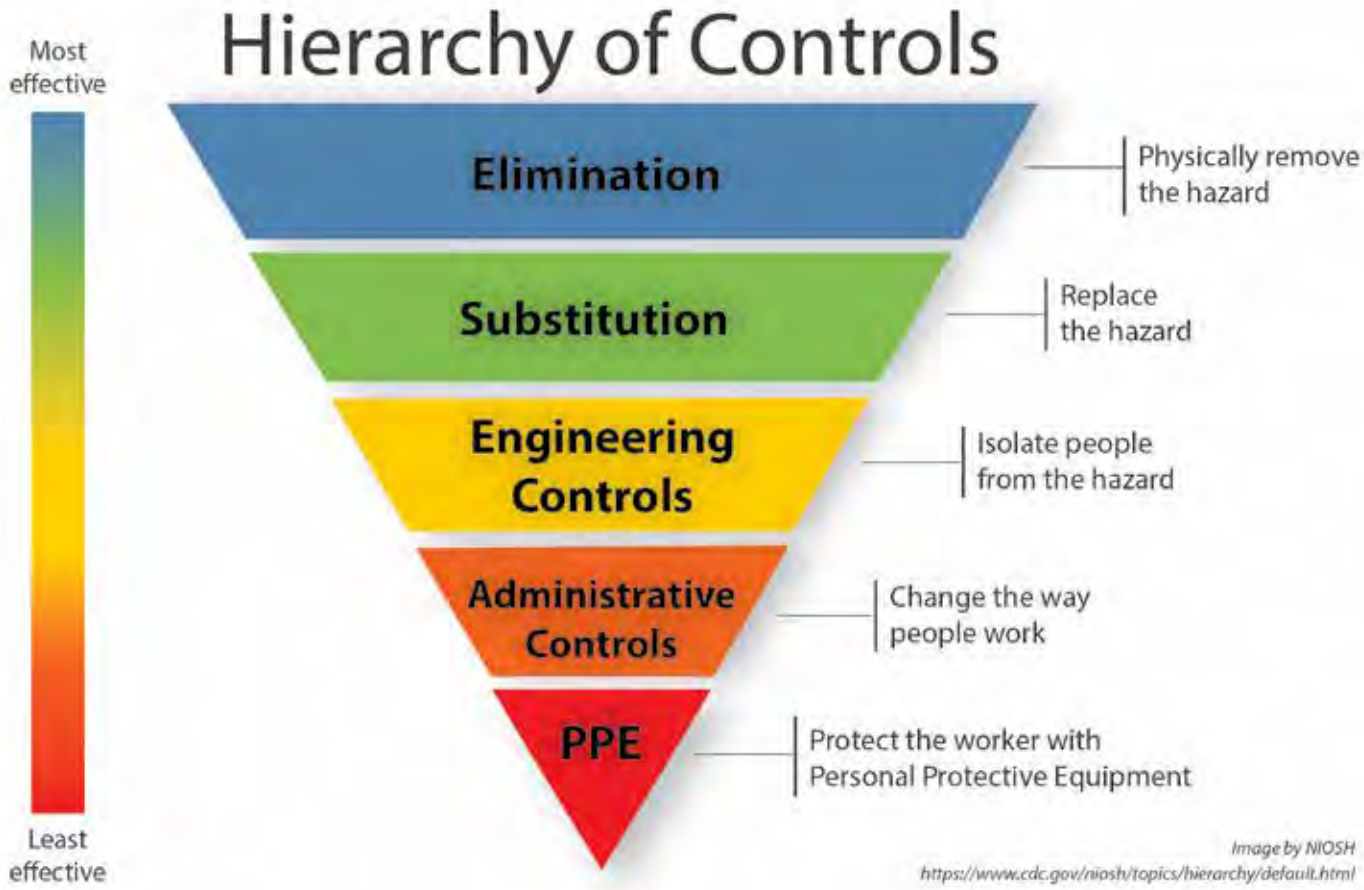
62. Human T-cell lymphotropic virus type I
63. Tonizing radiation (all types)
64. Iron and steel founding (occupational exposure during)
65. Isopropyl alcohol manufacture using strong acids
66. Kaposi sarcoma herpesvirus
67. Leather dust
68. Lindane (see also Hexachlorocyclohexanes)
69. Magenta production
70. Melphalan
71. Methoxsalen (8-methoxypsoralen) plus ultraviolet Aradiation
72. 4,4'-Methylenebis(2-chloroaniline) (MOCA)
73. Mineral oils, untreated or mildly treated
74. MOPP and other combined chemotherapy including alkylating agents
75. 2-Naphthylamine
76. Neutron radiation
78. Nickel compounds
79. N'-Nitrosonornicotine (NNN) and 4-(N-Nitrosomethy lamino)-1-(3-pyridyl) - 1-butanone (NNK)
80. Opisthorchis viverrini (infection with)
81. Opium consumption
82. Ortho-Toluidine
83. Outdoor air pollution
84. Outdoor air pollution, particulate matter in
85. Painter (occupational exposure as a)
86. 2,3,4,7,8-Pentachlorodibenzofuran
87. Pentachlorophenol (see also Polychlorophenols)
88. 3,4,5,3', 4' -Pentachlorobiphenyl (PCB-126)
89. Phenacetin
90. Phenacetin, analgesic mixtures containing
91. Phosphorus-32, as phosphate
92. Plutonium
93. Polychlorinated biphenyls
94. Polychlorinated biphenyls, dioxin-like, with a Toxicity Equivalency Factor (TEF) according to WHO (PCBs 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189)
95. Processed meat (consumption of)
96. Radioiodines, including iodine-131
97. Radionuclides, alpha-particle-emitting, internally deposited
98. Radionuclides, beta-particle-emitting, internally deposited
99. Radium-224 and its decay products
100. Radium-226 and its decay products
101. Radium-228 and its decay products
102. Radon-222 and its decay products
103. Rubber manufacturing industry
104. Salted fish, Chinese-style
105. Schistosoma haematobium (infection with)
106. Semustine [1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitro sourea, Methyl-CCNU]
107. Shale oils
108. Silica dust, crystalline, in the form of quartz or cristobalite Solar radiation
109. Soot (as found in occupational exposure of chimney sweeps)
110. Sulfur mustard
111. Tamoxifen
112. 2,3,7,8-Tetrachlorodibenzo-para-dioxin
113 Thiotepa
114. Thorium-232 and its decay products
115. Tobacco smoke, second-hand
116. Tobacco smoking
117. Tobacco, smokeless
118. Treosulfan
119. Trichloroethylene
120. Ultraviolet radiation (wavelengths 100-400 nm, encompassing UVA, UVB, and UVC)
121. Ultraviolet radiation from welding
122. Ultraviolet-emitting tanning devices
123. Uranium, mixture of isotopes
124. Vinyl chloride
125. Welding fumes
126. Wood dust
127. X- and Gamma-Radiation

Hierarchy of Controls

Common instructions to eliminate reduce exposure to carcinogens at the workplace

There are many ways to eliminate and reduce exposure to carcinogens at the workplace.

The hierarchy of controls is an inverted pyramid that helps to select the best control methods in a given context using a step-by-step approach


Hierarchy of Controls
Most effective
Least effective
Elimination
Physically remove the hazard
Substitution
Replace the hazard
Engineering Controls
Isolate people from the hazard
Administrative Controls
Change the way people work
PPE
Protect the worker with Personal Protective Equipment
Image by NIOSH
https://www.cdc.gov/niosh/topics/hierarchy/default.html

The hierarchy of controls - Inverted pyramid

Choosing a control method to protect the worker from the hazard.

- Start from the top of the inverted pyramid.
- Assess the feasibility of the first layer of controls (elimination) before moving on to the second layer (substitution)
- Continue this process until you reach the bottom of the pyramid
- Introduce as many controls as require

1. Elimination

- The process of removing the hazard from the workplace.
- It is the most effective way to control a risk because the hazard is no longer present
- It is the preferred way to control a hazard and should be used whenever possible

  E.g. Arsenic ban in Sri Lanka

2. Substitution

- If eliminating a hazard is not possible, substitution is the next control method.
- Substitution is the act of replacing something with another less hazardous one.

2. Substitution

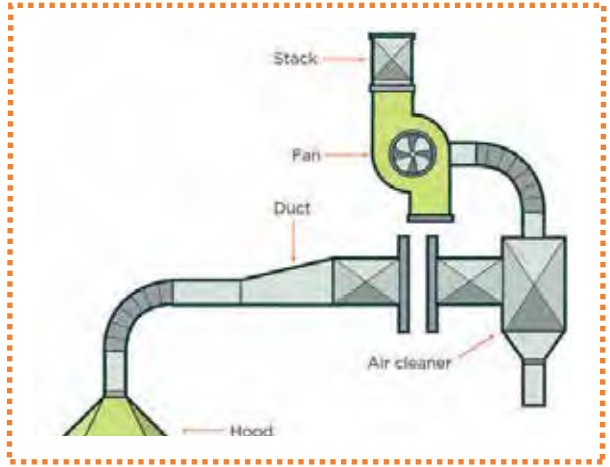
Examples for Substitution

Instead Of:	Consider:
Carbon tetrachloride (causes liver damage, cancer)	1,1,1 - trichloroethane, dichloromethane
Benzene (causes cancer)	Toluene, cyclohexane, ketones
Pesticides (causes various effects on body)	"Natural" pesticides such as pyrethrins
Organic solvents (causes various effects on body)	Water -detergent solutions
Leaded glazes, paints, pigments (causes various effects on body)	Versions that do not contain lead
Sandstone grinding wheels (sauses severe respiratory illness due to silica)	Synthetic grinding wheels such as aluminium oxide

3. Engineering Controls

Engineering controls can be built into the designing of a plant, equipment, or process to minimize the hazard.

Eog.: Local exhaust ventilation



4. Administrative controls

Administrative controls involve developing procedures to ensure that the work is conducted in a way that minimizesthe hazard.

Fog. Developing policies, providing training and education, developing or enhancing work practices and procedures like making regular medical check ups compulsory

4. Administrative controls

Good practices

- Proper maintenance of equipment

Training

- Employee education and training on how to c onduct their work safely

Good housekeeping

- Essential to prevent the accumulation of hazardous or toxic materials

Personal hygienic practices and facilities

- Washing hands after handling material and before eating
- Avoiding touching lips, nose, and eyes with contaminated hands
- Providing separate eating and washing areas

5. Personal Protective Equipment (PPE)

Personal protective equipment (PPE) refers to anything workers wear to help protect them from a workplace hazard.

- Respiratory protection e.g. Respirators
- Skin protection (e.g. gloves coveralls, aprons, full body suits)
- Eye protection (e.g. face shield, goggles)

References

International Agency for Research on Cancer. Agents classified by the IARC monographs, volumes 1–129. [homepage on the internet] Lyon: IARC; Available from: http://monographs.iarc.fr/ENG/Classification/index.ph

NCCP. 2021. National cancer registry Sri Lanka, cancer incidence data. National Cancer Control Programme,
Sri Lanka. Available from: https://www.nccp.health.gov.lk/en/incedencedata.

Centers for Disease Control and Prevention 2022. Hierarchy of Controls. The National Institute for Occupational Safety and Health (NIOSH) Available from: https://www.cdc.gov/niosh/topics/hierarchy/default.html

Centers for Disease Control and Prevention 2022. Workplace Safety and Health Topics. The National Institute for Occupational Safety and Health (NIOSH) Available from: https://www.cdc.gov/NIOSH/

National Cancer Control programme
Ministry of Health
2024