

# Occupational cancer diseases

# External environment and the occurrence of malignancies

- **80 – 90 % of tumors are caused by external factors:**
- smoking – 30 %
- nutritional factors and diet – 35 %
- alcohol – 5 %
- infections, especially viral – 5-10 %
- low physical activity – 5 %
- solar radiation, pollution

# Occupational cancer diseases

- Occupational cancer is caused wholly or partly by exposure to a cancer causing agent (carcinogen) at work, or by a particular set of circumstances at work.
- **It is estimated that 5% of tumors are caused by exposure to carcinogens in the workplace.**
- Men are affected more often.

# Cancers in the EU

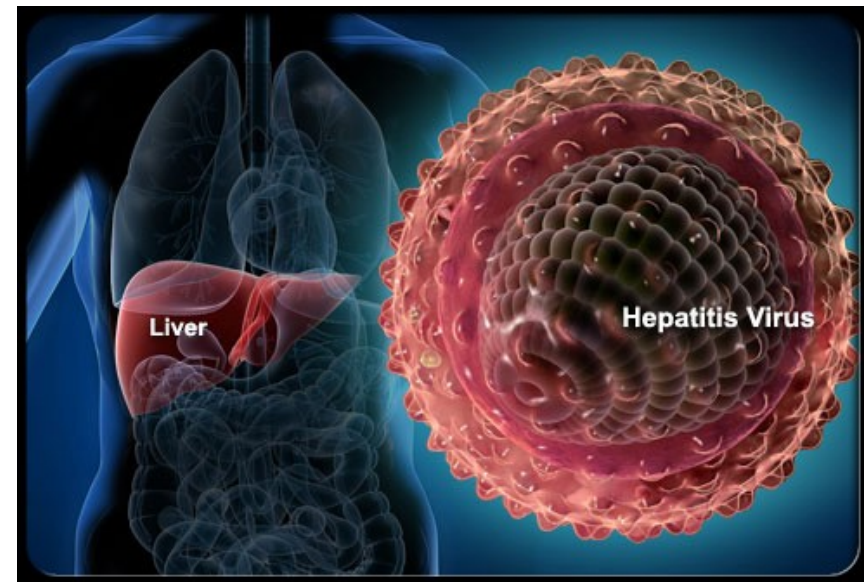
- New cases of cancer: > 2 million/year
- Cancer mortality: > 1 million/year
- In the EU, 23 % of the workforce exposed to carcinogens on a daily basis
- Occupational cancer: 5-8 %, probably higher among male workers
- It is estimated that occupational cancers are a leading cause of work-related death in Europe (and also worldwide)

# What causes occupational cancer?

- Occupational cancer is caused by exposure to carcinogens in the workplace.
- Carcinogens are agents that cause the development or increase the incidence of cancer.
- There are three different types of occupational carcinogens:
  - **Biological carcinogens**
  - **Physical carcinogens**
  - **Chemical carcinogens**

# Biological carcinogens

- some micro-organisms such as **viruses** have been known to cause cancer:
  - ✓ by damaging cells directly
  - ✓ by decreasing the body's ability to control abnormal cells
- for example Hepatitis B, C, HIV viruses and so on  
(*hepatocellular carcinoma in response to HBV, HCV*)



# Physical carcinogens

- agents such as ionising and ultraviolet (UV) radiation have the potential to cause cancer
- **ionising radiation:** X-rays, alpha, beta and gamma, neutron radiation (*skin cancer, leukemia...*)
- **UV radiation** can be divided into a number of bands such as UV-B, UV-C etc, some of which are known to cause skin cancer (*historically - sailors*)



# Chemical carcinogens

- a number of chemicals are known to be carcinogenic
- these chemicals may occur naturally, such as **asbestos**, be manufactured like vinyl chloride, or be by-products of industrial processes, for example, polycyclic aromatic hydrocarbons



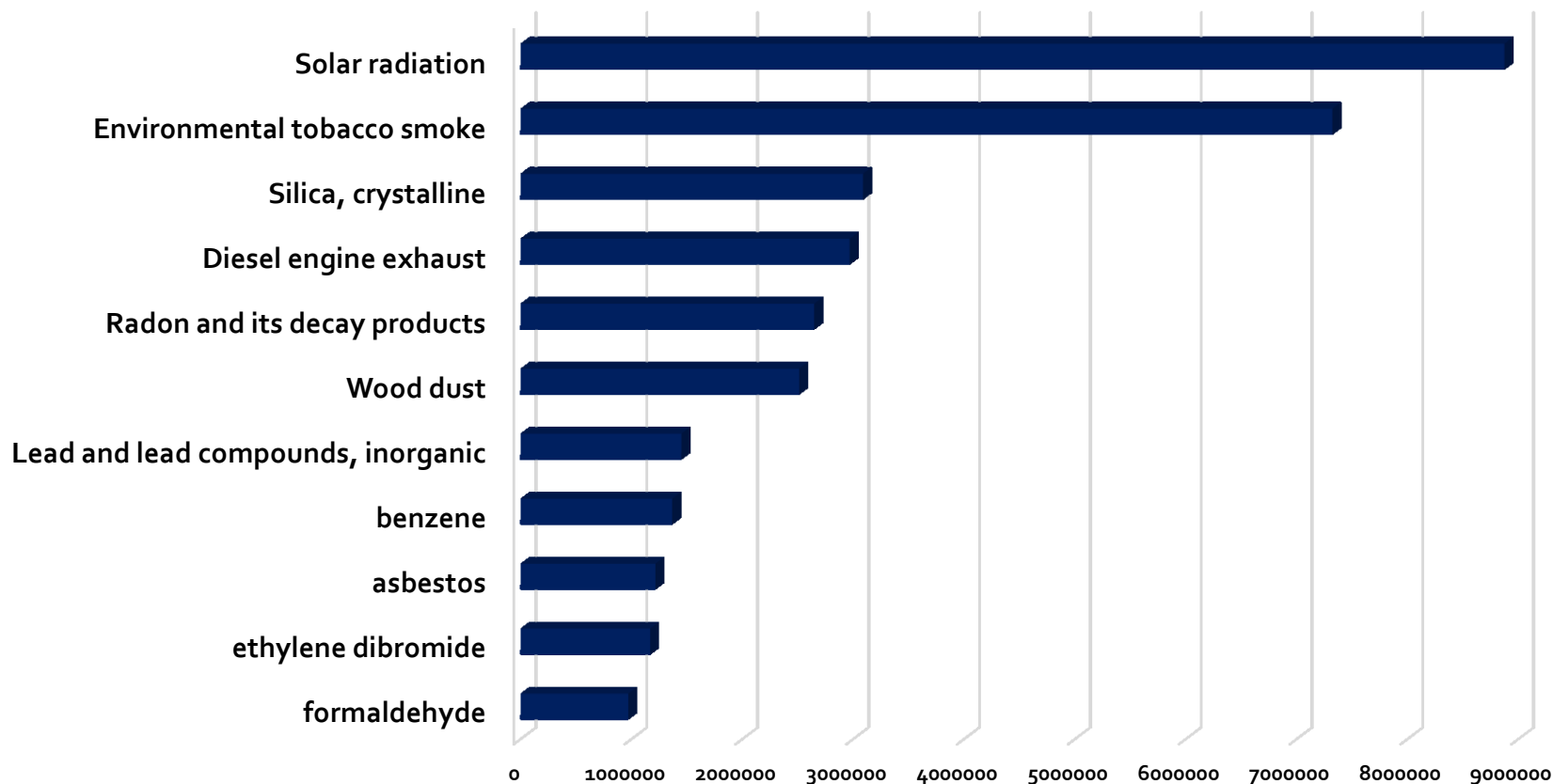


# Most widespread carcinogens at work:

- Radioactive substances (radon)
- Asbestos
- Coke oven gases and polycyclic aromatic hydrocarbons
- Aromatic amines and nitro compounds
- Benzene
- Vinyl chloride monomer
- Silica dust
- Wood dust
- Others: solar radiation, passive smoking, diesel engine exhausts, formaldehyde, chromium, arsenic etc.

# Common Exposures, EU

## Exposures by Agents



- **International Agency for Research on Cancer,**  
Lyon France
- [www.iarc.fr](http://www.iarc.fr)
- official institute to declare a certain substance or factor as proven human carcinogen
- 4 groups of factors + TARGET ORGANS



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### IARC News

#### Launch of the Global Cancer Observatory (GCO) website



12/05/2016

The International Agency for Research on Cancer (IARC) is pleased to announce the launch of the **Global Cancer Observatory (GCO)**, an interactive web-based platform providing global cancer statistics to inform cancer control and cancer research. The **Cancer Today** subsite of the GCO is a global data visualization tool that offers innovative ways to examine national estimates of the incidence, mortality, and burden of cancer.

Presentación del Código Europeo contra el Cáncer en España

Chernobyl, 30 years on: Interview of Dr A. Kesminiene on the research and health impact of the Chernobyl disaster

### Featured News

#### The IARC Monograph on Glyphosate



# Carcinogens by IARC/WHO

- **1. Sufficient evidence of carcinogenicity to humans** (118) – (benzen, VCM, aromatic amines, crude mineral oils, alcohol, ionising radiation...)
- **2. Limited evidence of carcinogenicity**
  - 2A) Probably carcinogenic to humans (79) - (acrylamide, cisplatin...)
  - 2B) Possibly carcinogenic to humans (290) - (lead,...)
- **3. Not classifiable as to its carcinogenicity to humans** (501) – (cholesterol, caffeine, toluene,...)
- **4. Probably not carcinogenic to humans** – only one chemical! (caprolactam - production of polyamide fibers - nylon)

# Most affected organs

- Lung
- Urinary bladder
- Nasal cavity
- Liver (angiosarcoma)
- Mesothelioma
- Leukemia
- Non-melanocytic skin cancer

# Types of occupational cancers

- **Cancers associated with occupational exposure include:**
- **bladder cancer** (arsenic; aromatic amines; coal tars and pitched, diesel engine exhaust; work as a hairdresser or barber; metalworking fluids and mineral oils; work as a painter; work in the rubber industry)
- **bone cancer** (ionising radiation)
- **brain and other central nervous system cancers** (ionising radiation)
- **breast cancer** (ionising radiation; ethylene oxide; shift (night) work)
- **colon and rectal cancer** (asbestos, ionising radiation)
- **kidney cancer** (arsenic, cadmium; coke production; trichloroethylene)
- **laryngeal cancer** (asbestos; work in the rubber industry: strong inorganic acid mists including sulphuric acids)
- **leukaemia** (benzene, ethylene oxide, formaldehyde, ionising radiation, non-arsenical insecticides)
- **liver and biliary cancer** (ionising radiation; trichloroethylene, vinyl chloride)

# Types of occupational cancers

- **lung cancer** (arsenic; asbestos; beryllium; cadmium; chromium; coal tar and pitches, cobalt; coke production, diesel engine exhaust, dioxins; inorganic lead; iron and steel foundry work, mineral oils; nickel; work as a painter; natural radon in workplaces; ionising radiation, rubber production; silica; work as a welder...)
- **melanoma of the eye** (welding)
- **mesothelioma** (asbestos)
- **nasal and sinus cancer** (chromium, formaldehyde, leather dust, nickel, textile industry, wood dust)
- **non-hodgkin's disease** (work as a hairdresser or barber, non-arsenical insecticides, work as a painter, tetrachloroethylene, trichloroethylene)
- **non-melanoma skin cancer** (coal tars and pitches, mineral oils, solar radiation)
- **oesophageal cancer** (soots; tetrachloroethylene)
- **pharyngeal cancer** (asbestos)
- **stomach cancer** (asbestos)



# Lung cancer from radioactive substances

- is the most common occupational cancer in the Czech Republic
- **miners of uranium mines**
- etiology:  
radon and its radioactive decay products  
(alpha radiation)



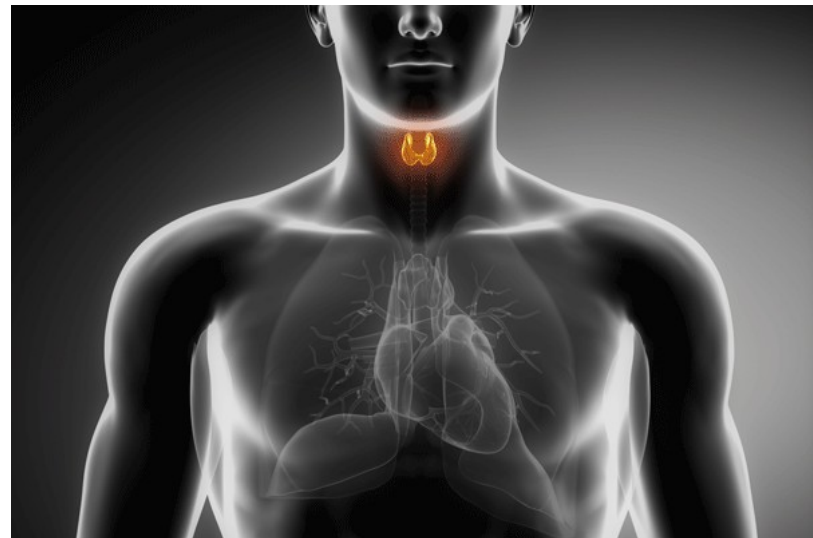
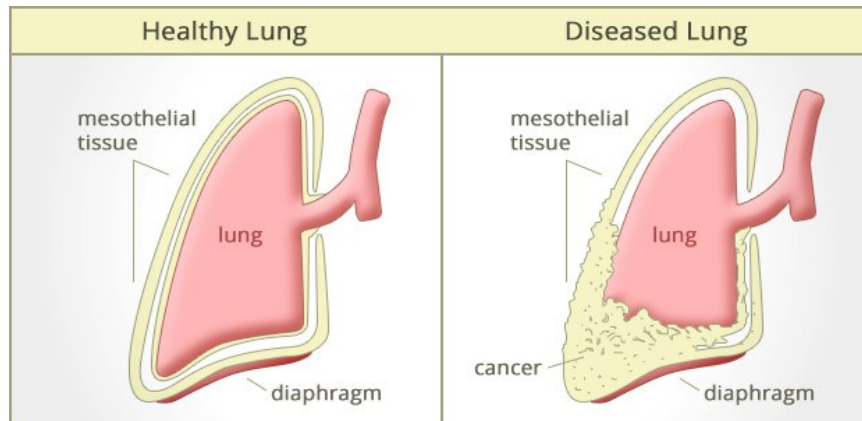
# Radon 222

- is created by the radioactive decay of radium and uranium
- emissions from uranium ore
- inert gas, great diffusion capability
- natural decay (T 3,8 day) → radioactive decay products of radon (T s-min) → binding the particles to dust → radioactive aerosol → inhalation and deposition in the airways to the surface of the epithelial lining, decay and emission of **alpha radiation** with high biological activity → radiated energy is absorbed in the basal cells of the bronchial epithelium → bronchogenous carcinoma



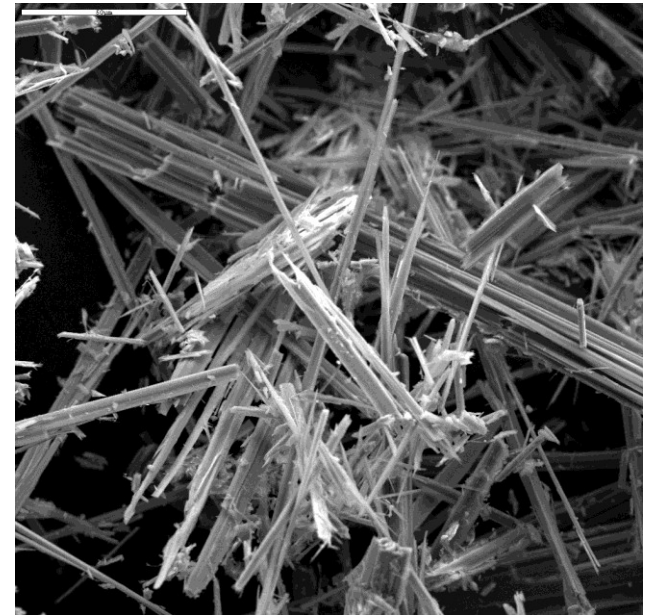
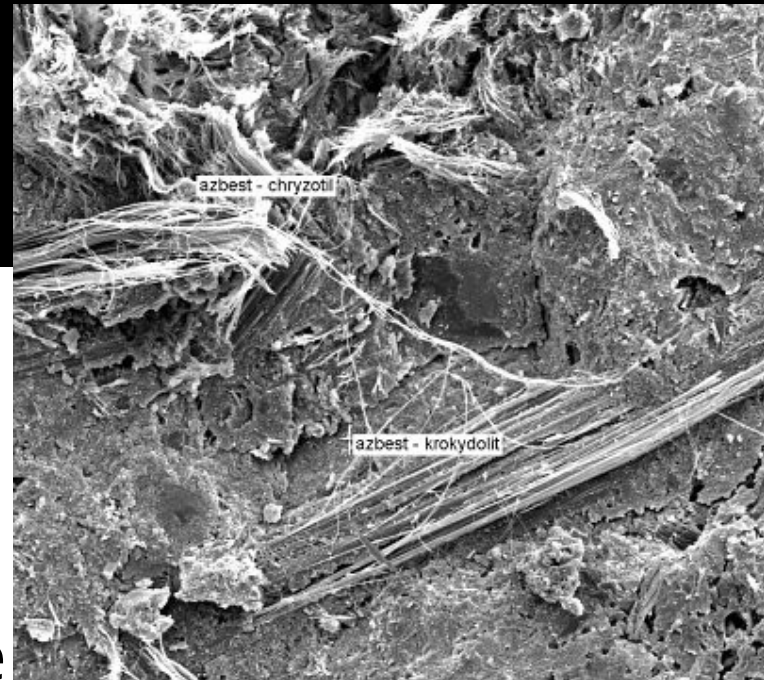
# Tumors arising from exposure to asbestos

- **lung or larynx cancer** caused by asbestos in connection with asbestosis or pleural plaques
- **malignant mesothelioma** (pleural – most common, peritoneal)
- **ovarian cancer** caused by asbestos



# Asbestos

- **silicate, fibrous minerals**
- in nature in two forms:
  - **serpentine** - chrysotile
  - **amphibole** – amosite, crocidolite, actinolite, tremolite
- asbestos fibers are extremely durable and resistant to fire and most chemical reactions
- strength and flexibility → used for many years in various industrial branches (roofing shingles, pipeline, textile protective equipment...)



# Asbestos

- biological effects of asbestos: **fibrogenic and carcinogenic** (amphibole)
- exposure to this mineral can be linked to a number of lung and respiratory diseases →
- asbestos is now strictly regulated!

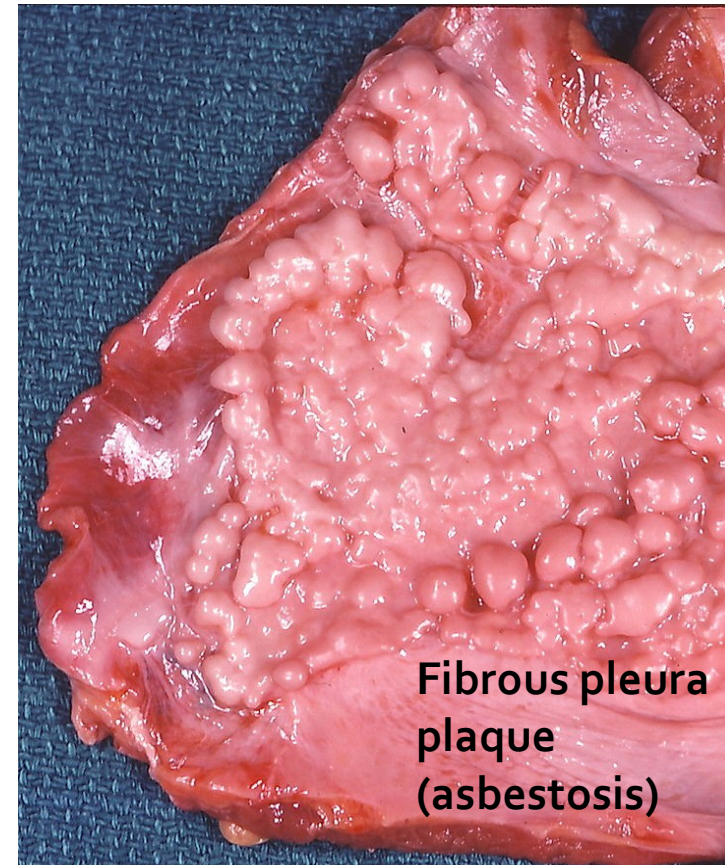
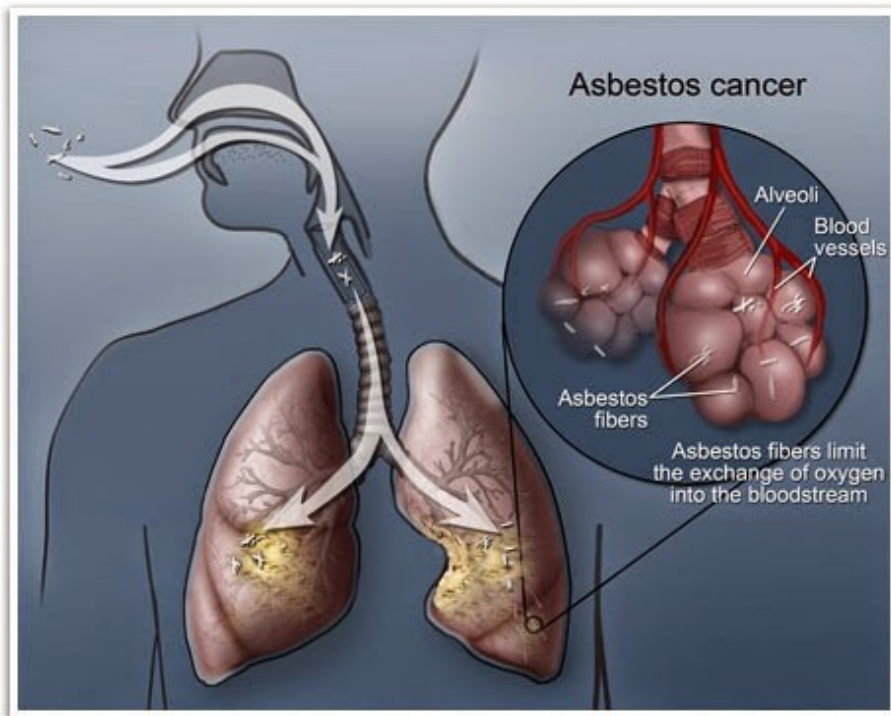






# Lung cancer caused by asbestos

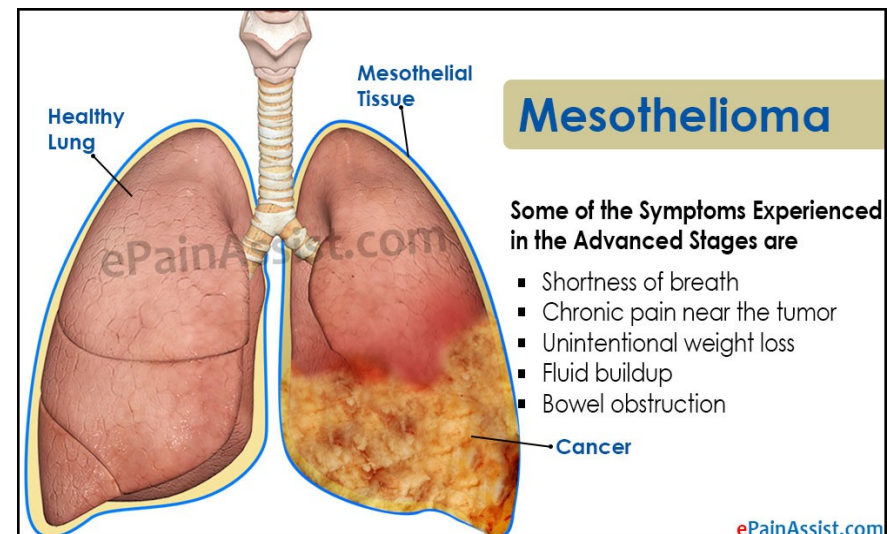
- increase in the incidence 15-30 years after the beginning of exposure
- the effect of asbestos and smoking are synergistic
- indistinguishable from lung cancer from other causes

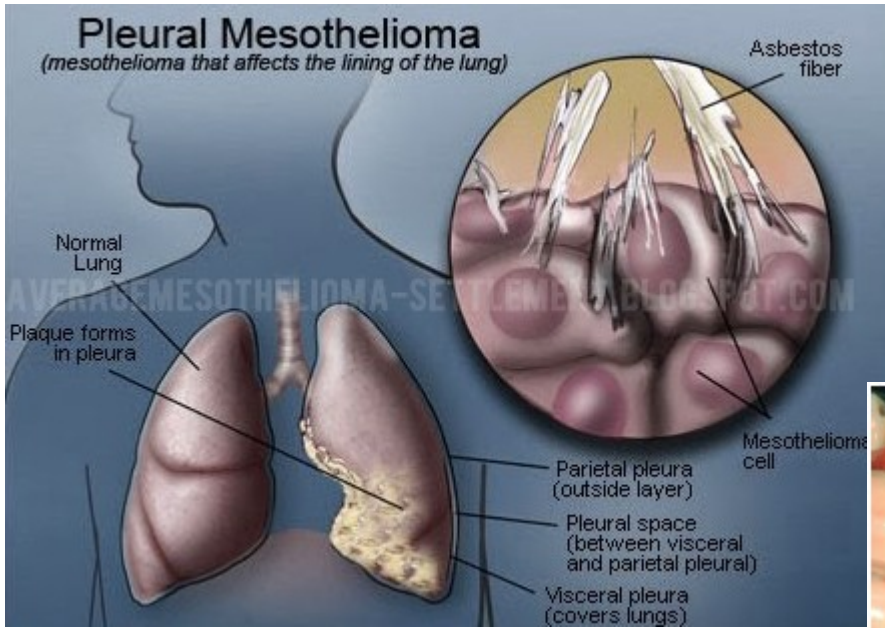




# Pleural Mesothelioma

- is a rare but aggressive form of asbestos cancer for which the only known cause is exposure to asbestos
- **anamnesis:** exposure to asbestos in the past
- **long latency period** (30-45 years) → it remains silent in the body for decades, finally appearing via symptoms like cough, shortness of breath, difficulty breathing, chest pain and fatigue
- **prognosis:** 6-12 month



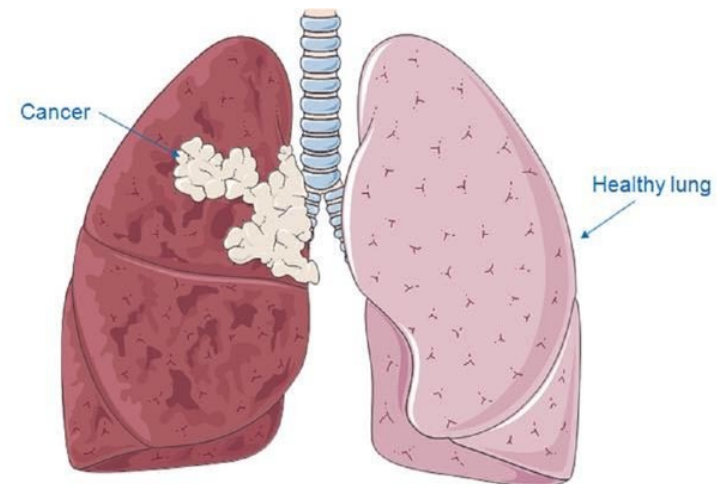


peritoneal mesothelioma



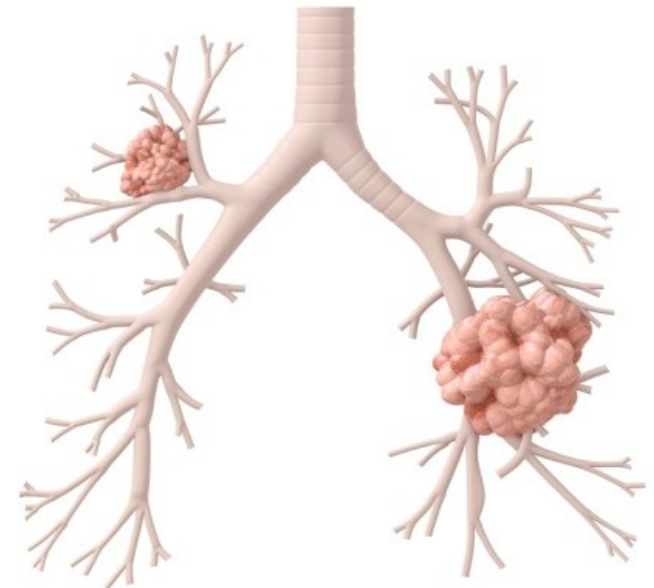
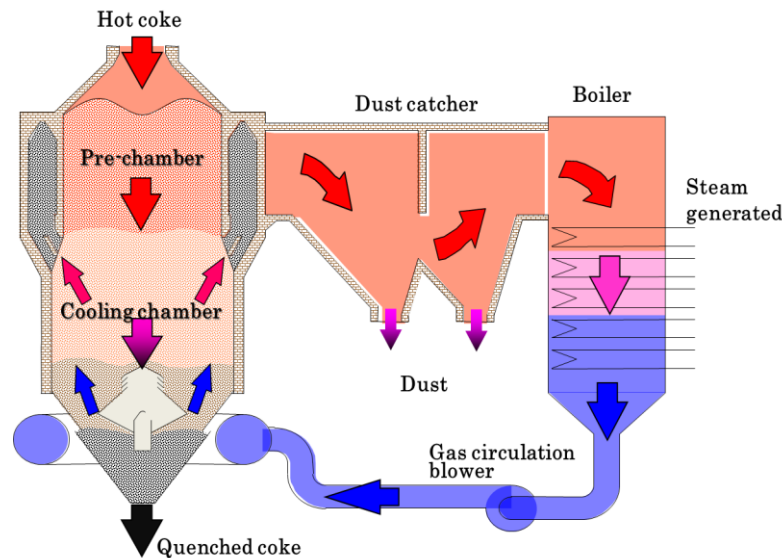
# Lung cancer in connection with pneumoconiosis caused by silica dust

- workers in high risk jobs such as foundry work, stonecutting, rock drilling, quarry work and tunneling



# Cancer of the respiratory tract and lungs caused by coke oven gases

- production of coke, coal gasification, coal tar, crude mineral oil, soot
- polycyclic aromatic hydrocarbons – benzopyrene

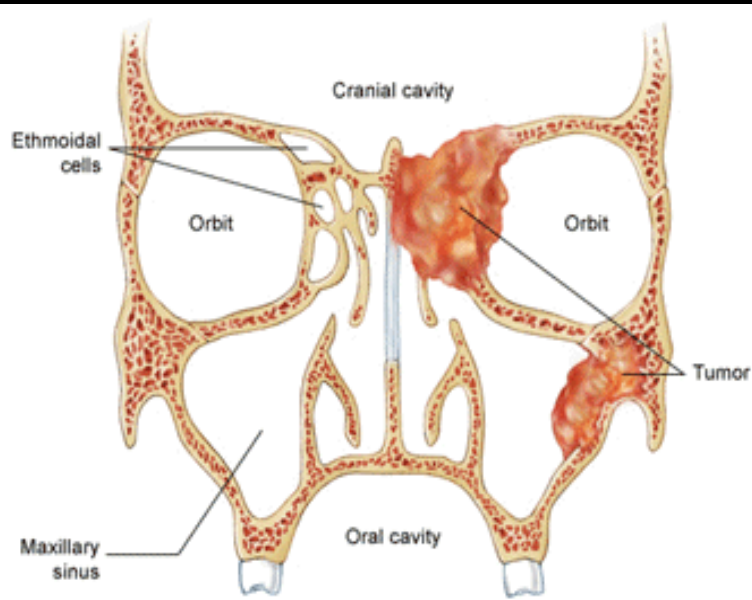




# Cancer of nasal mucosa or paranasal sinuses from wood dust

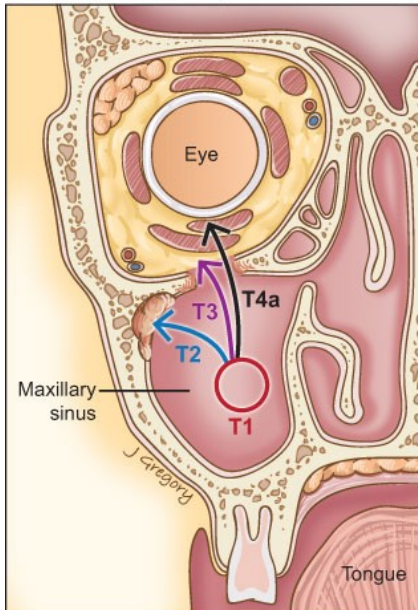
- especially adenocarcinomas
- exposure to hardwood dust (oak, beech, exotic wood)
- furniture and cabinet making, sawmill works and carpentry
- long latency



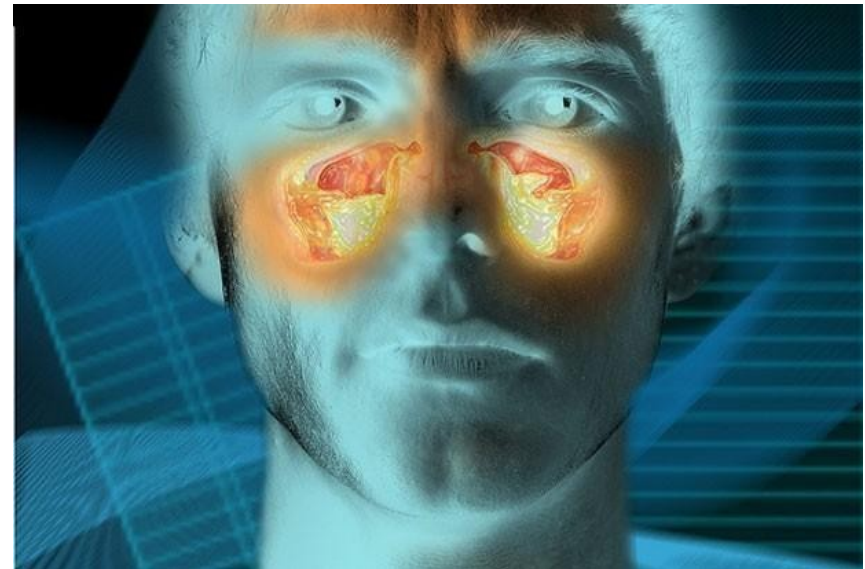
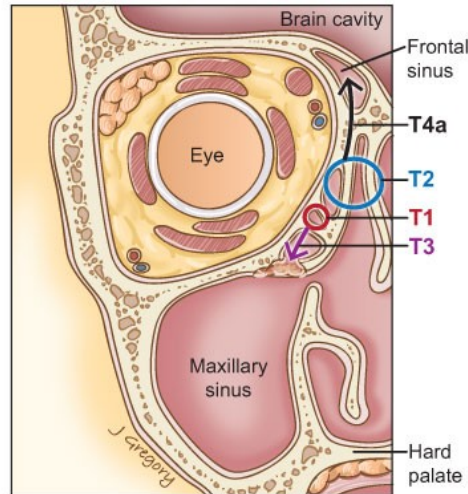


**DANGER**  
**Dust hazard**

**Tumors of the Maxillary Sinus**



**Tumors of the Ethmoid Sinus**



# Diagnosis considerations

- Occupation accounts for all or part of the tumor process in 5 per cent of cancers
- Long latency - induction times for cancer
- As a general rule, cancers that are of occupational origin are not distinguishable from non-occupational cancers whether in clinical features, natural history, pathological findings or other special investigations
- Occupational cancer may present earlier than the non-occupational varieties
- Movement of workers between jobs, work areas or industries
- Rare tumors may be an indicator
- Multiple exposures



# Taking measures

- First of all, the material which is defined as carcinogen should be forbidden in industry.
- Therefore, a substitute for this material should be researched.
- If there is a need of working by carcinogens, taking measures of decreasing exposure as minimum is mandatory.

# MEASURES THAT REDUCE EXPOSURE

- producing and carrying of carcinogens inside a closed system
- measuring exposures in working atmosphere and worker's biological system
- well working ventilation system
- personal protective equipment
- prohibiting of smoking cigarettes and eating on workplace

# Sources

- <https://www.iosh.co.uk/Books-and-resources/Our-OH-toolkit/Occupational-cancer.aspx>
- <http://www.iarc.fr/>
- <http://www.ttl.fi/en/pages/default.aspx>
- [http://www.ttl.fi/en/chemical\\_safety/carex/countries/pages/default.aspx](http://www.ttl.fi/en/chemical_safety/carex/countries/pages/default.aspx)
- <http://www.cancer.gov/about-cancer/causes-prevention/risk/substances/radon/radon-fact-sheet>
- <http://www.mesothelioma.com/asbestos-cancer/what-is-asbestos.htm>
- [https://www.osha.gov/OshDoc/data\\_General\\_Facts/crystalline-factsheet.pdf](https://www.osha.gov/OshDoc/data_General_Facts/crystalline-factsheet.pdf)
- <http://www.cancer.ca/en/cancer-information/cancer-type/nasal-paranasal/risks/?region=on>