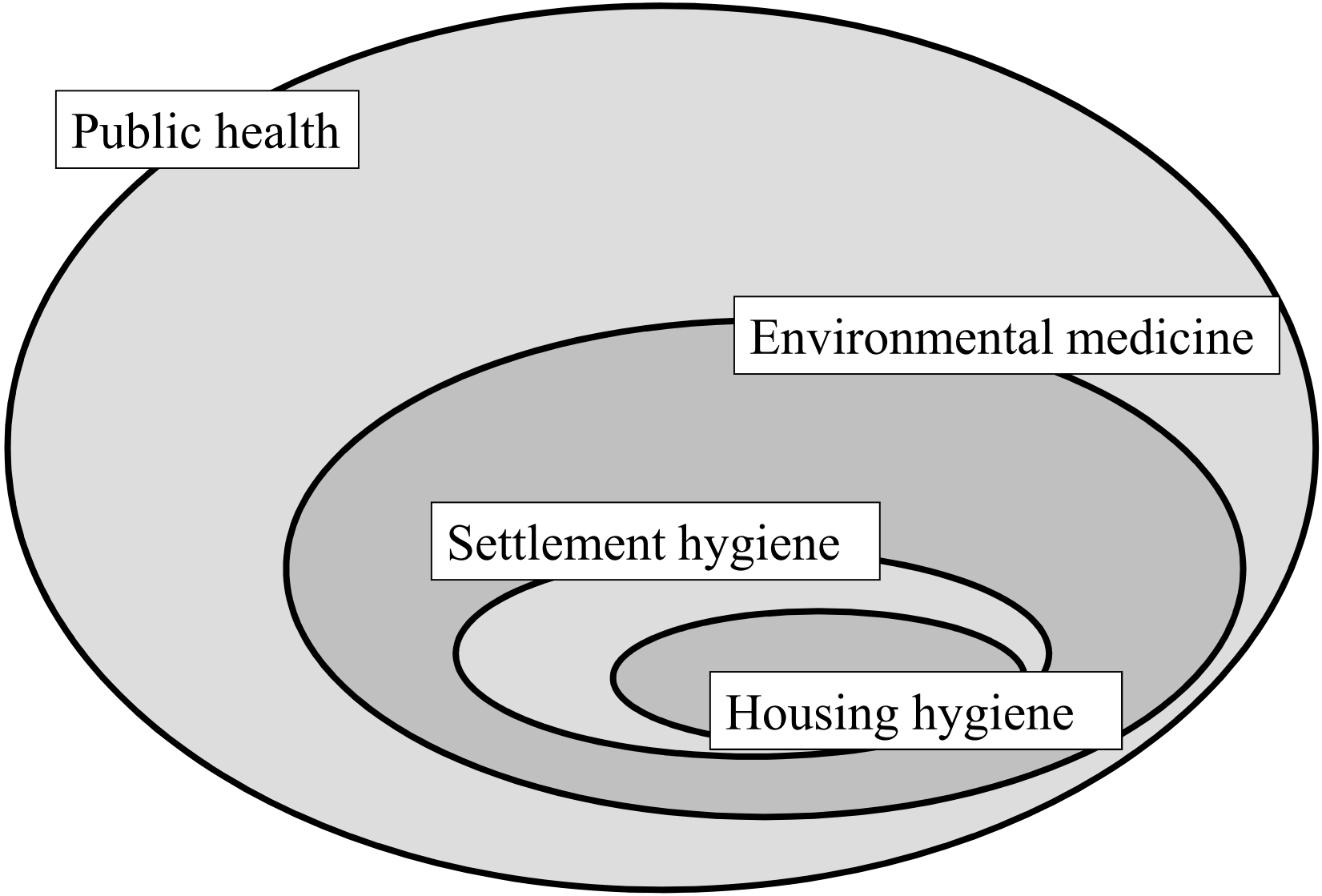
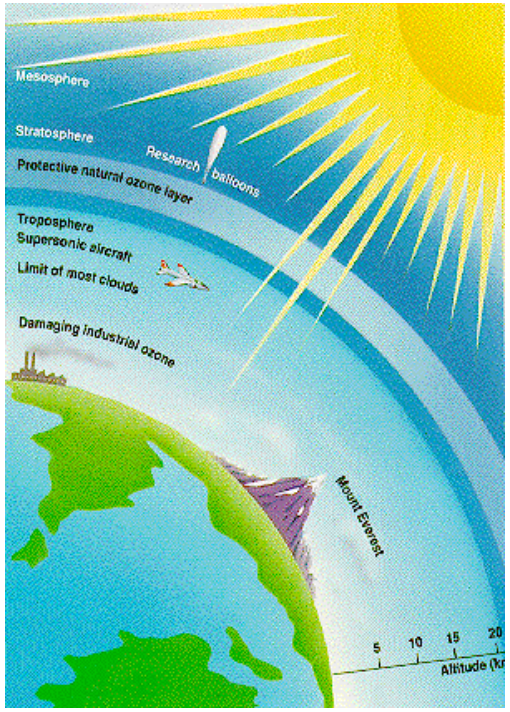
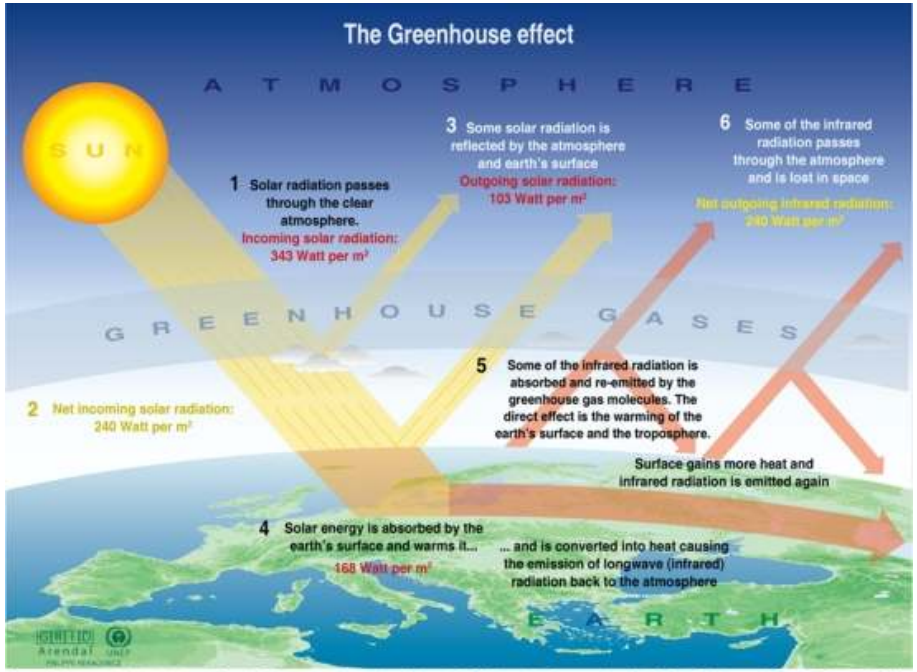
Environmental medicine I.


Public health
Environmental medicine
Settlement hygiene
Housing hygiene

Factors enhancing the climate change

- Accelerated emission of the greenhouse gases (most important: CO_2, methan)
- Chemicals depleting the ozone layer (most important: CFC)

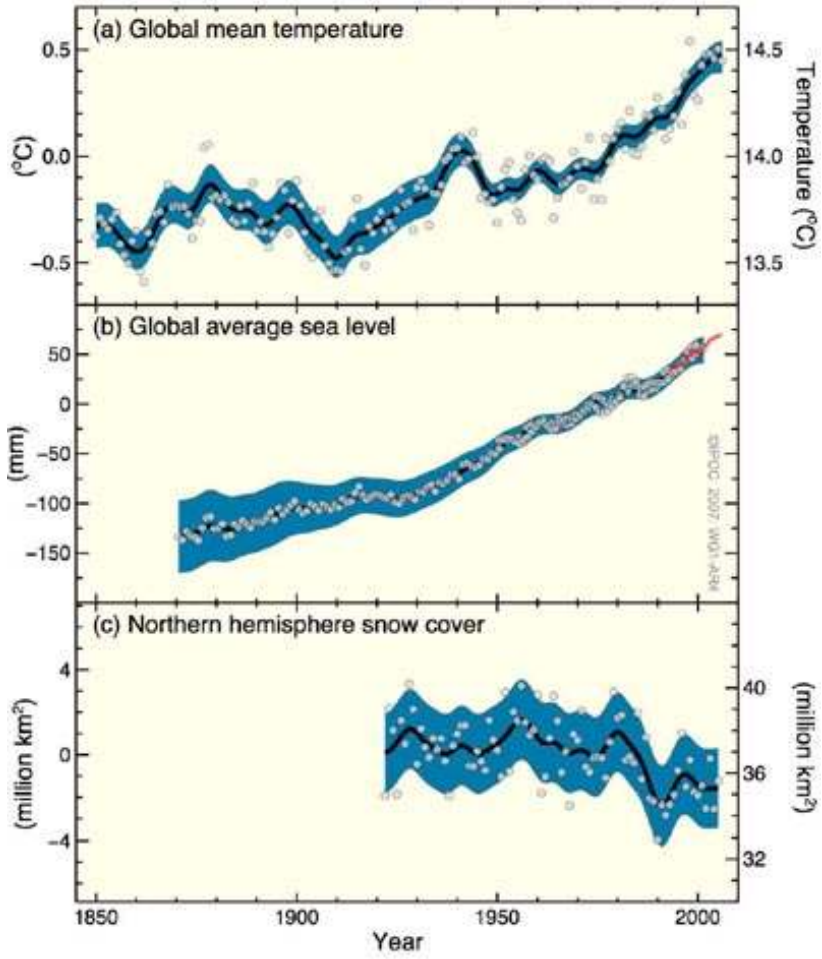




Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

IPCC report on climate change

- Concentration of CO_2 has risen from 280 ppm (parts per million) to 378 ppm from 1750 until 2005.
- Concentration of methan has risen from 715 ppb (parts per billion) to 1774 ppb.
- The temperature on the Earth's surface has risen 0,74 degree Celsius in the last century.
- From 1978 the ice cap on the northern sea declines with 3 % in every decade and in the summer the decline can reach 7 %.



What can we expect??

- The average temperature of the Earth can rise between 1,0 and 6,3 degree Celsius depending on the emission of greenhous gases in the future.
- The sea level can rise 0,18 – 0,6 meter until 2090 if global trends remain the same.
- Extreme weather events can be more frequent.

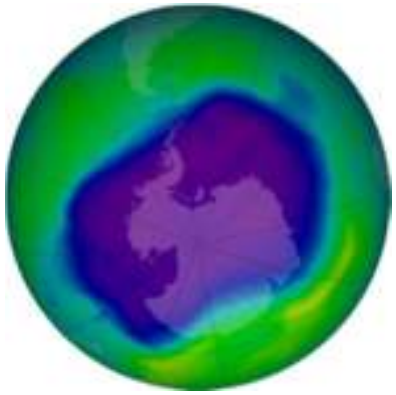
The effects of the melting of the polar cap

The health effects of climate change

- Extreme events like drought, flood, hurricane, extreme heat and cold can have acute (life threatening) effects
- Droguhts can deliver famine (especially in the develpoing countries)
- Global warming may lead to the rise of cases of the following diseses:
  - Diarrhea: sesonality can widen
  - Malaria: Anopheles mosquito can spread even on moderate climate
  - Dengue
  - The number of rodents (communicable diseases reservoir) can rise
- The number of air-borne diseases can decline in the winter

Ozone layer depletion

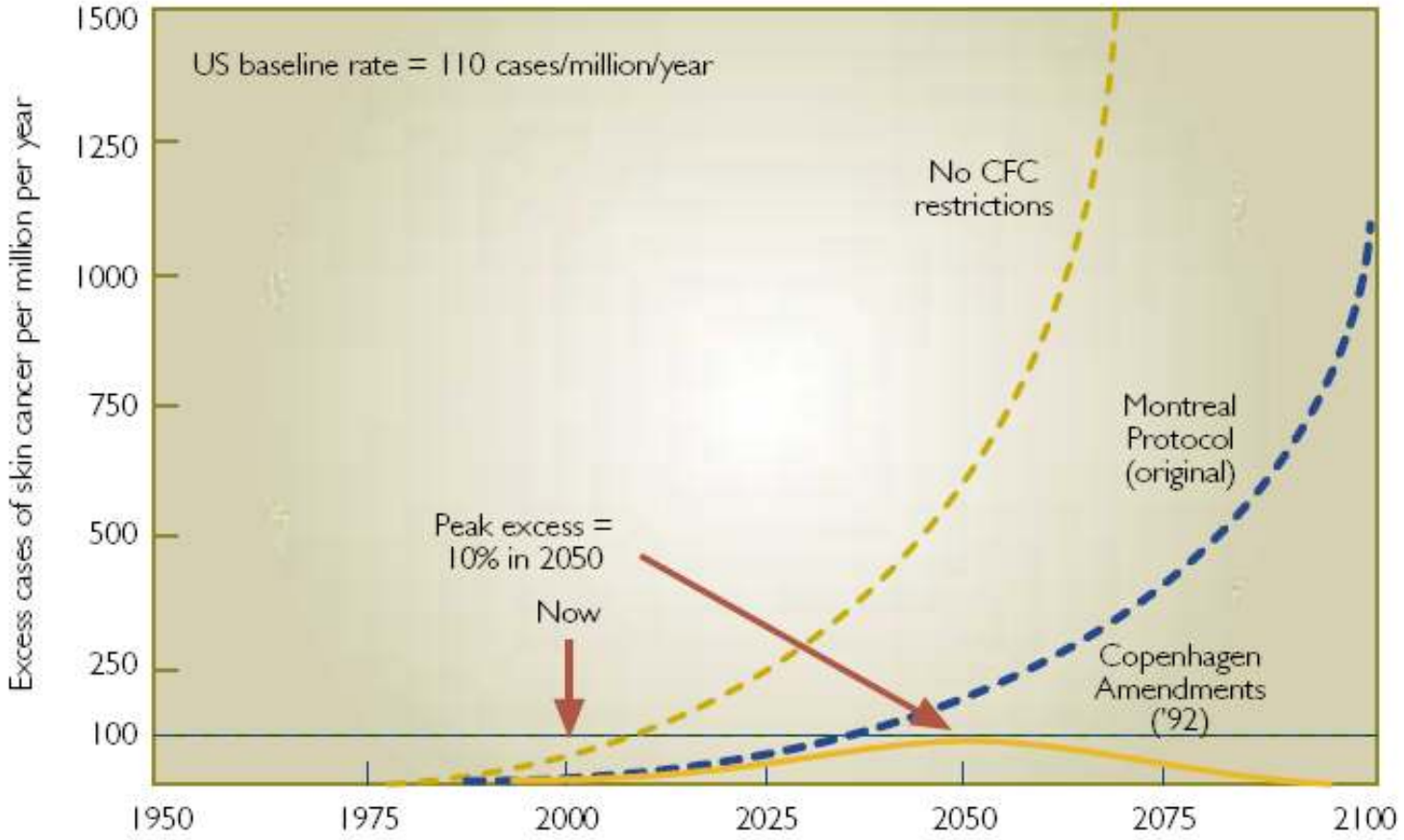
- Ozone layer found in the stratosphere (15-35 km) protects from UV radiation
- Certain gases (CFC) deplete the layer
- 1978: Sweden bans the use of these gases
- 1985: Discovery of the ozone hole above the Antarctis
- 1987: Montreal protocol – reduce (and later total ban) of ozone depleying gases
- 1997: Total ban of CFC use
- 2003: the depletion of the ozone layer slows down
- From WWII the amount of ozone depleyed with 4 % every decade



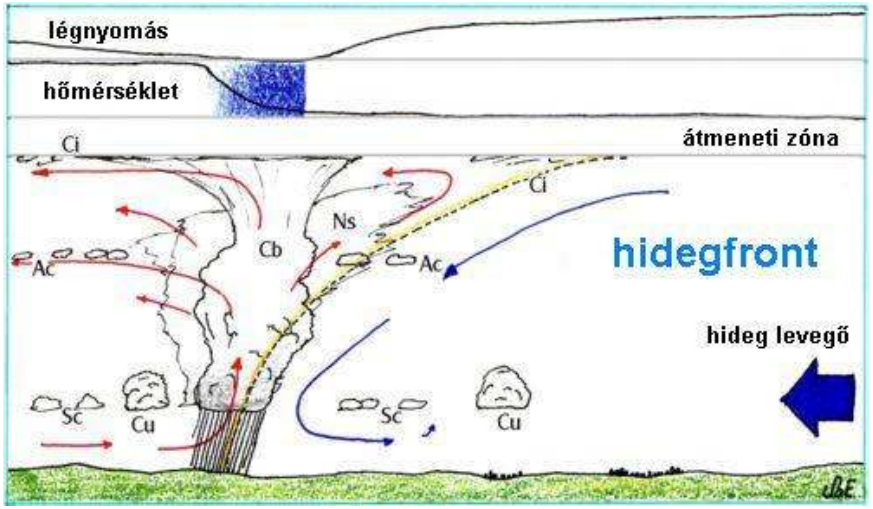
Health effects of ozone layer depletion

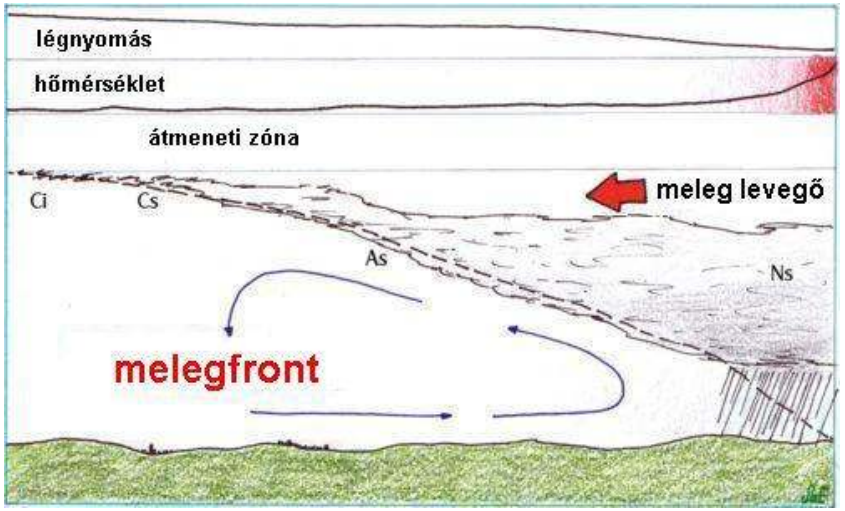
- Skin problems
  - Melanoma and other cancer
  - Dermatosis
- Eye problems
  - Keratitis, conjunctivitis
  - Macula degeneration
- Immune system damage
- Extra amount of vitamin D
- Possible protective effect for CV and diabetic patients and for some cancer

Connection between ozone and skin cancer incidence



Weather fronts



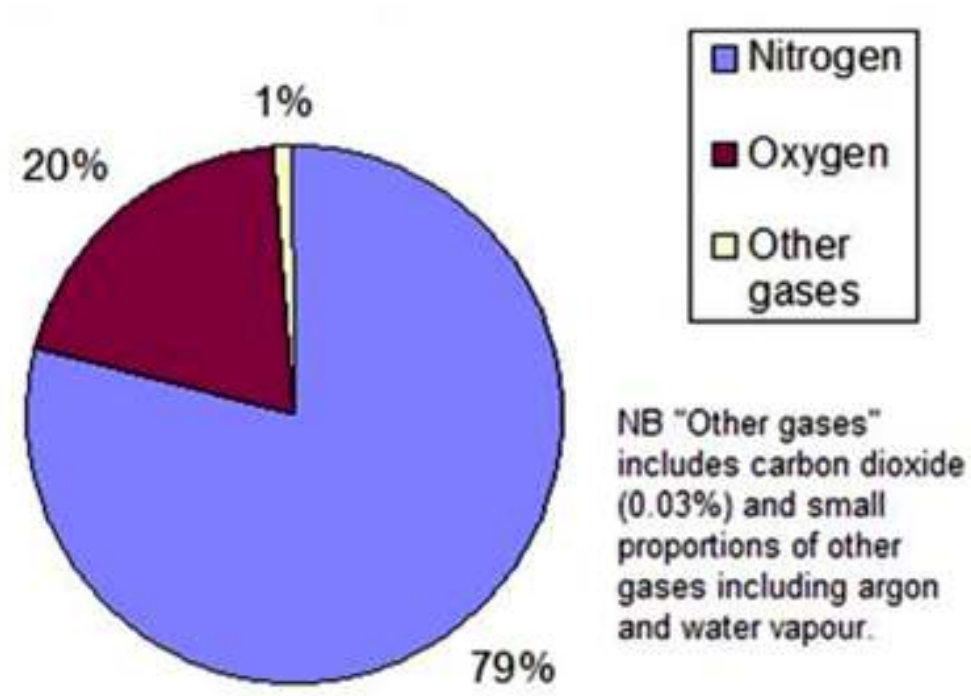


Air composition and parameters

Main parameters used to describe air:

- temperature
- pressure
- humidity
- air movement (air flow)
- radiation levels

Air composition



Source: Wikipedia online encyclopedia (http://simple.wikipedia.org/wiki/Air)

Air pollution

- „***An air pollutant is any substance in the air that can cause harm to humans or the environment***.” (US Environmental Protection Agency)

Air pollution may be classified according to:

- **Physical state**

  Gas, liquid (vapor), solid (particulate matter)

- **Chemical composition**

  Organic, inorganic

- **Toxicity**

  Non-toxic, unpleasant, toxic, carcinogenic, mutagenic

- **Source**

  Primary emitted pollutants and secondary pollutants that are produced from these in air

- **Importance** (the following are some of the most important air pollutants)

  Gaseous: SO_2, NO_x, CO, CO_2, O_3, PAHs

  Solid: PM 0-10 μm, metals, grime, dust

  Biological: bacteria, viruses, microscopic fungi, spores, pollen etc.

Basic concepts in air pollution

- ***Emission***

Emission of pollutants from source (measured in grams/hour)

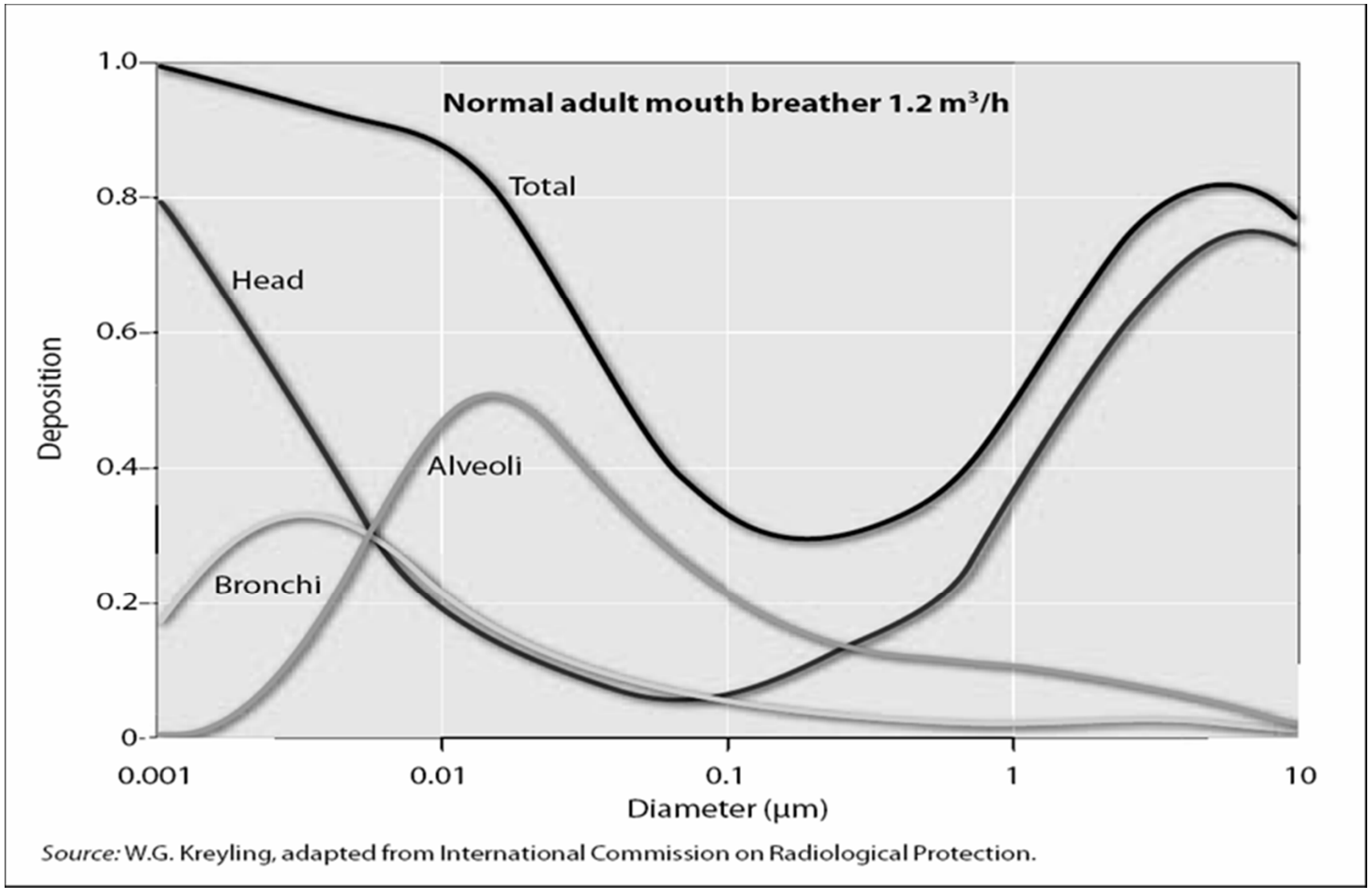
- ***Transmission***

Physical and/or chemical transformation of emitted pollutants in the environment

- ***Immission***

Concentration of pollution that is present in human environments at 2m height (measured in mg/m^3 or $\mu g/m^{3)}$

Deposition of particulate matter according to diameter



Source: Health aspects of air pollution. WHO Europe, 2004 (http://www.who.dk).

Smog

Los Angeles

- +25 - 35 C
- less than 70% humidity
- less than 2 m/s wind
- July - October
- O_3, NO_X, CO
- Oxidative
- peak concentration: noon

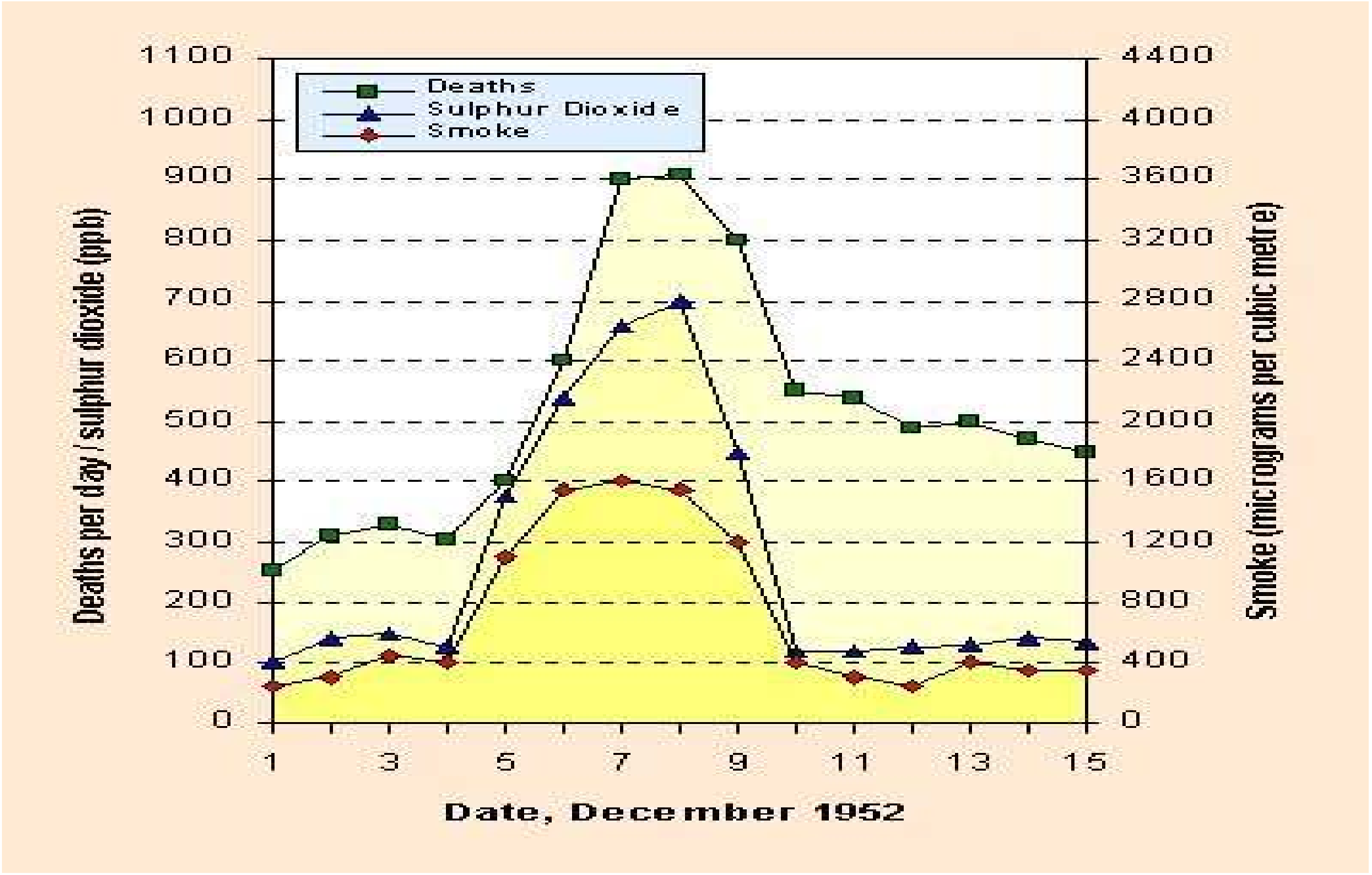
London

- -3 - +5 C
- over 80% humidity
- less than 2 m/s wind
- November - January
- SO_2, CO, dust
- Reductive
- Morning - night

Smog

- London-type smog is relatively rare nowadays with decreasing reliance of populations on coal as a source of energy
- Los Angeles type smog constitutes a significant public health problem in specific regions of various developed and developing countries
- Most important factors associated with the occurrence of (L.A. type) smog are: heavy traffic, high UV irradiation levels, high temperatures and little air movement or temperature inversion (warm air is trapped at ground level instead of rising as normal)
- Smog is directly harmful to human health (aggravates various respiratory and cardiovascular diseases), has adverse environmental effects and significantly decreases visibility

Statistics from the Great London Smog 1952



Health effects of common air pollutants

Pollutant	Effects related to short-term exposure	Effects related to long-term exposure
Particulate matter	• Lung inflammatory reactions • Respiratory symptoms • Adverse effects on the cardiovascular system • Increase in medication usage • Increase in hospital admissions • Increase in mortality	• Increase in lower respiratory symptoms • Reduction in lung function in children • Increase in chronic obstructive pulmonary disease • Reduction in lung function in adults • Reduction in life expectancy, owing mainly to cardiopulmonary mortality and probably to lung cancer
Ozone	• Adverse effects on pulmonary function • Lung inflammatory reactions • Adverse effects on respiratory symptoms • Increase in medication usage • Increase in hospital admissions • Increase in mortality	• Reduction in lung function development
Nitrogen dioxide[a]	• Effects on pulmonary function, particularly in asthmatics • Increase in airway allergic inflammatory reactions • Increase in hospital admissions • Increase in mortality	• Reduction in lung function • Increased probability of respiratory symptoms

[a] In ambient air, nitrogen dioxide serves as an indicator for a complex mixture of mainly traffic-related air pollution.

Source: Health aspects of air pollution. WHO Europe, 2004 (http://www.who.dk).

Why children are at higher risk

Factors related to physiology	• Children breathe more per unit body weight than adults
	• Children have smaller airways and lungs
Factors related to metabolism	• Different rate of toxification and detoxification
Factors related to lung growth and development	• Vulnerability of developing and growing airways and alveoli
	• Immature host defence mechanisms
Factors related to time-activity patterns	• Time spent outdoors
	• Increased ventilation with play and exercise
Factors related to chronic disease	• High prevalence of asthma and other diseases
Factors related to acute disease	• High rates of acute respiratory infections

Source: Health aspects of air pollution. WHO Europe, 2004 (http://www.who.dk).

Prevention of the effects of air pollution

- Emission and immission limits
- Technological advances
- Continuous monitoring
- Regular prediction of pollutant levels and information of public)
- Smog-alert plans (coordinating efforts of public health authorities and local municipal governments, decreasing traffic, informing the public to stay indoors etc.)
- Reducing biological sources (ragweed etc.)

Limits on air pollution

Health-protection limit values and guidelines

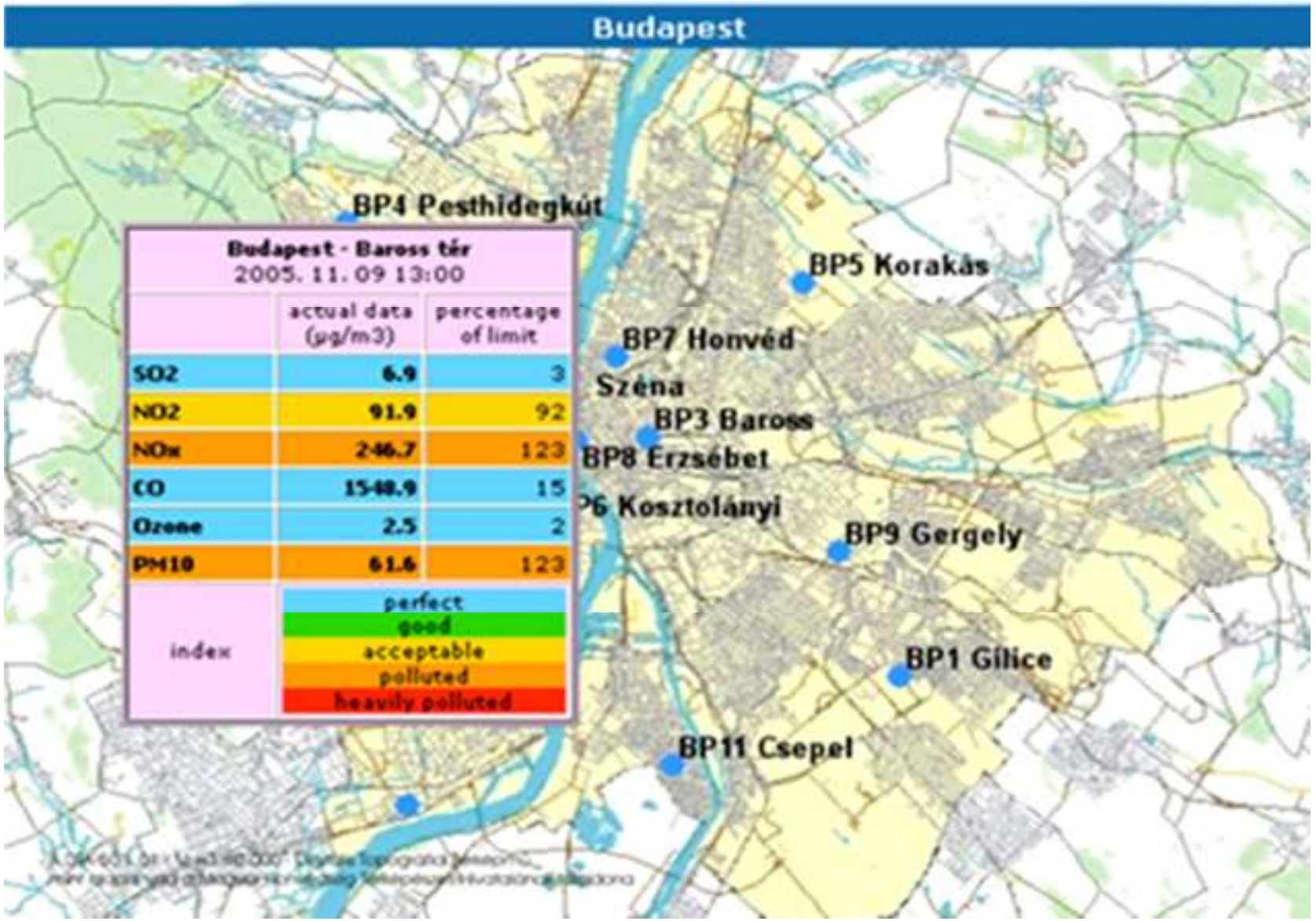
EU Directives

Compound	Limit/target value			Target year
PM_{10} Stage 1	Annual average:	40 µg/m³		2005
	Daily average:	50 µg/m³	Not to be exceeded more than 35 days a year	2005
PM_{10} Stage 2	Annual average:	20 µg/m³	Indicative	2010
	Daily average:	50 µg/m³	Indicative; not to be exceeded more than 7 days a year	2010
NO_2	Annual average	40 µg/m³		2010
	Hourly average:	200 µg/m³	Not to be exceeded more than 18 hours per year	2010
Ozone	8-hour average:	120 µg/m³ (target value)	Not to be exceeded more than to 25 days per year (1)	2010
SO_2	Daily average:	125 µg/m³	Not to be exceeded more than 3 days per year	2005
	Hourly average:	350 µg/m³	Not to be exceeded more than 24 hours per year	2005
CO	8-hour average:	10 µg/m³		2005
Pb	Annual average:	0.5 µg/m³		2005 (2)
Benzene	Annual average:	5 µg/m³		2010

(1) As an average over the three preceding years.
(2) 2010 in the immediate vicinity of specific industrial sources, notified to European Commission before 19 July 2001.

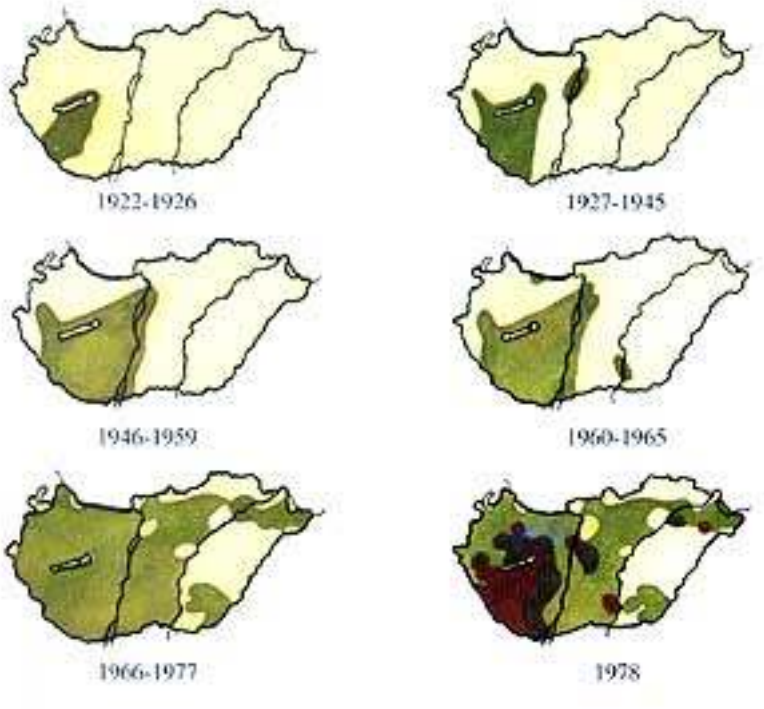
Source: European legislation on sources of air pollutant emissions (Source: European Environment Agency, EEA, http://www.eea.eu.int).

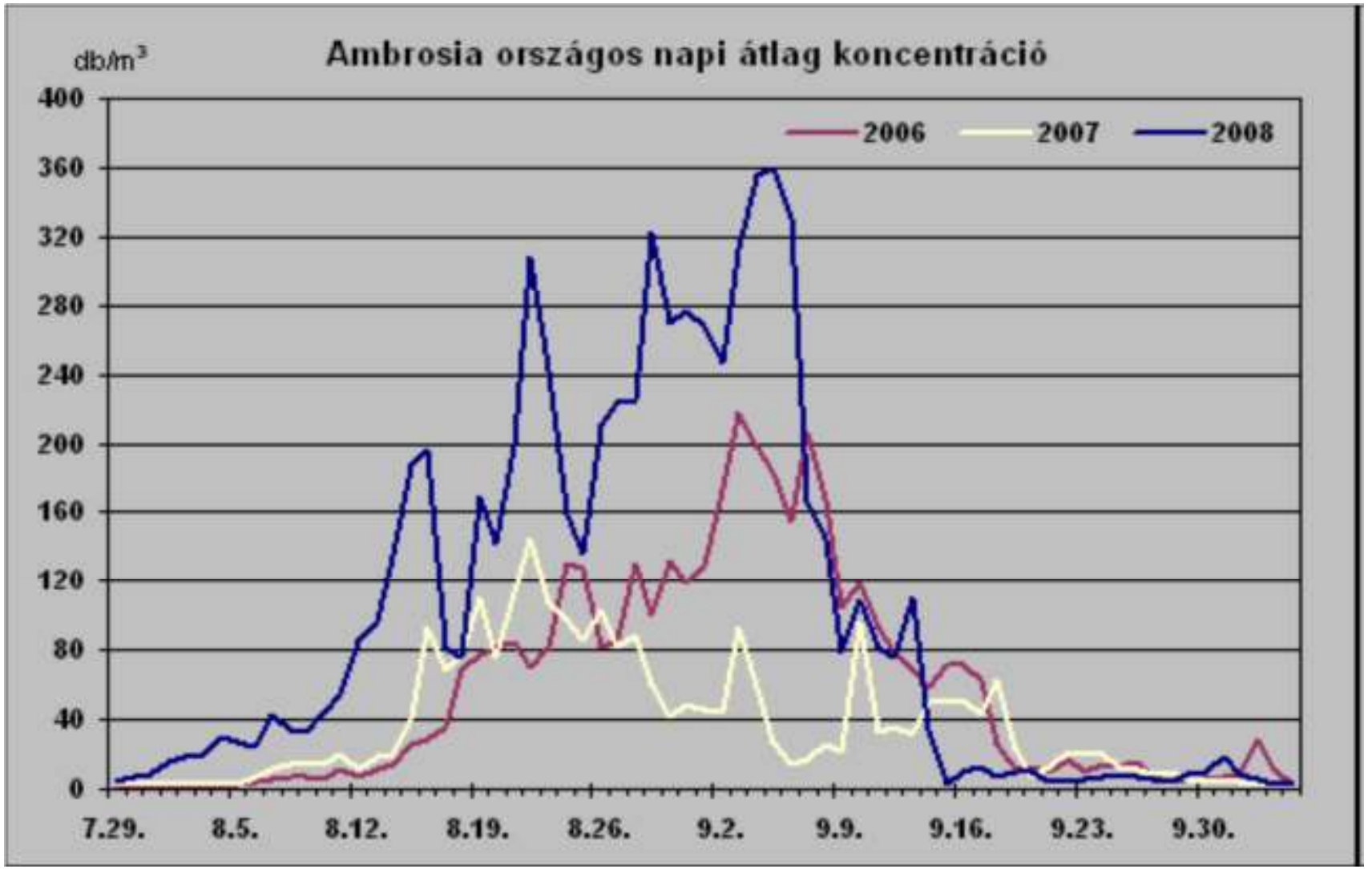
Source: Hungarian Air Quality Network http://www.kvvm.hu/olm



Source: Hungarian Air Quality Network http://www.kvvm.hu/olm

Ragweed (ambroise)

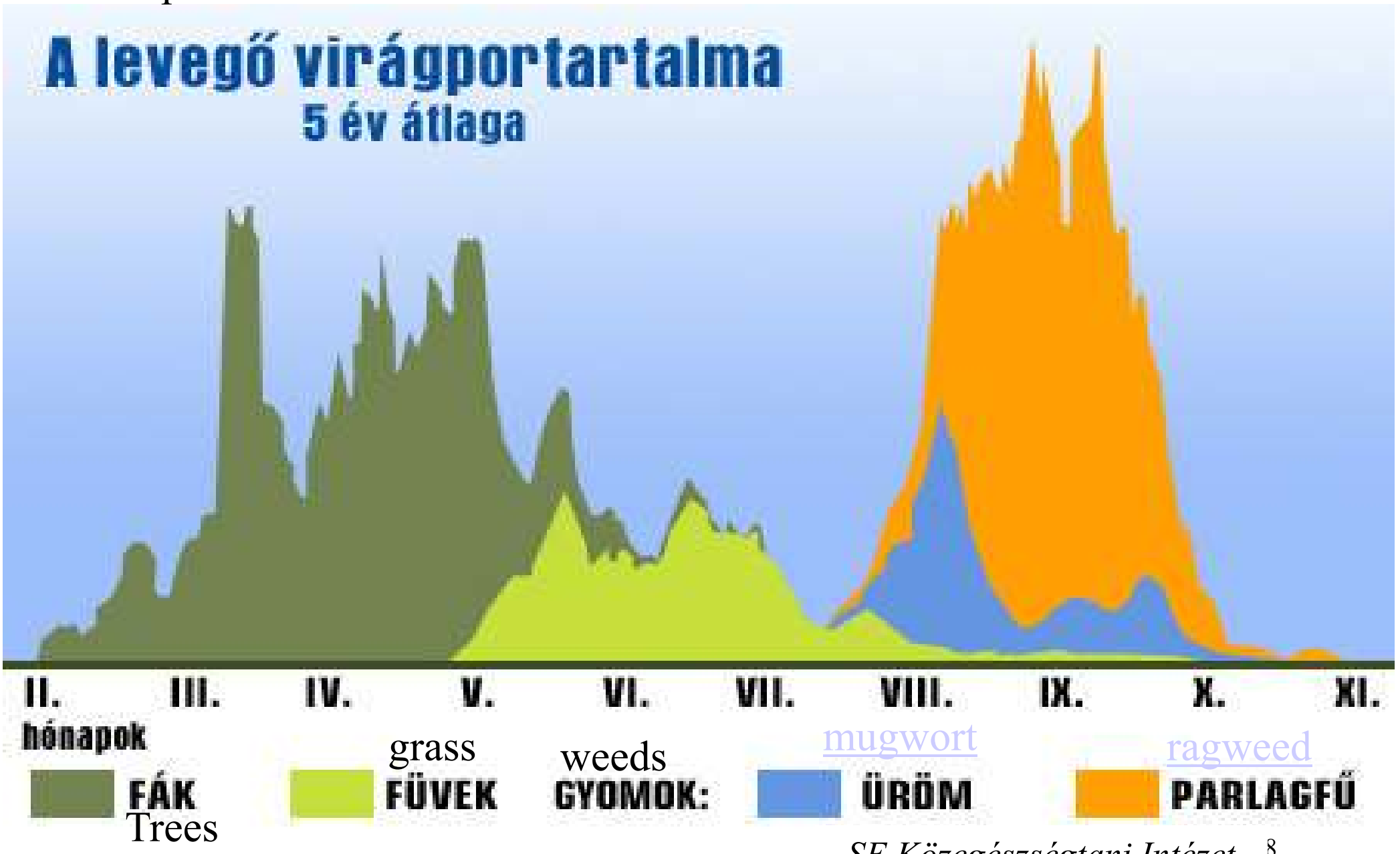




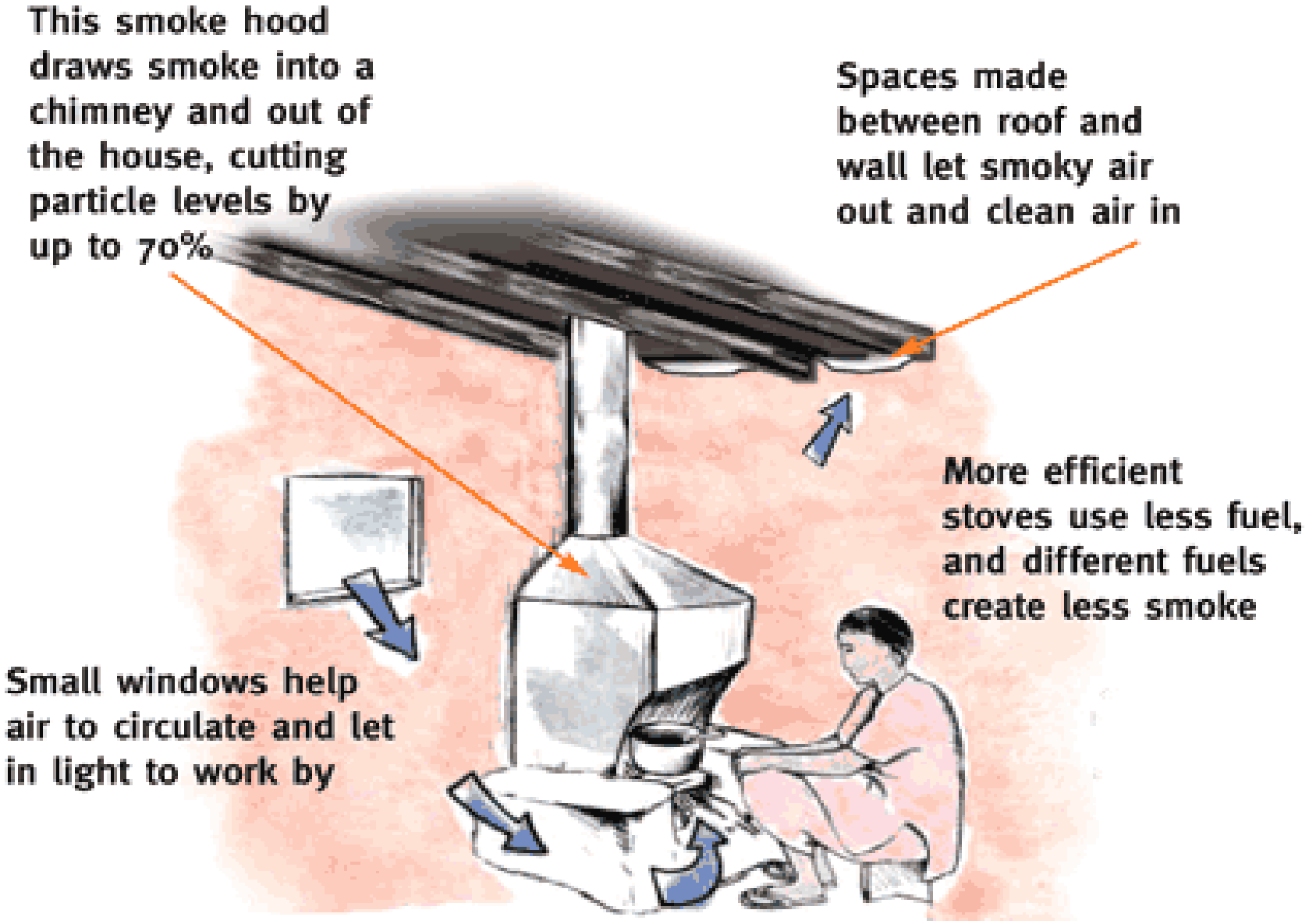
ORSZÁGOS KÖRNYEZETEGÉSZSÉGÜGYI INTÉZET:

The daily average concentration of ragweed (*Ambrosia artemisiifolia*) in Hungary

The pollen content of the air

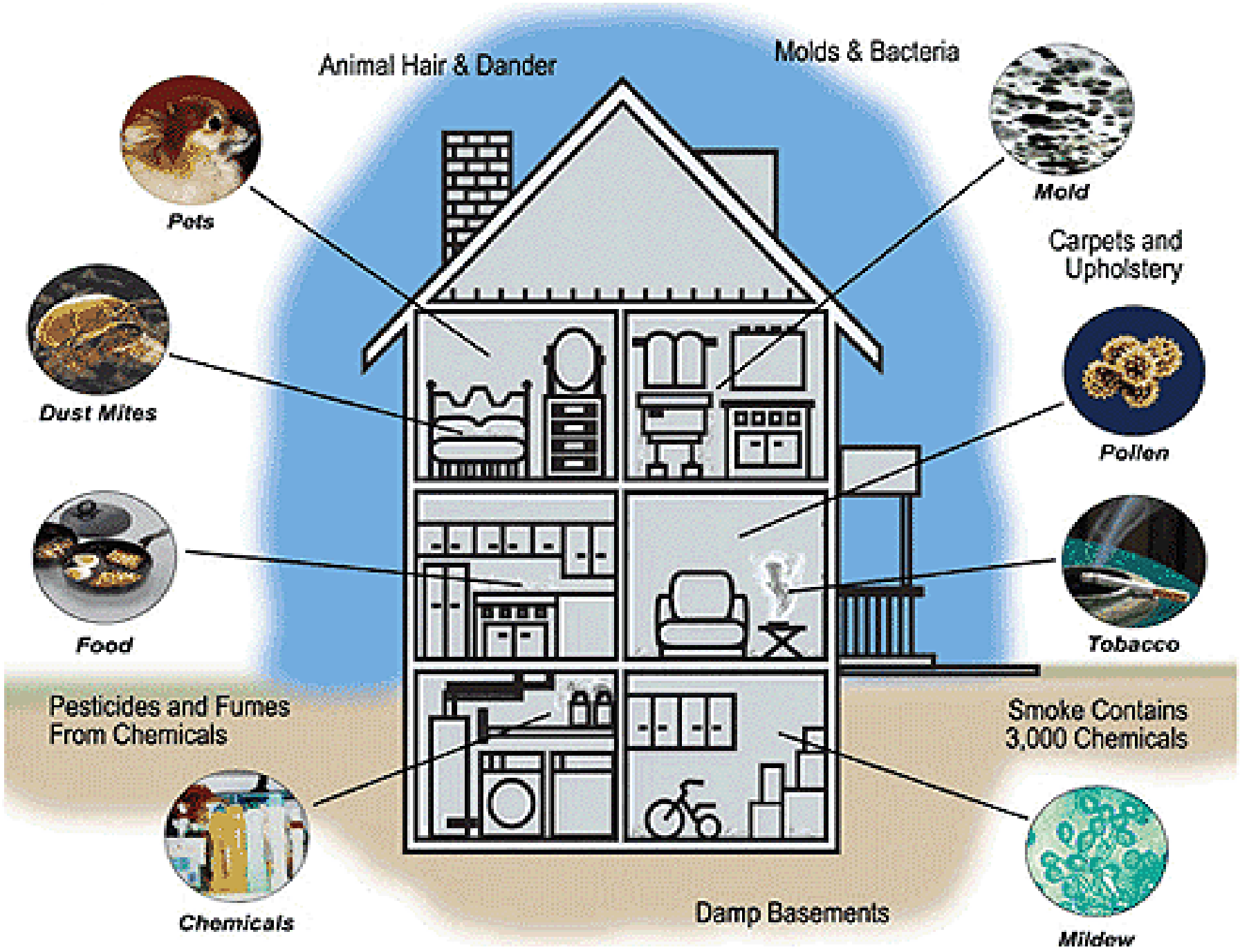


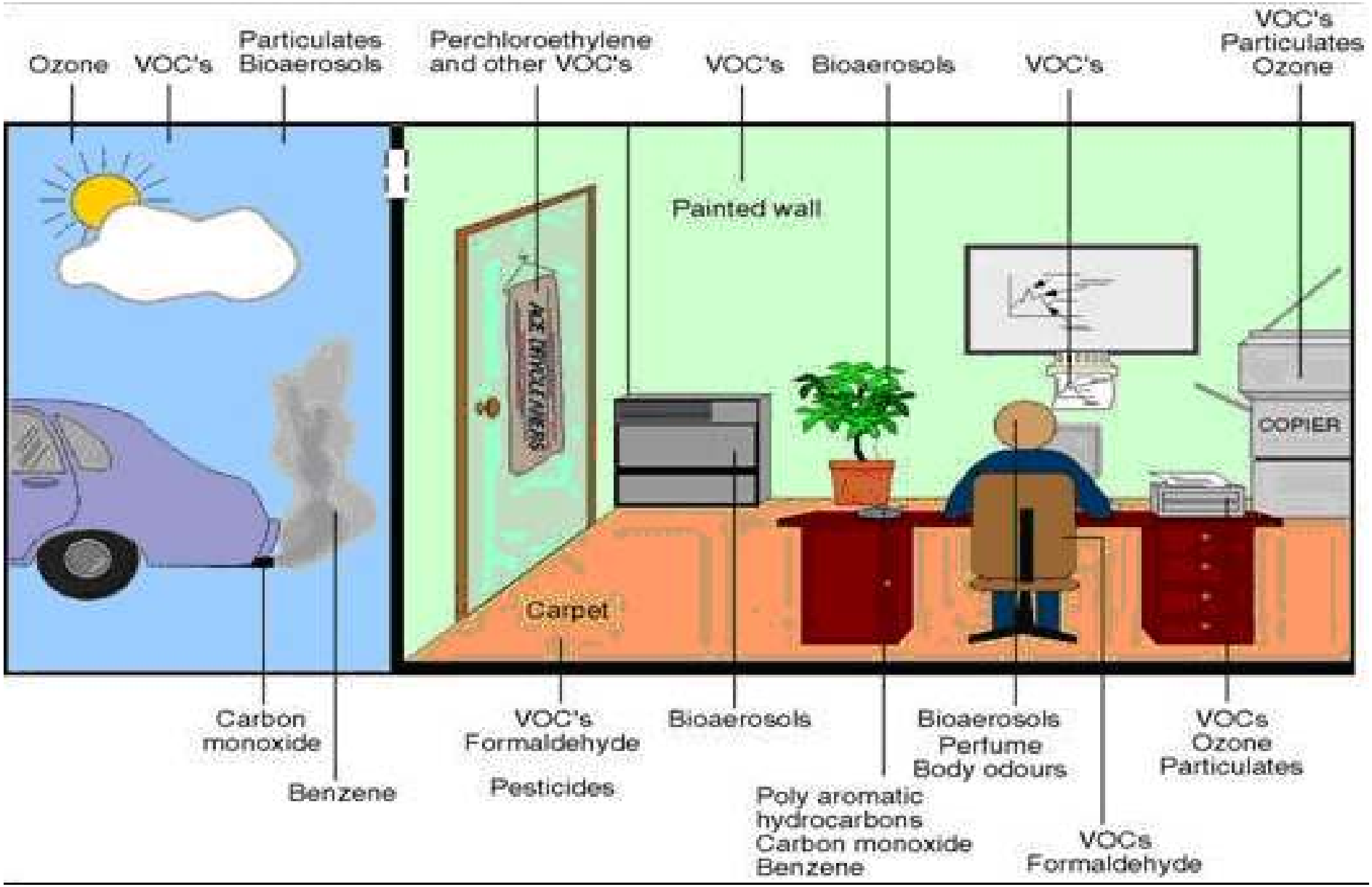
Indoor air pollution



Sources of potential health damage in the home

- **Accident**-prone circumstances (illumination, stairs, electric circuitry…)
- **Fire**-prone circumstances (flammable materials near heat sources or open flames)
- Problems with **lighting**
- **Asbestos** containing insulation
- **Radon gas** accumulation and consequent exposure to radiation
- **Noise** and **vibration**
- **Toxic** combustion products (ETS (**E**nvironmental **T**obacco **S**moke)!!, CO, CO_2, NO_X, SO_X)
- **Lead** (lead-based paint, water (plumbing), outdoor air, dust)
- **Volatile organic compounds** (formaldehyde, paints, varnishes, solvents, air-fresheners, wood-preservatives…etc.)
- **Biological, allergenic or infectious** agents (mold, house-mites, pets and farm animals, rodents, arthropods, pollen, Legionella, M. tuberculosis, E. coli)
- **Crowding, aesthetic and ergonomic** inadequacies (psychological/physical effects)


Animal Hair & Dander
Molds & Bacteria
Pets
Mold
Carpets and Upholstery
Dust Mites
Pollen
Food
Tobacco
Pesticides and Fumes From Chemicals
Smoke Contains 3,000 Chemicals
Chemicals
Damp Basements
Mildew



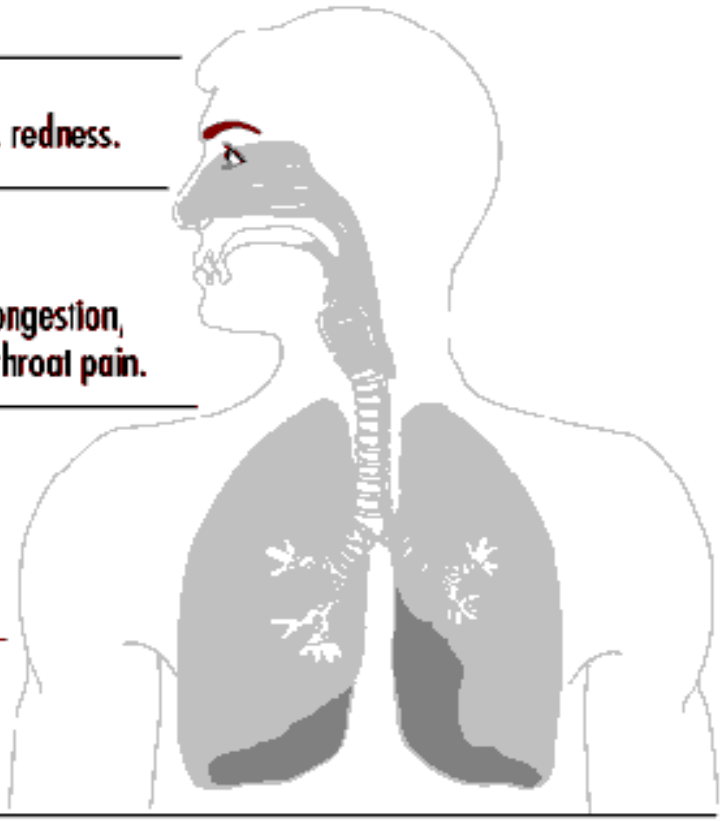
Some possible indoor air pollution sources in an office

EYES
Dryness, itching/stinging, tearing, redness.

UPPER RESPIRATORY TRACT
(nose and throat)
Dryness, itching/stinging, nasal congestion, nasal drip, sneezing, nose bleed, throat pain.

LUNGS
Chest tightness, drowning sensation, wheezing, dry cough, bronchitis.

SKIN
Redness, dryness, general and localized itchiness.



GENERAL
Headache, weakness, drowsiness/lethargy, difficulty concentrating, irritability, anxiety, nausea, dizziness.

MOST COMMON ILLNESSES:

HYPERSENSITIVITY
Hypersensitivity pneumonitis, humidifier fever, asthma, rhinitis, dermatitis.

INFECTIONS
Legionellosis (Legionnaire's disease), Pontiac fever, tuberculosis, common cold, flu.
Of unknown chemical or physical origins, including cancer.

Symptoms and illnesses related to the quality of indoor air

Pneumonitis

Humidifier fever

Asthma

Rhinitis

Dermatitis

Infections

Syndromes connected to indoor environments

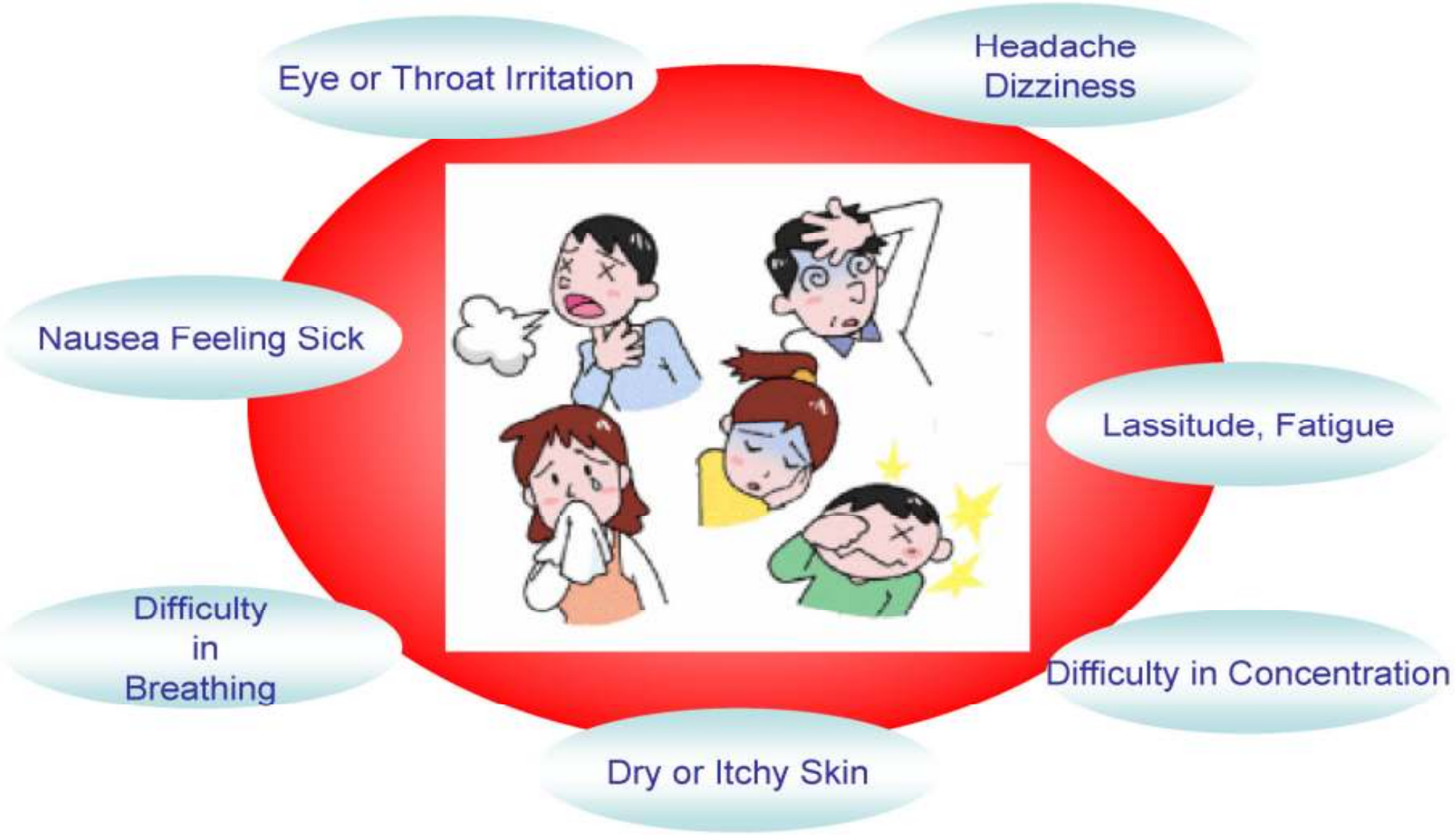
Building Related Illness: a **discrete, identifiable disease or illness that** can be traced to a specific pollutant or source within a building.

Sick Building Syndrome: term that refers to **a set of symptoms** that affect some number of building occupants during the time they spend in the building and **diminish or go away during periods when they leave the building**. Cannot be traced to specific pollutants or sources within the building.

Humidifier Fever: a **respiratory illness caused by exposure to toxins from microorganisms found in wet or moist areas in humidifiers** and air conditioners. Also called air conditioner or ventilation fever.

Source: EPA: "The Inside Story: A Guide to Indoor Air Quality (http://www.epa.gov/iaq/pubs/insidest.html)

Sick Building Syndrome



To Avoid Sick Building Syndrome usually include a combination of the following measures:

- **If the pollutant source is easily identified, removal or…**

Heating, air conditioning and ventilation systems should be kept clean and regularly maintained

- **Smoking should be banned or…**

- **Try to ensure access to natural sunlight and opening windows for ventilation can also help …**

- **Regular cleaning of soft furnishings to avoid the built up of dust and dust mites**

- **Wherever possible sources of pollution should be eliminated or relocated to a place where there are fewer people**
(for example, the removal of gas heaters or photocopiers from busy work areas)

- **Canteens or kitchens should be kept clean with food and drink remains regularly disposed of**