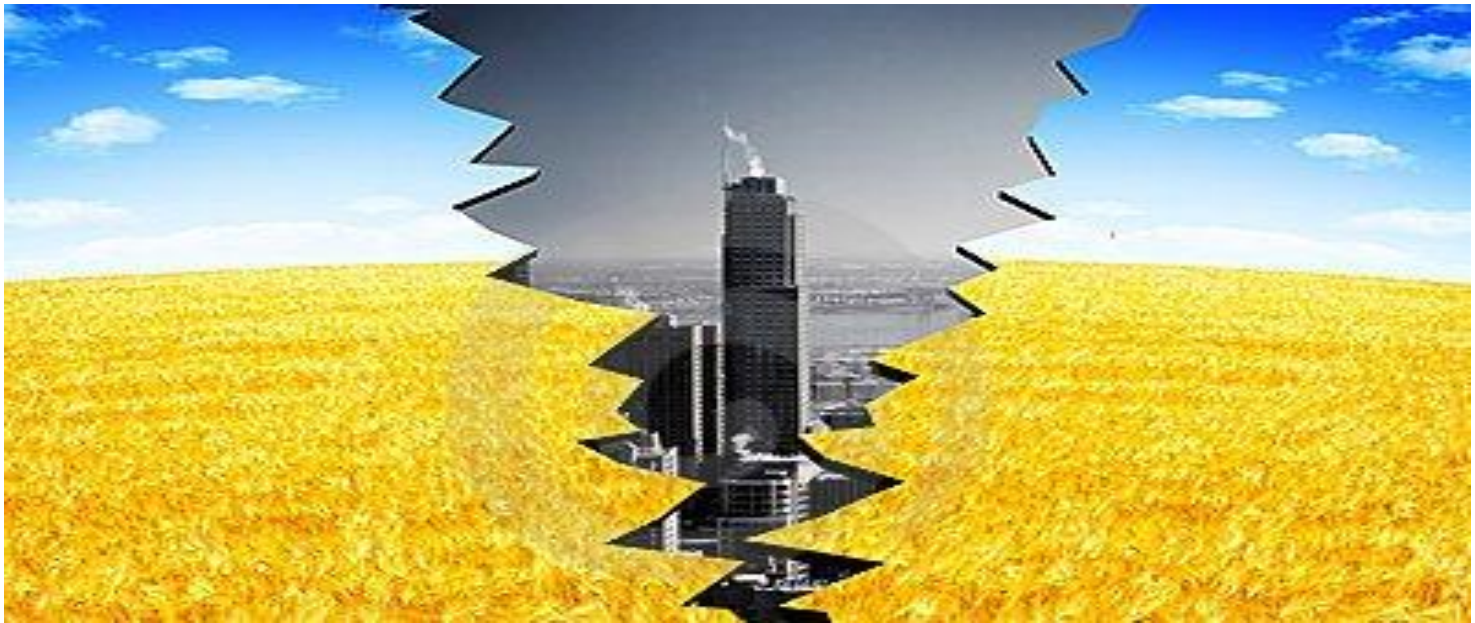
VOLGOGRAD STATE MEDICAL UNIVERSITY
CHAIR OF GENERAL HYGIENE AND ECOLOGY

Lecture:

Hygienic problems of human settlements. Living conditions in modern cities and their impact on population health.



WORLD POPULATION: HISTORY, TRENDS, AND PROJECTIONS

- For 99% of human history population growth was restricted by disease and food supplies.
- This continued until the mid-18th century, when the Industrial Revolution improved the standard of living for much of the world.
  - Improvements included better food, cleaner drinking water, improved housing and sanitation, and medical advances.

- Scientific and technological revolution which began in the 19th century, had a huge effect on all sides of the life of a society, emphasizing economic, natural, scientific, social and medical problems. One of such problems was **the problem of urbanization**.

- The word *“URBANIZATION”* derives its name from the Latin word *“urbanus”* which means *“city”*.
- It is a process of increasing the role of a city in the development of a society (according to Academician N.A. Agadzhanjan).

SOME PRECONDITIONS OF URBANIZATION:

- Development of industry
- Territorial division of labour
- Development of cultural and political functions of a city

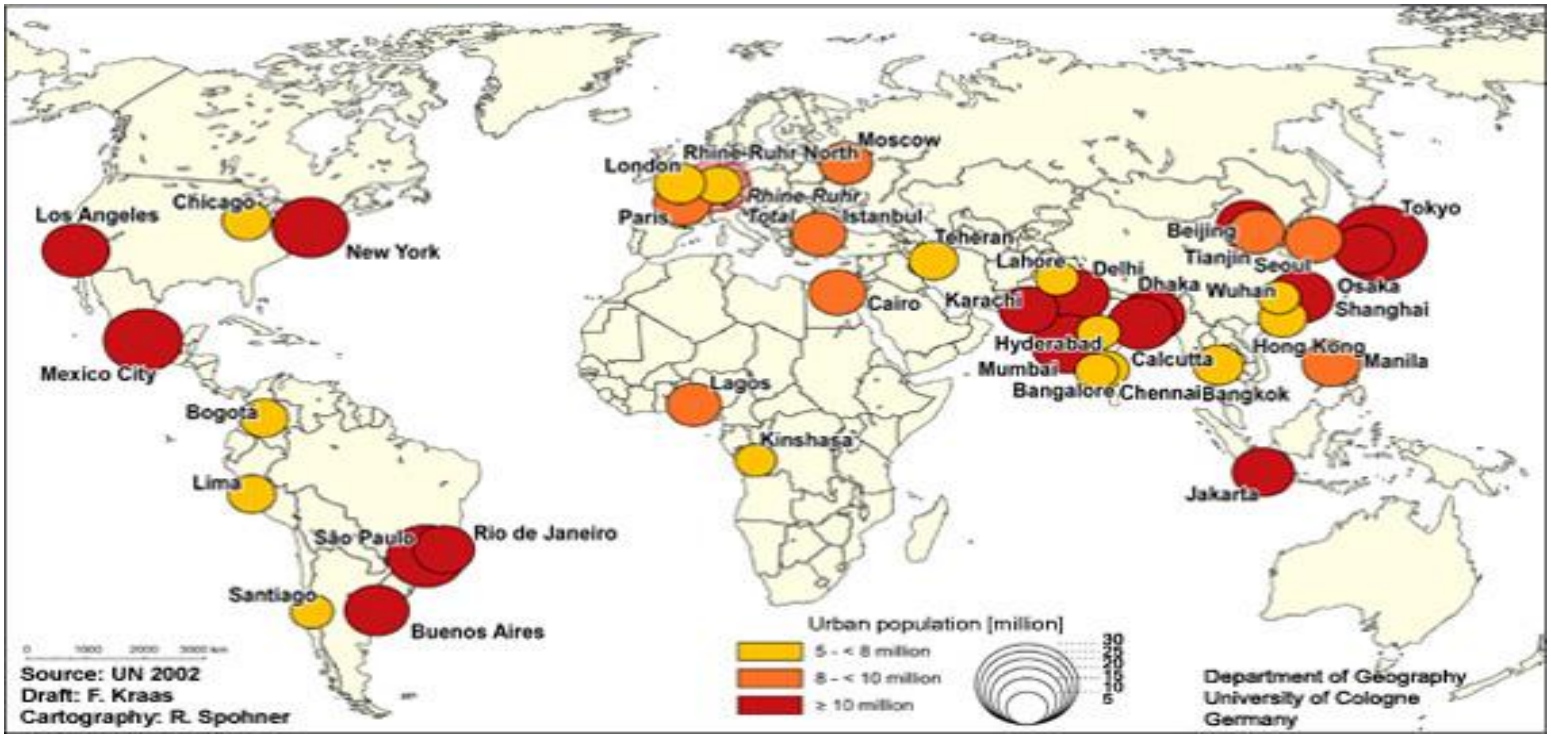
The industrial revolution led to a rapid development of production and, as a result, to a growth of cities.

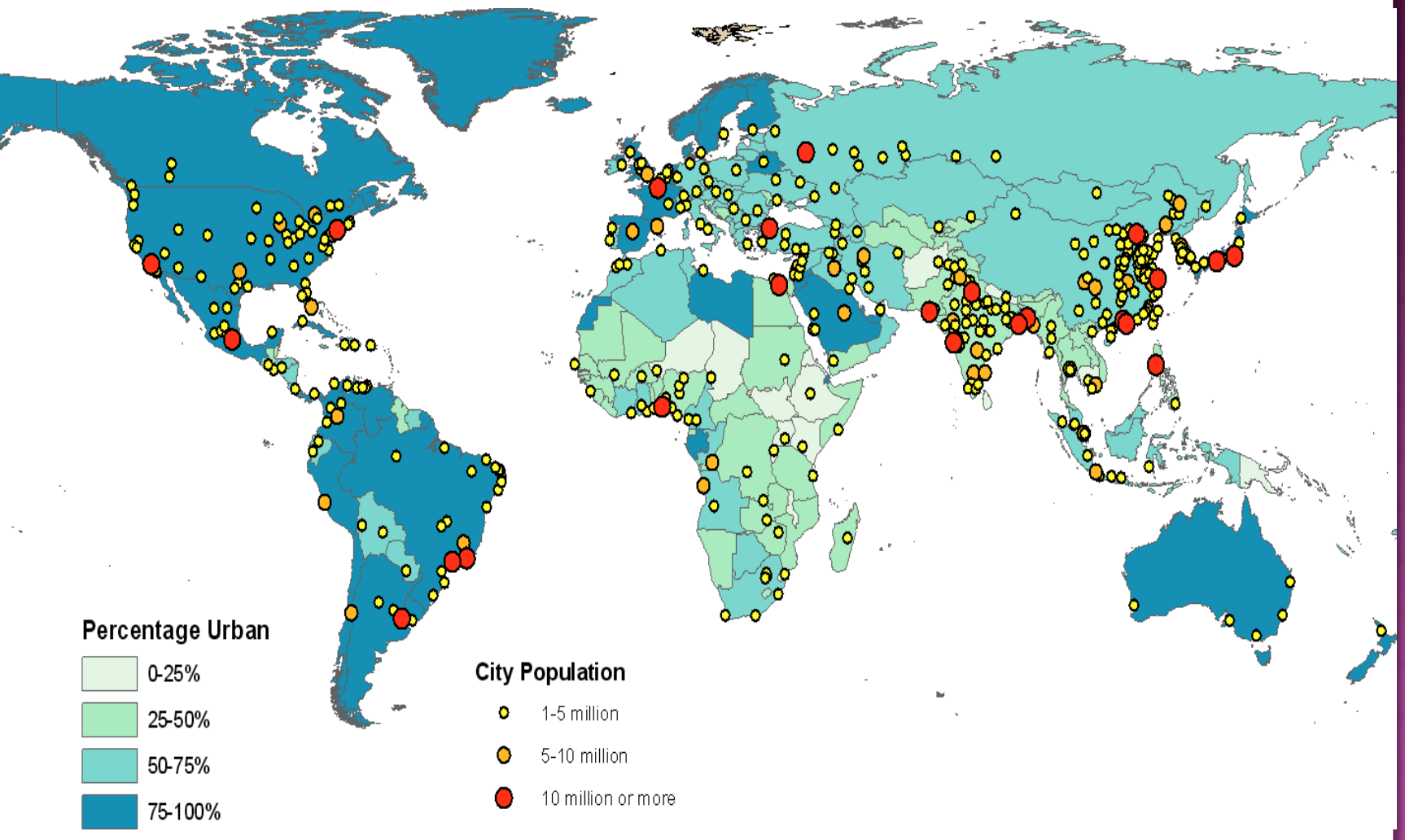
By a 1800 the population of London had 1 000 000 people,

the population of Paris had over 1 000 000 inhabitants, and at the beginning of the 20 century there were already ***12 cities – millionaires****, including St –Petersburg and Moscow*

THE WORLD'S URBAN CENTERS

At this moment world's population is 6 billion people. The urbanization is about 50 per cent which means that half of the population is living in the urban areas and the other half in the rural areas.




Percentage Urban
0-25%
25-50%
50-75%
75-100%
City Population
1-5 million
5-10 million
10 million or more

Cities with more then 1 million people in Russia

THE MOST URBANIZED COUNTRIES ON THE PLANET

- USA –about 74 % of the population live in the cities
- France –about 78 %
- Germany –about 85 %
- Great Britain –91 %.

IN RUSSIA

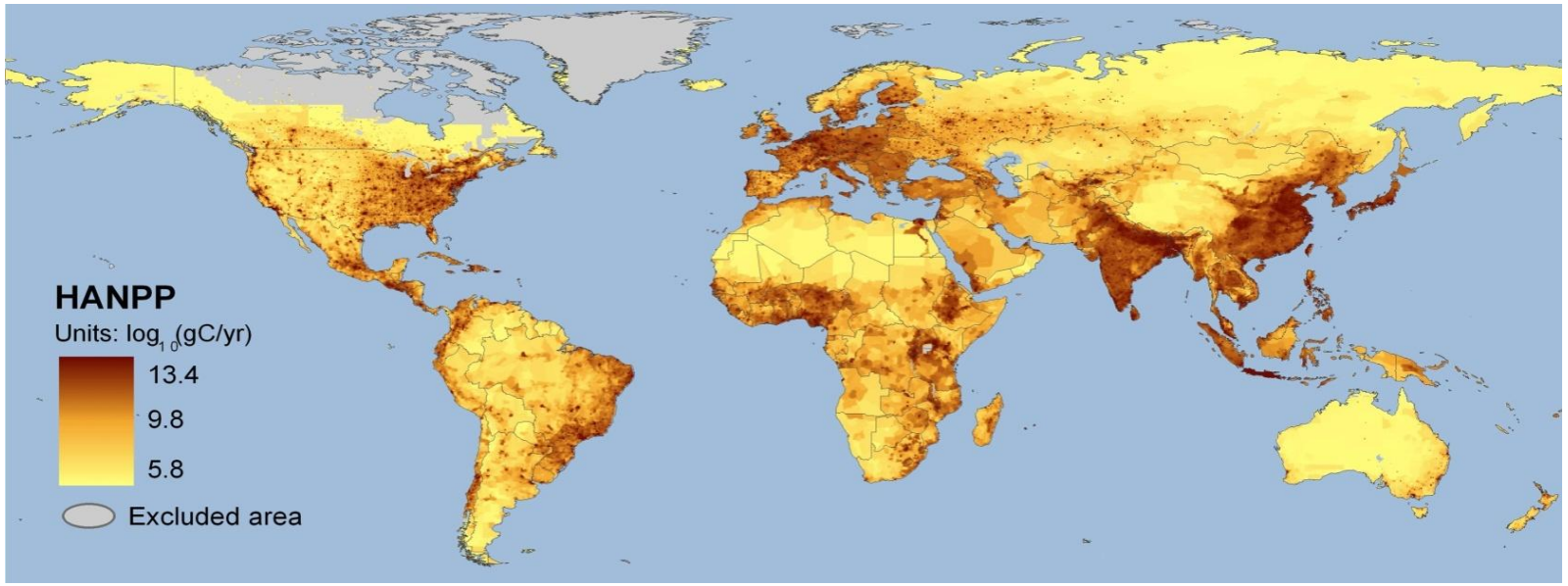
- 73 % of the population live in the cities at the moment.
- There are 13 cities with the population of more than 1 000 000 people
- and 36 cities with the population of more than 500 000 inhabitants in Russia.

URBANIZATION

- Transformation of a society from a rural to an urban one.
- **Urbanized area** - One or more places and the adjacent densely populated surrounding area that together have a minimum population of 50,000.
- **Megacities** - Cities with 10 million residents or more.

POPULATION DENSITY

- The number of people per unit of land area.
- *The population density of India is 869 people per square mile, compared with 80 people per square mile in the United States.*



ADVANTAGES OF URBANIZATION

- high level of a sanitary improvement of a city environment
- higher cultural maintenance
- some opportunities for education, sports, politics

DISADVANTAGES OF URBANIZATION

- Effects on the health of the residents of a city
- high levels of stress

SUBURBANIZATION

- As city residents left the city to live in the suburbs, cities experienced **deconcentration**, the redistribution of the population from cities to suburbs and surrounding areas.
- As more and more people moved to the **suburbs,** urban areas surrounding central cities - suburbanization.

WHAT ARE POSSIBLE FORMS OF INTERACTION OF THE CITY AND ENVIRONMENT?

City and the atmosphere

City and water

City and hazardous waste of production and consumption

City and anthropogenous factors of nature

- city noise
- city and electromagnetic fields
- microclimate of a city

Bacteriological danger in a city

Peculiarities of a psychic and physiological state of the city population

CITY AND THE ATMOSPHERE

The Sourses of air pollutants:

- different branches of industry
- enterprises of thermal energy
- transport

INDUSTRY

- **Ferrous metallurgy** is one of the most important pollutants of the air in the city.

The emissions of these enterprises contain *simple dust, fine-grained dust, oxides of carbon* .

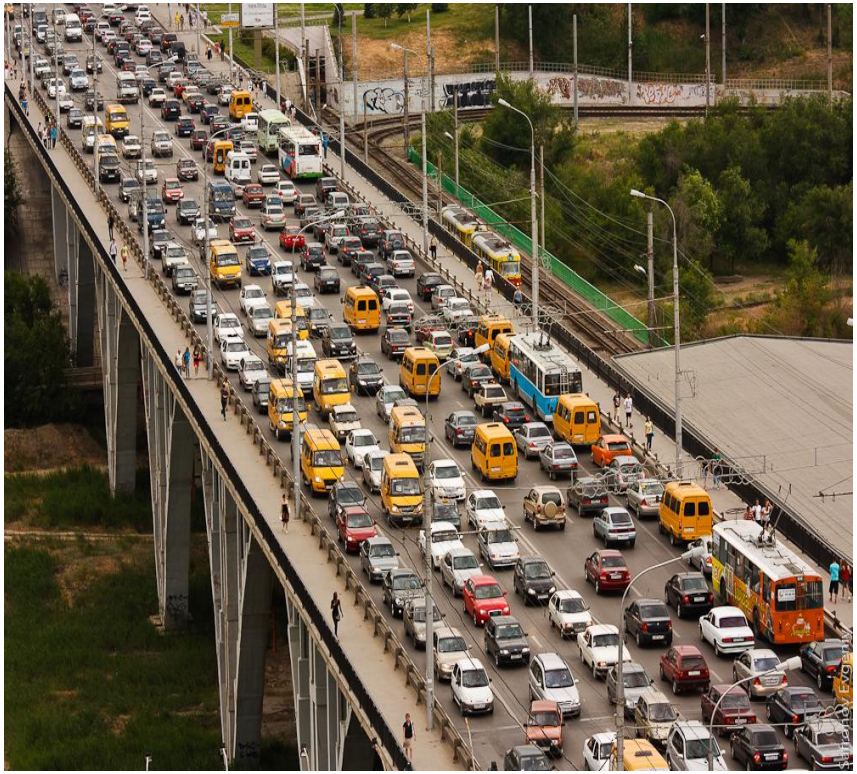
- **The chemical Industry** is characterized by a variety of emission(compounds of sulfur, oxides of nitrogen,chlorine and its derivatives, fluorine)
- **The enterprises of thermal energy** include TPS (thermal power station) - compounds of sulfur, oxides of nitrogen and carbon.

TRANSPORT

- Nevertheless, in the global air pollution the most important role belongs to **transport** (more then 70 %).

  The car exhaust fumes are emitted into the surface layer of the atmosphere, which is the area of breathing.

  The narrow streets lined with high buildings makes the dispersion of the car exhaust fumes even more difficult.



The main pollutants:

- oxides of nitrogen
- compounds of lead
- hydrocarbons,

which under the influence of sun rays form complex compounds called «**photochemical smog**»

- Several pollutants,such as **polycyclic hydrocarbons**, whose concentrations near the motor and highways are 10 to 12 times more than the maximum permissible concentration, are believed responsible for air pollution.

- **Railway transport** (whose emissions make up 9%) and **air transport** (especially supersonic) still pollute the air we breath.
- For ex., according to its toxicity, a modern jet liner is equal to 7000 or 8000 of cars.

WATER

- Conditions for contaminations of Water with hazardous waste are created in modern cities.
- Besides hazardous waste that many factories produce,toxic compounds of metals and organic substances are dumped carelessly into the water.
- Water pollution affects a *biological balance of water flora and fauna* and makes it possible for some substances of any nature to exist.

CITY AND HAZARDOUS WASTE OF PRODUCTION AND CONSUMPTION

- One of the most crucial problems of a city is the problem of trash – its disposal, transportation and recycling.
- The amount of waste dumped is steadily increasing.A daily amount of solid waste per one person 10 years ago was only 0,6 kg, and now it makes about 1,2 kg and even more.
- *Nowdays* we are facing a trash crisis since there are a great deal of synthetic, plastic, flammable liter which cannot be dumped because it does not decomposed, and on buring it some extremely *toxic substances are released.*

CITY AND ANTHROPOGENOUS FACTORS OF NATURE.

TRAFFIC

- Many public roads in urban areas are afflicted with what some call **auto sclerosis,** clogged vehicular arteries that slow rush hour traffic to a crawl, even without accidents or construction crews.

YELLOW BIKE PROGRAM

- In Austin, Texas, a community bike program makes bikes available for anyone to use and then leave in a prominent place so someone else can use the bike.

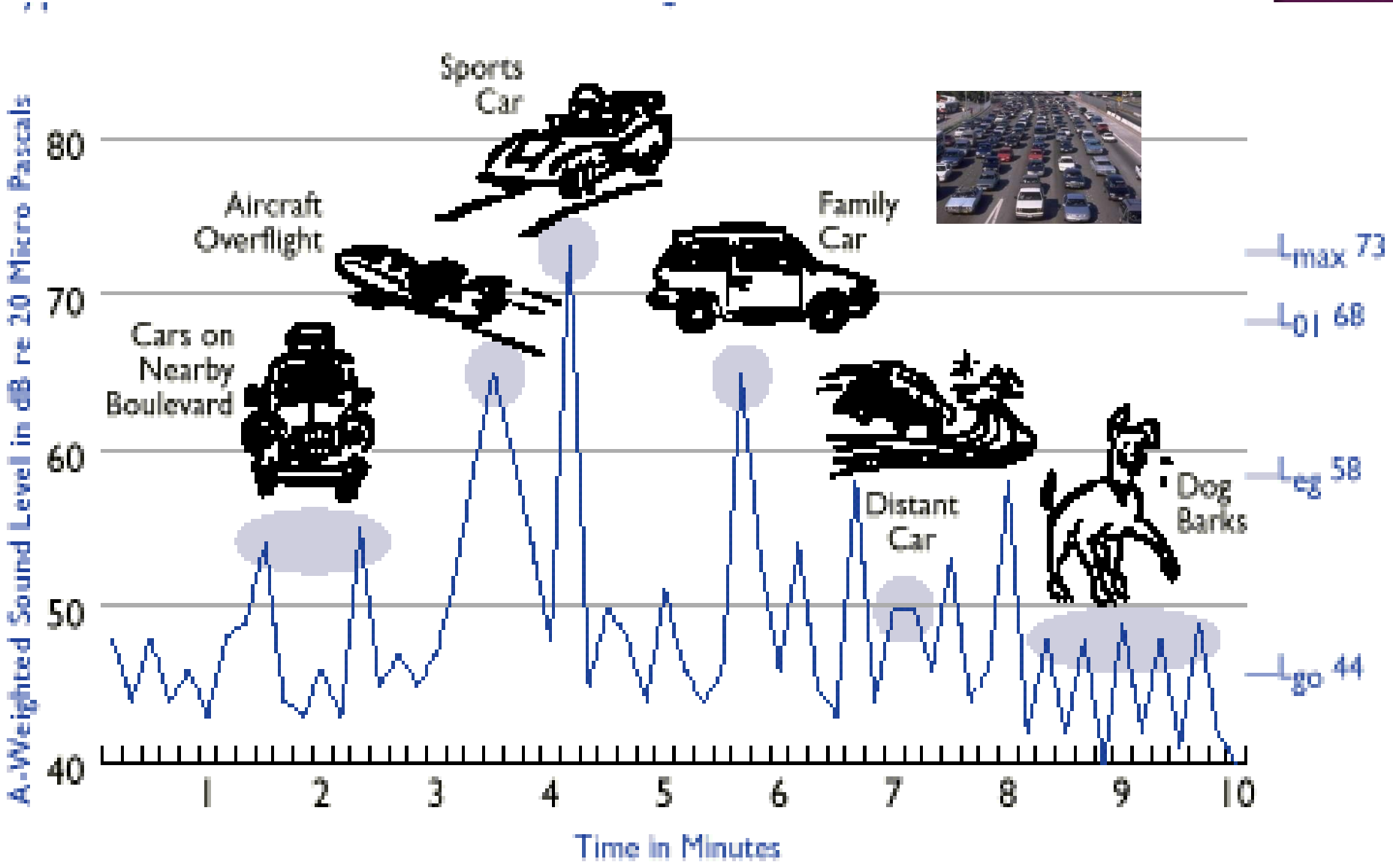
NOISE

- In the urban environment there are many sources of noise. The most serious sources are transport, industrial operations, highway traffic and construction activities.

WHAT IS NOISE POLLUTION?

World Health Organization stated that “Noise must be recognized as a major threat to human well-being”

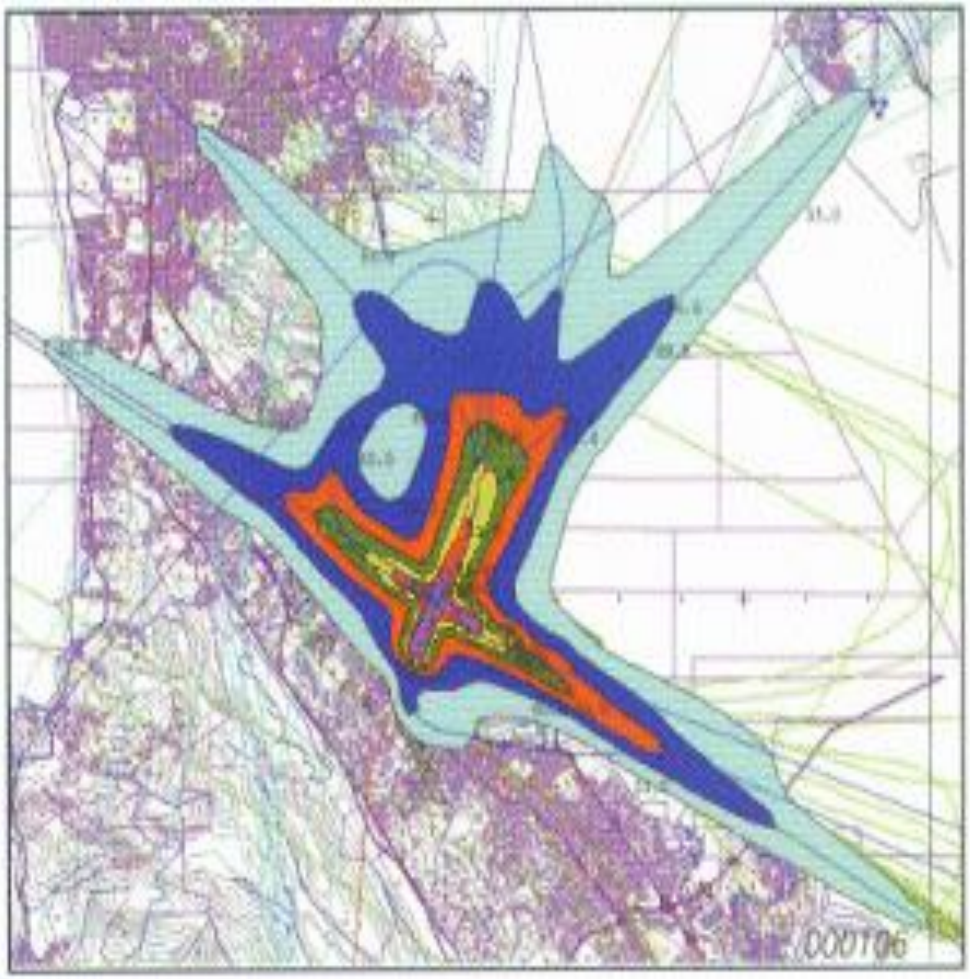
Typical suburban sound and their levels

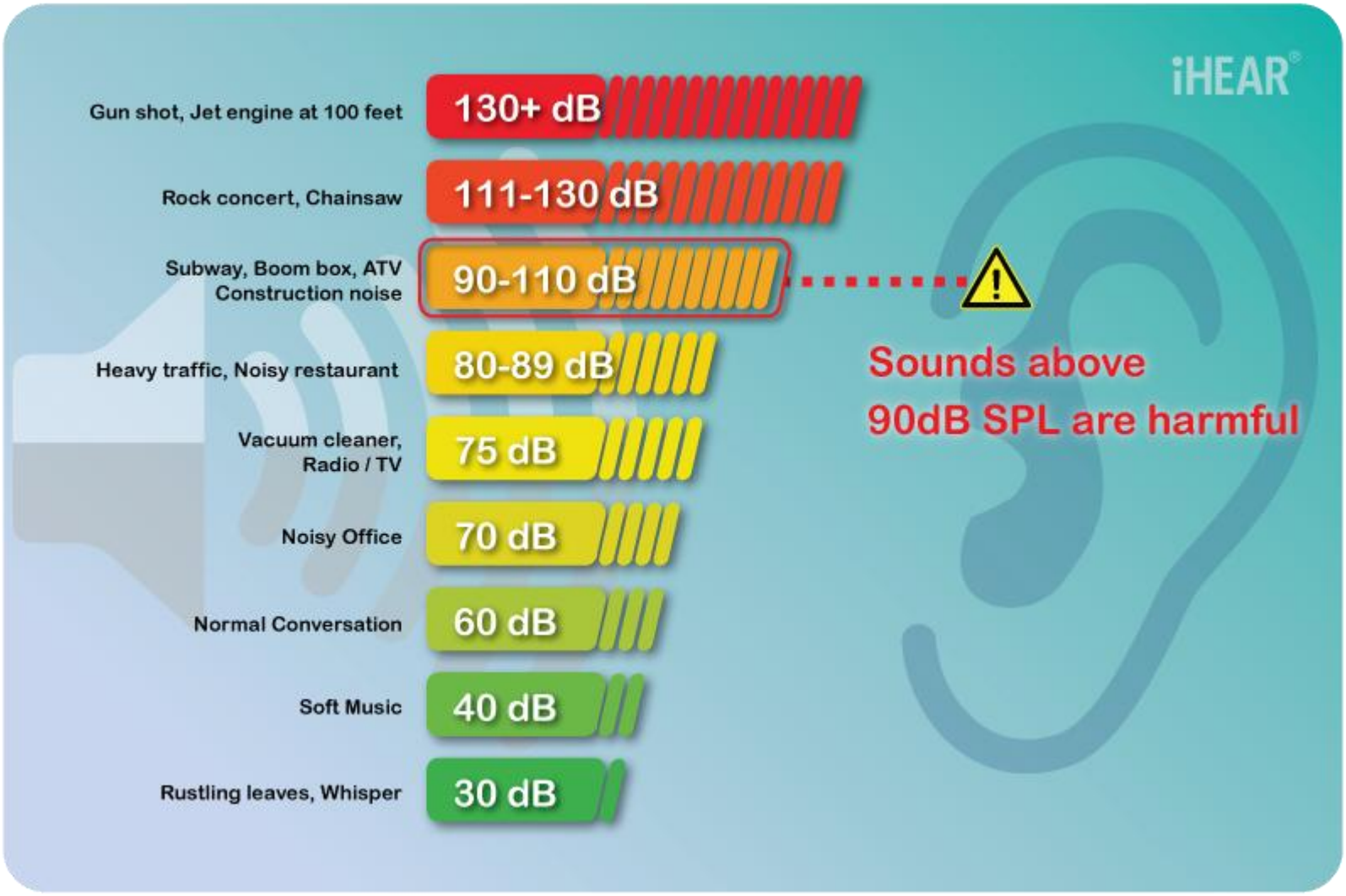


Airport Noise

Noise contours around an airport calculated using INM (Integrated Noise Modeling) based on previous noise measurements

55 - 60 dB = Light blue
60 - 70 dB = Dark blue
70 - 75 dB = Red
75 - 80 dB = Green
80 - 85 dB = Yellow
> 85 dB = Pink




iHEAR
Gun shot, Jet engine at 100 feet
130+ dB
Rock concert, Chainsaw
111-130 dB
Subway, Boom box, ATV
Construction noise
90-110 dB
Heavy traffic, Noisy restaurant
80-89 dB
Vacuum cleaner,
Radio / TV
75 dB
Noisy Office
70 dB
Normal Conversation
60 dB
Soft Music
40 dB
Rustling leaves, Whisper
30 dB
Sounds above
90dB SPL are harmful

Hearing loss affects:

Nearly **750 million** adults worldwide

1 in 6 adults have hearing loss, making it the third most common physical condition they face.

Hearing loss affects:

500 million
people
under 65

1 in 6 adults
have hearing loss, making it the third most common physical condition they face.

Hearing loss affects:

two-thirds
of adults
over 70

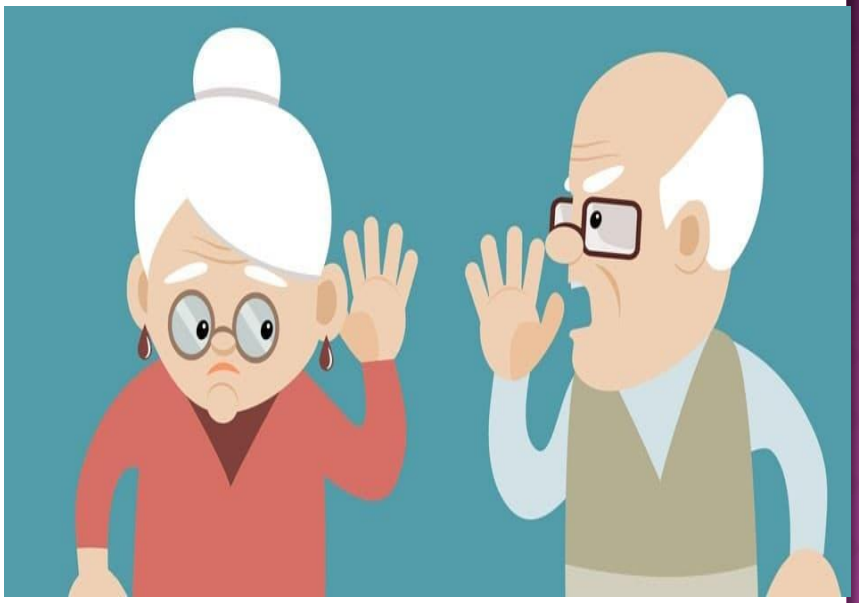
1 in 6 adults
have hearing loss, making it the third most common physical condition they face.

HEALTH EFFECTS

Specific effect of noise

- the effect on auditory analyzer

- hearing loss (It usually occurs in the individual engaged in extremely noisy activity and declares itself as an occupational pathology)

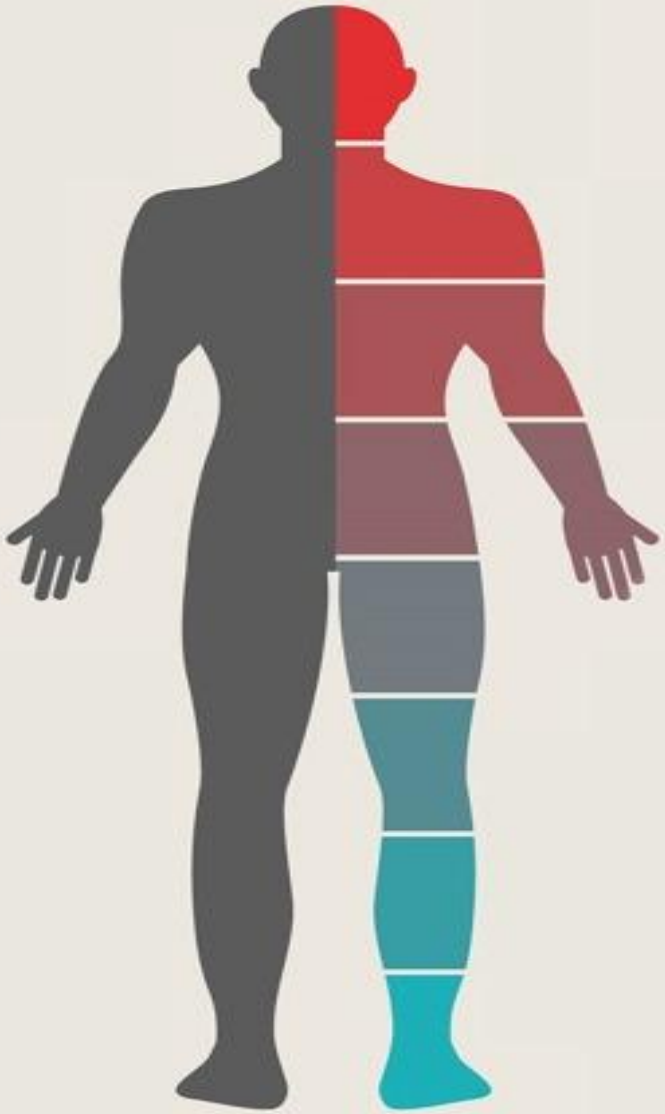


AS FOR THE INHABITANTS OF A CITY - ITS NON SPECIFIC ADVERSE EFFECTS.

Nonspecific effect of noise

- high blood pressure
- stress related illness
- sleep disruption
- GIS disorders
- memory loss, severe depression, and panic attacks
- vegetative reactions
- neurosis

The effects of stress on the body



Mood issues including anger, depression, irritability.
Lack of energy, concentration problems, sleeping issues, headaches.
Mental issues including anxiety disorders and panic attacks.

Increased blood pressure, increased heart rate, higher cholesterol and risk of heart attack

In the immune system, there is reduced ability to fight and recover from illness

Stomach cramps, reflux, and nausea

Loss of libido, lower sperm production for men, and increased period pain for women

Aches and pains in the joint and muscles

Lower bone density

Holistic Dentistry.ie
Natural & Safe Dentistry. Bray, Co. Wicklow

- According the WHO, one in four suffers from sleep disturbance and take sleeping – draughts in developed countries.

  One of the reasons for this is constant city noise.

Roadway Noise - Solutions

• **Regulations limit the amount of noise** some vehicles can produce

• Some regulations require **vehicles to be properly operated and maintained**

Despite regulations, the noise levels are usually only reduced by 5 to 10 dBA

Roadway Noise - Solutions

Barriers:

- **buffer zones**
- **wooden fences**
- **concrete walls**
- **vegetation (if dense enough)**

AESTHETIC NOISE BARRIER

Roadway Noise - Solutions

Pavement type of road

Certain asphalt, such as those containing rubber or stone, can be less noisy.

Planting bushes and trees in and around sound generating sources

Buildings can be designed with suitable noise absorbing material for the walls, windows, and ceilings.

Regular servicing and tuning of automobiles can effectively reduce the noise pollution

Workers should be provided with **equipment** such as ear plugs and earmuffs for hearing protection.

SOLUTIONS FOR NOISE POLLUTION

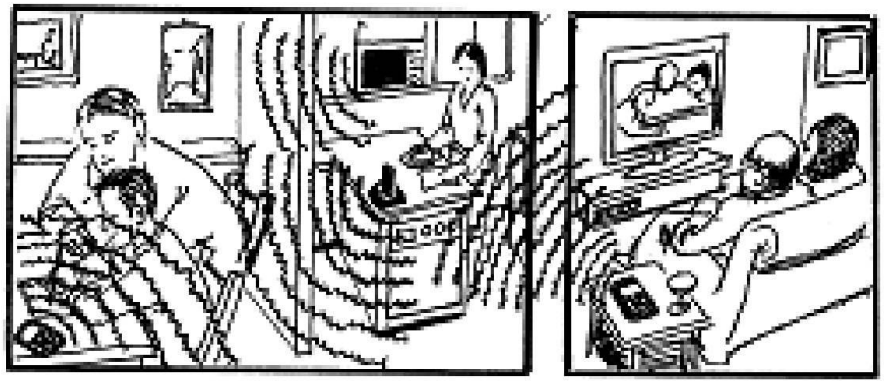
- **Soundproof doors and windows** can be installed to block unwanted noise from outside.
- Regulations should be imposed to **restrict the usage of loudspeakers in crowded areas and public places.**

CITY AND ELECTROMAGNETIC FIELDS.

The inhabitants of cities literally "bathe" in electromagnetic fields.

The sources of electromagnetic fields are conventionally classified as:

- ***The sources of long-lasting action***
- ***The sources of short duration***

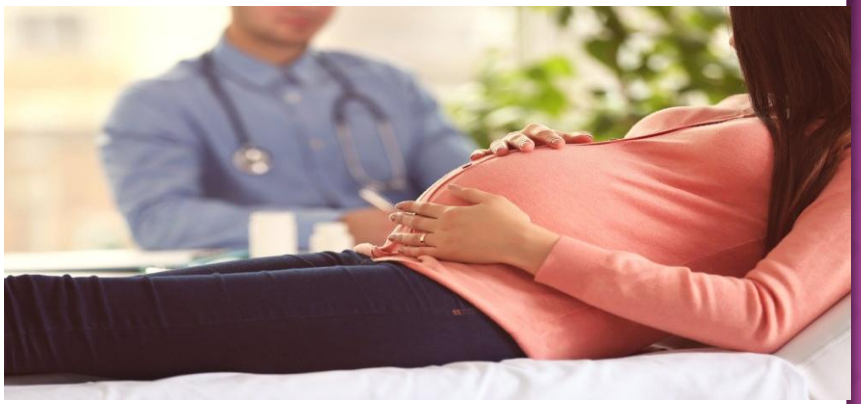


- ***The sources of long-lasting action*** include the following items: TV sets, fridges, electrical appliances, surfaces with electrostatic charges and personal computers (PCs).

- ***The sources of short duration*** include such devices as personal and radio communication, electrical irons, all household appliances with an electricity cable.

FIELDS INFLUENCE THE HUMAN BODY?

- low-frequency component of electromagnetic fields which may cause **changes in biochemical reactions** in blood on a cellular level.
- It results, in its turn, in the development of the **symptoms of irritability, nerve tension and breakdown.**
- It may **complicate the course of pregnancy** and **increase the risk of miscarriages**, promote **reproductive dysfunction** and occurrence of **malignant growths.**

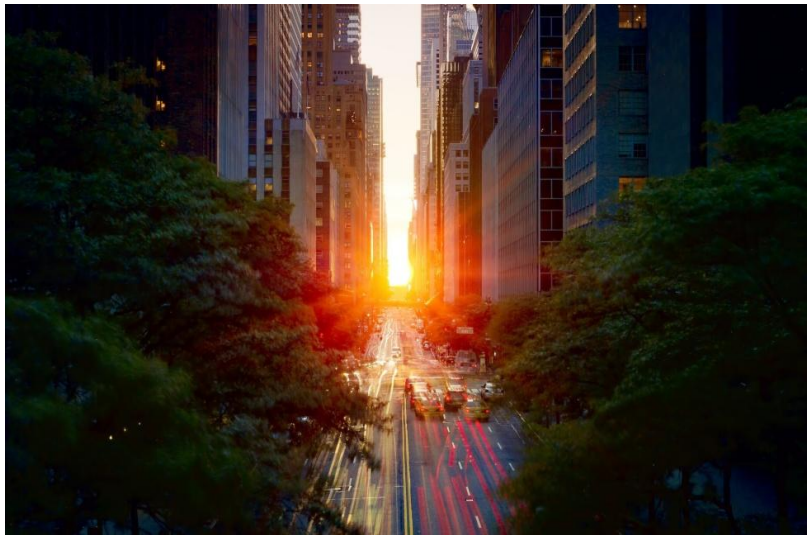


Some preventive measures:

- following the standards stated in the regulations
- annual check-ups at the clinic

MICROCLIMATE OF A CITY

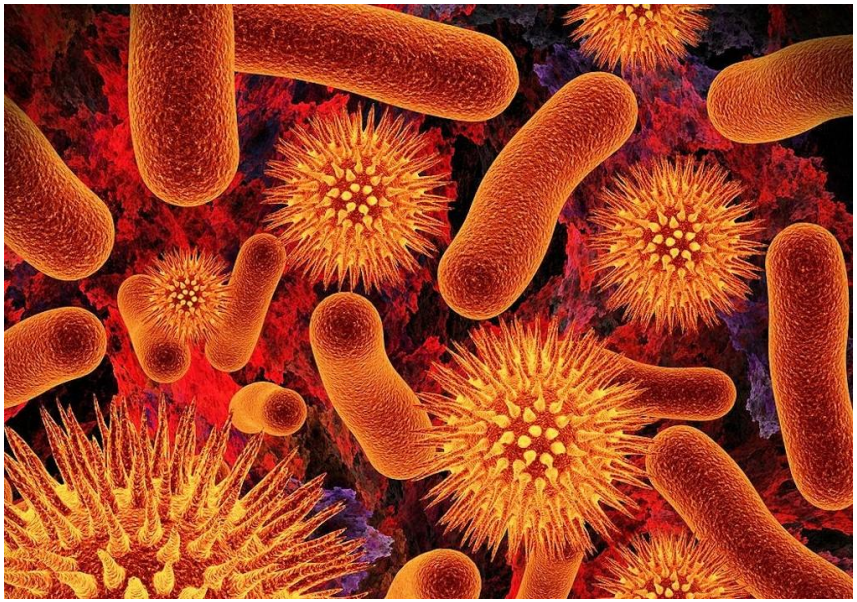
- **Insolation** (that is reaching the ground with the direct sun rays) is 15 – 20% less in a city than in the countryside. The loss of biologically active ultraviolet rays in the city is much less due to irrational planning of blocks and high density of building.
- The average annual temperature of the air in the city is 1, 5 – 2 C° higher than in the countryside. Though, the air humidity in the city is 5 – 10% less than in the countryside.
- **Fogs** are frequent in the city which is related to the polluted environment in the cities.



BACTERIOLOGICAL DANGER IN A CITY

- Bacteriological danger in the city **is much higher** than in the countryside. The reasons for this are the following:

- ***1. Mutations of microorganisms*** under the influence of chemical substances which contaminate water, land and air. As a result, new strains of microorganisms and even new species of microorganisms appear.



- ***2. Concentration of streams of people*** in the city, high density of the population. Numerous contacts between people lead to a rapid spread of the infection.

PECULIARITIES OF A PSYCHIC AND PHYSIOLOGICAL STATE OF THE CITY POPULATION

- Sedentary lifestyles, light physical loads are characteristic of the city population.

It leads to the development of **hypodinamia** and some complications **overweight, CVS diseases,endocrine pathology**

The lifestyle of the city population is characterized by a great number of contacts of people in transport, turns that may result in the **dysfunction of the CNS**, such as **neurosis.**

Environment-related diseases

Most of these diseases are caused by pathogens in water, food, soil, or air. ***Burns, scalds, and accidental fires*** are common in overcrowded shelters, especially where five or more persons live in a small room.

Non-communicable diseases

- The rising trends of non-communicable diseases are a consequence of the demographic and dietary transition
- Decreases in activity combined with access to processed food high in calories and low in nutrition have played a key role
- Urbanization is an example of social change that has a remarkable effect on diet in the developing world

Non-communicable diseases

Urban areas ⇒ higher rates of obesity

- Greater range of food choices (at lower prices)
- Less labor-intensive working activities
- People work away from home

PREVENTIVE MEASURES AIMED AT OPTIMIZATION OF LIVING CONDITIONS IN A CITY.

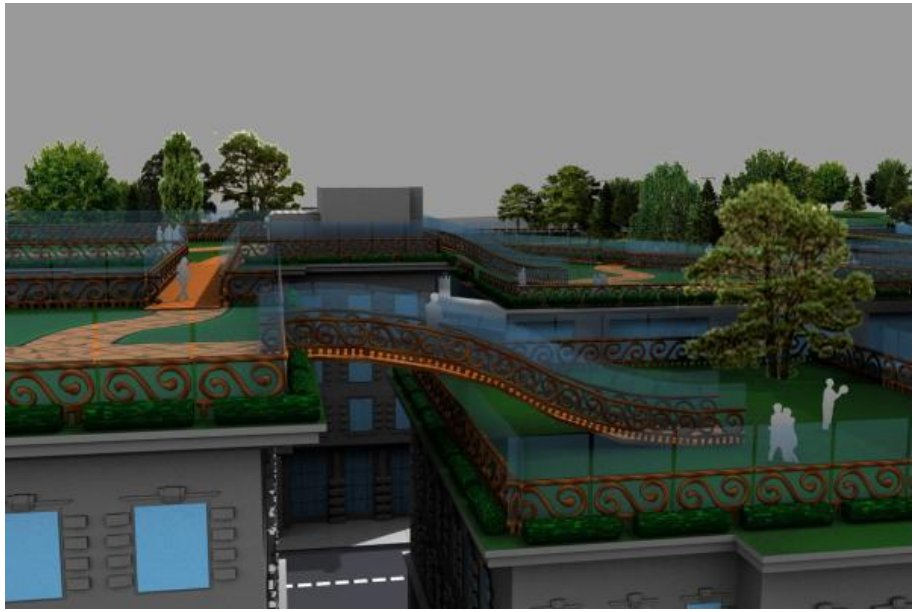
1. Determining functional areas in a city.

- Each city must have at least four areas, such as industrial, residential, transport & storage area and a recreation (e.g. parks, squares etc.).
- The areas must be located in the city taking into account a wind rose so that hazardous waste produced by modern industrial societies must be directed at the opposite side from the residential area.

- 2. Modern industrial factories must have sanitary and protective areas which are to be wide enough for hazardous waste to end up.

3. Maximum gardening and planting of a city.

- The inhabitants of a city must get 25 m^2 of green plantings each, and if the air, water and land in the city are believed contaminated, the inhabitants of the city must get at least 30 m^2 of green plantings each.



GREEN PLANTATIONS ARE IMPORTANT ELEMENT OF TOWN PLANNING.

- The hygienic value of green plantations is evident in regulation of thermal and radiation conditions, **in creation of a comfortable microclimate.**

  It is known, that the thermal conditions of the air caused by heating of the soil under the influence of solar radiation.

  In summer months the temperature of the ground reaches 52 even in a moderate climatic zone.

DECREASE IN THE AIR T UNDER THE INFLUENCE OF GREEN PLANTATIONS IS CAUSED BY 2 FACTORS:

- *Green plantations* in case of correct placement *protect* the surface of walls,soil and artificial covering from a direct solar irradiation and consequently *they are less heated*.
- The t of the surface of green cover does not reach such a high values as the t of the open soil and stone walls due to significant reflection of solar rays and the intense evaporation of moister.

THE INFLUENCE OF GREEN PLANTATIONS DEPENDS ON THE SIZE OF THE WOODLAND

- **Single-row street planting** reduce air temperature in comparison with open space by 2 C
- **Large green plantations** reduce the air temperature not only under the tree crowns, but also in adjoining open area.

  Temperature of the air near to large green plantings in a radius of up to 100 m is 1-1.5 C lower, than in distant area.This occurs due to the air circulations near to green plantations .

BUT

in territories with incorrect placement of plantations on hot summer days unfavorable microclimatic conditions can be created.

Such conditions may arise in badly aired courtyards with very dense planting, increased air humidity and also in the open lawns surrounded by dense, high vegetation.

- **Green plantations influence the air humidity** due to evaporation of moisture by large surface of leaves. Humidity of air among green planting on summer days is **18-20% higher than in the open areas.**
- The increased air humidity of green mass can spread to adjoining insolated closed spaces.

- **Green plantations possess dustproof and gas-protective properties**.Dust level of air among green planting is 2-3 times less, than in the exposed city territories.
- **Green plantations** reduce the dust level of the air during the vegetative period approximately by 42%, and in absence of a deciduous cover - by 37%.

  The dustproof properties of green plantations are more effective when the soil is covered with green glass.

- ***The influence of green plantations on reduction of harmful gases concentration*** in the air is the result of dispersion of these gases into the top layers of atmosphere by trees crowns and by absorption of the gases by leaves.

  It is known that green plantations catch sulfurous gas from atmospheric air and accumulate it as sulphates in their fibers.

  For ex. green plantations of 50 m in width and 15-20 m in height can reduce the level of air pollution by 70-75%.

WHAT IS THE AIM OF GARDENING AND PLANTING?

- carbon dioxide is utilized and oxygen is released
- dust and gases are accumulated on the leaves so that the atmospheric air is being cleaned up
- city noise is reduced
- air velocity is decreased as well; as a result the speed of the wind is reduced
- microclimate is improved
- psychic and emotional states of the individuals are improved

- 4. Fountains in a city may improve the microclimate of the city, though the rate of ionization of the air is increased. In this case the amount of easy negative ions in the air, which stimulate breathing, and have tonic and bactericidal action is increased.