Imissions

Imissions are generated as a result of emissions being in contact with the environment, leading to their storage in the soil, plants and organisms. Their concentration is lower than the concentrations of emissions and imissions' concentrations in cities are monitored.

Solid air imissions

Solid air imissions include dust and aerosols. The most frequent agents are various inorganic powders, such as metal particles, silicates, fluorides, chlorides and sulphates. Dusts of organic origin such as tars, bacteria and pollens. General harm of solid air imissions are mainly:

1. Reducing visibility
2. Toxicity to living organisms
3. Corrosive effect on materials.

These substances also adsorb gas particles and thus contribute to then increase of the reactivity of particles and secondary emissions. In industrial areas they are responsible for the condensation of water droplets → an increased incidence of fog and clouds. The specific degree of harm depends on many factors:

1. Particle size (and dispersity which depends on it). According to these parameters depends the substance retention in the lungs.
2. Biological aggressiveness (react or not reacting with lung tissue? Formation of coniosis?).
3. Physical properties: especially particle shape, crystalline structure and surface wettability.

Harmful solid air imission depending on particle size:

- Particles larger than 100 μm have relatively little importance to the health of individuals, because they quickly settle due to their considerable weight. For this reason, considerably limited their interaction with other pollutants in the air.
- Dust particles in the size of 10 μm are referred to as an aerosol. Mass content is relatively low in the air. They have great biological significance. They are inhaled by humans, but for the most part are already captured in the upper respiratory tract. They settle in a layer of mucus that is moved by cilia toward the nasopharynx and then swallowed. If these particles have a toxic chemical nature, they have a significant health impact.
- Particles smaller than 10 μm in the air are present in small quantities, but have great biological significance. The respiratory tract in 24 hours they will receive up to 0.01 g. The molecular size of 1-2 micron penetration into the bronchioles and alveoli, where they are sometimes captured in more than 90%. These particles are therefore in terms of retaining the aerosol in the lungs the most dangerous.
- On the contrary, particles smaller than 0.01 micron in the lungs begin to behave like gas molecules and are largely exhaled.

Chemical composition of dust as a factor of harmfulness

Biologically inert powder doesn't have a specific biological effect and thus does not harm the lungs. Conversely, biologically aggressive dust has specific effects thanks to its chemical composition. Examples:

- Inhalation of silica (SiO2) → fibroplastic effects. If the air contains about 10% of the dust, occurs when the long-term inhalation of progressively to chronic airway inflammation, increased connective tissue in the lungs, honeycombed lungs, increased blood flow resistance in the pulmonary circulation, and consequently right heart hypertrophy and failure. These expressions are summarized under the name of lung silicosis.
- Long-term inhalation of **asbestos fiber** dust is to develop asbestosis, and increases the risk of pleural mesothelioma.
- Dusts containing **beryllium** inhaled during immunosuppression can lead to beryllosis.
- Dusting powder **iron** in the lungs is known as siderosis.

Physical properties of dust as factor of harmfulness

Physical properties of particles are the answer to the question of why silica dust causes silicosis in the glass industry, while the population of the Sahara, which is exposed to inhalation of large quantities of silica dust, is not suffering. Sahara dust is predominantly silica, but due to the age of particles and their mutual abrasion they become amorphous. Dust particles in glass are newly created and predominantly crystalline having many edges and tips → far more toxic.

Gaseous air imissions

Gaseous air imissions include compounds of various elements, mainly sulfur compounds, nitrogen oxides, carbon oxides, halogen compounds and various organic compounds. They have diverse origin:

- Sulfur oxides (SO_2 and SO_3), sulphide, carbon disulphide - resulting from the burning of fossil fuels (mainly coal), burning fuel oil as the product of different technologies (especially in chemical industry)

- Oxides of nitrogen, ammonia - result from burning at high temperatures (heat and power plants on fossil fuels), the cylinders of piston engines;
- Carbon oxides (CO and CO_2) - formed by incomplete combustion of carbonaceous fuels (mainly car traffic), as significant concentrations in the boiler;
- Halogen compounds (HF, HCl) - released into the atmosphere in metallurgical processes (aluminum), also arise in the manufacture of phosphate fertilizers;
- Organic compounds (saturated and unsaturated aliphatic and aromatic hydrocarbons, formaldehyde, formic acid, acrolein) - in the atmosphere occur in large nožství(?). Major sources are automobile engines (two-and four-stroke gasoline engines).

Detection of most of these substances is significant because:

- Nitrogen compounds are highly irritating to the body after inhalation and the change in the blood are the cause of methemoglobin.
- They participate in photochemical reactions that lead to the formation of secondary emissions.
- Organic compounds in air pollution is a large amount, especially saturated and unsaturated aliphatic and aromatic hydrocarbons and their oxygen derivatives, as well as indoor. They are emitted as vapors or volatile compounds.
- Many polycyclic aromatic hydrocarbons have proven carcinogenic properties.

Radioactive air imissions

Radioactive air imissions include strontium, caesium and iodine isotopes and other substances. These imissions, threatened the man by air almost exclusively in a nuclear accident (such as in Chernobyl in 1986). If properly operated, nuclear power plants are, in terms of radioactive emissions into the atmosphere, less dangerous than normal coal fired thermal power plants.

Smog

The Great Smog of London 1952

The dramatic events of December 1952, are a classic example of that in normal conditions of a stabilized situation may change by the weather and turn into a disaster. Involvement of England's (especially London and the Thames Valley) thermal inversions associated with fog led to the usual concentration of smoke increasing 5 times. The level of carbon dioxide, achieved during this period was 6 times the normal levels. The concentration of air pollution began to soar about 12 hours after the arrival of dense fog.

A type of smog reduction (reaction) took place. It is a mixture of smoke, oxides of sulfur and coal combustion gases in combination with high relative humidity. It has reducing properties and is accompanied by dense fog. Diagnosis of gaseous components is more obvious by the presence of ash, which allows their penetration into the lower respiratory tract. This type of smog peaks early in the morning, at temperatures from 0 to 5 ° C. These changes led to an unusual incidence (fourfold increase) of disease and death:

- Dominated by particular diseases of the respiratory tract: coughing with little sputum, runny nose, sore throat
- Sudden vomiting

More severely affected individuals, were those who had already a similar history of disease and also patients who were treated for heart problems: in severely ill people dyspnea, cyanosis, bronchospasm, and mild temperatures could be observed. Most of these diseases had a sudden onset.

Statistical data showed that men were more frequently affected than women and most patients were older than 45 years of age. The two-week period (the week of Great smog and the week after) were recorded about 4000 more deaths than the same period the previous year. In a later study of this situation, it was concluded that the devastating effects caused by a combination of:

1. Fog
2. Low temperatures
3. Carbon dioxide
4. Fly ash from coal smoke

Los Angeles Smog (summer smog)

Similarly, as in the previous example, it is the occasional occurrence of irritable smog during clear summer days in Los Angeles. The site is bounded on one side of the Pacific Ocean coast and the northern side of the mountain is closed → characteristically slow air flow, which records the occurrence of smog. There is oxidation of smog from exhaust gases through the combustion gases at low humidity and intense solar radiation and a number of photochemical reactions. It is most intensive in specific environmental conditions:

- temperature 25-30 °C
- low humidity
- clear weather with intense sunlight

Characteristic coloration for smog in California in the beige cloud bank behind Golden Gate Bridge. The brown coloration is due to the NOx in the photochemical smog.

The result is called photochemical smog, whose components are constantly transforming themselves because of the ongoing reactions. Its basic components are:

1. Atmospheric oxygen
2. Ultraviolet radiation
3. Nitrogen oxides
4. Hydrocarbons (mainly unsaturated)
5. Carbon dioxide.

The products of photochemical reactions are:

1. Ozone
2. Peroxiacetylnitrate
3. Aldehydes
4. Acetic acid

During the period of the smog, there were a number of hospitalizations of patients with respiratory and cardiac problems, and town residents often complaining of irritation of the eyes, nose and throat. It was also found that children in school during the occurrence of smog were more restless than usual. As with the situation in London in 1952, it is shown that changing weather conditions can cause the abnormal accumulation of normal emissions.

Bhopal accident in 1984

The disaster, which occurred in central India were due to accidents in a chemical factory belonging to Union Carbide group. During production, there was an accidental release of 900 liters of water into the tank containing stabilized phosgene methylisocyanate. Hydrolysis of phosgene was the emergence of HCl, which catalyzes the polymerization methylisocyanate. During this reaction, a considerable amount of heat released increased the pressure in the tank, causing subsequent release methylisocyanate (and probably also hydrogen cyanide) into the air.

The late reporting of the accident and inadequate emergency measures have led to an accident with tragic consequences. Escaped chemicals hit the slums near the factory. In addition, part of the population after hearing sirens got the impression that it is a fire and ran even closer to the factory in order to help extinguish it. About 150000 people were affected and 1800 had died and even more of them had long-lasting consequences, particularly affecting the eye. Many of the health problems could have been avoided by taking a simple measure: to lie down and cover their face with a wet cloth.

Similar accidents show the importance of informing the public about how to react in crisis situations and the necessary preparation of emergency plans to manage them.

Links

Related articles

Primary and Secondary Emissions

External links

Sources

References

Bibliography

- BENCKO CHARLES UNIVERSITY, PRAGUE 2004, 270 P, V, et al. *Hygiene and epidemiology. Selected Chapters.* 2nd edition. Prague. 2008. ISBN 9788024607931.

Further reading