

Pollutants in the environment

Determination of concentration limits of harmful substances is used in efforts for a healthy environment.

Maximum Permissible Concentration (MPC)

1. The permissible concentration of a certain pollutant is one that does not cause a direct or indirect harmful effect on a person, does not reduce his working capacity and does not reduce his well-being.
2. The habit of a pollutant in a certain concentration must be considered an adverse factor and proof of the inadmissibility of such a concentration.
3. Concentrations of pollutants that have an adverse effect on vegetation, the local climate, air clarity and normal living conditions are inadmissible.

Maximum Allowable Concentration (MAC)

The highest permissible concentrations of chemical substances in the working atmosphere are the concentrations of substances to which the employee must not be exposed in any time period of the working time^[1].

The previous formulation applies with respect to the following facts:

1. limited time of exposure of people in the work environment (most often 8 hours, 5 days a week) – MAC = such a concentration of pollutants in the air at which health damage will not occur even with many years of 8-hour exposure,
 - full shift concentrations,
 - impact concentration,
2. in the work environment healthy adults are exposed to the factors, in the environment it is the entire population,
3. in the work environment, we can regulate exposure to harmful factors (e.g. air conditioning equipment).

For these reasons, there is a higher demand for environmental quality and therefore lower MPC values in the environment compared to the work environment.

MAC = PEL (permissible exposure limit - given in a table) x concentration of the given substance in the environment.

Combined and complex effect

Pollutants in the environment exist mostly in mixtures

- **combined effect** – the effect of a mixture of pollutants in a certain part of the environment (water, air)
- **complex effect** – the action of a certain pollutant from different parts of the environment, we determine the total acceptable daily intake– ADI

ADI (permissible daily dose) = pollutant absorption coefficient + air dose + water dose + food dose. It is such a dose that is **harmless during lifelong exposure** (it will not cause the emergence of physical or mental illness or changes in health that are beyond the limits of adaptive reactions that can be affected by modern investigative methods), and that in the long term, either in himself or in his next generations .

Methodological procedures for determining MPC

1. The study of the natural background of the relevant pollutant in the human environment,
2. acute experiment (determination of the median lethal dose LD50), subacute and chronic experiment on animals,
3. observations and experiments with human volunteers – determination of changes in important physiological functions (olfactory threshold, changes in color vision, changes in the electroencephalogram , etc.)

After determining the MPC, these are retrospectively checked by systematic monitoring of groups of exposed people of different ages, sexes, etc., i.e. in epidemiological studies.

Acute toxicity test

It is performed on 3 species of animals, one of which is not supposed to be a rodent. At least 1 species should be determined acutely. toxicity in both sexes. The animals are observed for 2-4 weeks after a single application of the given noxa for monitoring the clinical picture, toxic symptoms and mortality, including necropsy findings of dead animals.

Subacute toxicity test

The effect of the investigated substances after repeated, possibly continuous application for a period representing approx. 10% of the expected lifespan of the animal (90 days for rats, 1 year for dogs). The test should be performed on at least 2 types of animals - a rodent and a non-rodent. Usually 10-20 animals of both sexes are used in each group exposed to a single concentration of the studied substance (in water, food, air or applied to the skin). Concentrations or doses should be chosen so that at least 1 does not cause any effect and, on the contrary, min 1 causes reliably identifiable toxic changes.

Chronic toxicity test

The goal is to find the highest dose or concentration that produces no demonstrable toxic effect when applied throughout the life or a substantial part of the life of exposed animals and to detect an effect that cannot be detected in subacute tests. It is most often performed on rats of both sexes in groups of 25 individuals for each dose or concentration and lasts 12-24 months. Shortening of life span, possible accumulation of tox in tissues or organs and potential genotoxic effects are evaluated based on detailed macro and microscopic analysis of tissues and organs of exposed animals and selected hematological and biochemical examinations. Extrapolation from results obtained in animal experiments to humans is usually an extremely difficult problem given the known interspecies differences among vertebrates.

Example: An increased concentration of hippuric acid was detected in the urine of rabbits in a chronic toxicity test of styrene, mandelic acid in humans, less phenylglyoxylic acid, and glyoxylic acid in rats.

Data on the effects of the studied substances on humans are obtained during the therapy of industrial poisoning, from clinical observations during preventive examinations, from targeted clinical-epidemiological studies on a non-professionally exposed population and in experiments on human volunteers.

Links

- ws:Škodliviny v prostředí

Reference

- 1.

References

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