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INDUSTRIAL AEROSOLS, THEIR HYGIENIC ASSESSMENT AND RESEARCH METHODS

Guidelines for practical training on "occupational Health" for students of the faculty of medical prevention

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Industrial aerosols, their hygienic assessment and research methods: guidelines for practical training on "occupational Health" for students of the faculty of medical prevention

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This methodological guide contains material that reflects modern hygienic ideas about such a common harmful production factor as industrial dust, as well as its effect on the body. The data on the classification of dust, physical and chemical properties that determine the strength of its harmful effects are presented. Information on nonspecific and specific diseases arising under the influence of industrial aerosols is given. The modern classification of pneumoconiosis, their clinical picture and the main methods of prevention are described.

The manual is supplied with tables, test items, a list of basic and recommended additional literature to facilitate the assimilation of the material.

Methodical manual "Industrial aerosols, their hygienic assessment and research methods", prepared according to the discipline "Hygiene" in accordance with the Federal State Educational Standard of Higher Professional Education for students studying in the specialty General Medicine (05.31.01).

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Dust is the most common occupational hazard, which affects large contingents of working numerous professions in various sectors of the economy. Occupational diseases of dust etiology by specific weight occupy the first place among occupational diseases.

The fight against pollution of the production atmosphere and the atmosphere of cities is of great hygienic and economic importance.

Dust-aerodisperse system in which the dispersion medium is air, and the dispersed phase – dust particles. Dispersion of solids occurs during explosions, impacts, grinding, crushing, combustion and many other operations. Aerosols formed by grinding solids are called disintegration aerosols. The shape of their particles is wrong. Condensation aerosols (or" fumes") are formed during melting, welding. Dust is classified by origin, method of formation, dispersion, effect on the body (table. 1, 2).

Hygienic value of industrial aerosols depends on their physical and chemical properties, quantitative characteristics. The main properties of dust include: the origin and chemical composition, toxicity, degree of dispersion, solubility, specific gravity, specific surface area, degree of radioactivity, electrical properties, etc.the Severity of the action of dust on the body also depends on the individual sensitivity of the body, the severity and intensity of the labor process, the production microclimate.

Classification of industrial dust by action on the body:

- fibrogenic action (APFD);
- General toxic;
- irritant;
- carcinogenic;
- mutagenic effect.

Dispersion of dust is its important property. The degree of dispersion determines the depth of dust penetration into the respiratory tract. In the alveoli easily penetrates dust size 0.5-5 microns. Expressed fibrogenic activity have disintegration aerosols with particles less than 0.3-0.4 microns, because they are directly retained in the alveoli. Larger particles are trapped in the upper respiratory tract and stand out with sputum. Ultramicroscopic dust particles easily pass from the alveoli into the lymphatic pathways and are removed from the lungs.

Solubility for toxic dust accelerates and enhances its harmful effects. Non-toxic soluble dust is less dangerous for the body.

Electrical properties of dust. Charged dust particles are more actively retained in the Airways.

With increasing dust surface increases its adsorption capacity to gases (carbon monoxide, methane, nitrogen oxides, etc.) this leads to increased harmful effects of dust on the body.

Many species of plant and animal dust are carriers of microflora (fungi, bacteria, helminth eggs, ticks).

Toxic aerosols are industrial poisons. Severe toxicity has dust of lead, beryllium, vanadium, thorium, cadmium oxide etc. When ingested, these dust particles can cause poisoning.

Pneumoconiosis is the most common occupational dust diseases. Depending on the type of impacting dust, there are 6 groups of pneumoconioses (table. 3). Depending on the predominant action of industrial dust and the reaction of the organism, 3 groups of pneumoconioses are isolated.

Group 1: pneumoconiosis, developing from exposure to high fibrogenic and moderately fibrogenic dust (with a free SiO_2 content of more than 10%). Silicosis is the most severe form of pneumoconiosis. The disease progresses even after cessation of work.

Group 2. Pneumoconiosis from exposure to weakly fibrogenic dust containing free SiO2<10% or not containing it). These include asbestosis, karbokoniozy, sideros, buritos etc.

These forms can be complicated by nonspecific infection, chronic bronchitis.

Group 3: pneumoconiosis from aerosols of toxic-allergenic action (dust containing metals – allergens, plastic dust, organic dust, etc.) this includes berylliosis, aluminosis, light farmer, etc.).

In the initial stages of the disease, clinical symptoms are not specific. Downstream distinguish rapidly progressive pneumoconiosis (fibrosis development for 5-6 years), slowly progressive and pneumoconiosis with signs of x-ray regression. Perhaps the later development of pneumoconiosis, a few years after the cessation of contact with dust.

Dust bronchitis occur when inhaling moderately aggressive mixed dusts of coarse dispersion (metal, plant, cement, etc.) more often bronchitis develops after 8-10 years from the beginning of contact with dust. Bronchitis from allergenic dusts is complicated by asthma, in the future-emphysema and pneumosclerosis.

Dust diseases of the eye. When exposed to arsenic compounds, aniline paints, cases of conjunctivitis and keratitis are described. Dust trinitrotoluene with prolonged exposure causes the development of professional cataracts.

Skin diseases from exposure to dust. When contamination of the skin dust of different composition may have irritating, sensitizing, photodynamic effect. Dermatitis occurs under the action of arsenic dust, calcium carbide, superphosphate. Allergic prideratsya (dermatitis, eczema) develop when the skin

dust of various polymeric materials, dust, chromium, copper, Nickel, cobalt, etc. Contamination by products of oil refining and coal on the background of solar radiation causes photodermatitis. Many types of dust of plant and animal origin have a pronounced allergic effect.

Regulation of dust content in the air is carried out depending on its chemical composition. Sanitary regulations provide for permissible levels for more than 130 different types of industrial aerosols. For aerosols with toxicity, they are set depending on the degree of toxicity. For non-toxic aerosols-depending on the content of free silicon dioxide. In various countries, the upper limits of the "respirable" fraction are 5, 7, 10 μm, etc.

Measures to prevent the harmful effects of dust.

1. Technological. The introduction of continuous technologies, automation and mechanization of production processes, remote control, sealing reduce the contact of workers with dust formation. Effective measures are the transfer of powdered substances into granular and tableted state, the transition from solid fuel to gaseous, wet method of processing and irrigation of products, the allocation of dusting units and isolated rooms.

2. Organizational: regulation of work and rest.

3. Sanitary-technical: shelter of dusty equipment with effective aspiration, the device of rational ventilation-exhaust ventilation from the place of dust formation. Dusty air must be cleaned before being released into the atmosphere. To combat secondary dust formation is carried out pneumatic cleaning of premises.

4. Individual protection and personal hygiene measures. Workers are given dust masks, goggles, helmets, dust suits, overalls. Protective pastes and ointments are used to protect the skin. You need a daily shower, frequent change of clothing.

5. Medical and sanitation: preliminary and periodic medical examinations, the organization of dispensaries, furries (for miners), breathing exercises, regular inhalation of alkaline solutions etc.

Determination of dust content in the air by weight method.

The method is accurate and objective. A certain amount of air is sucked through the analytical filter. The mass of all dust is calculated by the weight gain of the filter.

The counting method is used less frequently than the weight method. Counting indicators in the assessment of dust are expressed by the number of dust particles in 1 cm3 of air. In this case, the degree of dispersion of dust is determined using a microscope