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Occupational Diseases in Oil Processing

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ABSTRACT: The work studied occupational diseases during oil refining, the mechanism of action of oil and its products on the human body. The characteristics of air pollution in the working area are given. The symptoms of poisoning from inhaling high concentrations of gasoline vapors have been widely reported.
Key words: Petroleum and gas chemical industry; occupational Safety and Health; ; informational resources; source of threat; occupational diseases; precautionary measures; provision of first aid.

Modern technology for the extraction, preparation, transportation and processing of oil and gas, despite the achieved scientific and technical level, continues to have a complex of unfavorable production factors. The main ones are heavy physical labor, the presence of vibration and noise, toxic vapors and gases in the air of the working area, and unfavorable meteorological conditions.

The use of manual labor in combination with cooling, exposure to vibration, and injury to hand tissue when working on drilling sites is the cause of a significant spread of diseases of the peripheral nervous system and musculoskeletal system. Among drillers, diesel operators and workers at integrated gas treatment plants (IGTUs) and oil refineries, a high incidence of hearing loss was noted.

The content of toxic vapors and gases in the air of the working area at oil refineries has recently been significantly reduced, and cases of exceeding their maximum permissible concentrations have become rare. At the same time, when drilling oil wells and extracting oil, the air in the working area is still polluted by oil and gas components (methane, ethane, propane, hydrogen sulfide, carbon dioxide, ammonia, nitrogen), and exhaust gases from diesel engines. In hot climates, the evaporation of harmful substances increases. The widespread use of cluster drilling creates an increased risk of open well blowouts and dousing workers with crude oil. A specific unfavorable factor for a gas treatment plant with a glycol drying scheme is contamination of the air in the working area with diethylene glycol. At oil refineries (refineries), gas-diffuse pollution of the air environment of installations and the entire plant area with a complex of toxic substances consisting of saturated and unsaturated hydrocarbons, hydrogen sulfide, fatty acid vapors, phenol, aromatic hydrocarbons, and possible admixture of benzopyrene has also not been completely eliminated. Sources of gas emissions are usually various leaks in equipment, tank fittings, emergency valves, and tubular gas flaring furnaces. The danger of an emergency situation has not been completely eliminated, and therefore the possibility of acute poisoning, mainly from hydrocarbons and hydrogen sulfide, cannot be ruled

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out. In conditions of elevated concentrations, chronic intoxication can also develop. It is important from the standpoint of hygienic science and sanitary practice that the balance of produced oil and gas in our country is increasing in sulfurous (56.2%), polysulphurous (13%) oils containing free hydrogen sulfide.

Oil, its vapors, gases, as well as refined products are highly toxic substances that mainly affect the nervous system and have a skin-resorptive effect. They enter the body mainly through the respiratory tract and skin. Oil from individual fields, many petroleum products, and especially polycyclic aromatic hydrocarbons (PAHs) have carcinogenic activity to varying degrees. The clinical picture of poisoning depends on the nature of intake, concentration and qualitative composition of petroleum products.

Crude oil is a mixture of organic compounds consisting (up to 88%) of hydrocarbons, methane, naphthenic and aromatic substances, as well as sulfur, nitrogen, sulfur organic compounds and mineral impurities.

The end products of oil and gas refining are various gasolines rich in unsaturated and aromatic hydrocarbons, lubricating oils, paraffins, bitumens, and petroleum coke.

Gasolines - a mixture of methane, naphthenic aromatic and unsaturated hydrocarbons - are a clear, colorless or yellowish, flammable liquid with a characteristic odor. Gasolines have significant volatility, easily turn into a vapor state, and boil at 40-250°C. The maximum permissible concentration of solvent gasoline is 300 mg/m3, fuel gasoline is 100 mg/m3. The toxicity of gasoline varies depending on the nature of the oil, the nature of its processing, the hydrocarbons it contains, atmospheric pressure, and temperature. Gasolines have a narcotic effect and cause irritation of the mucous membranes.

The mechanism of action of oil and its products on the body has been studied by many scientists. Drug reactions are known. A significant decrease in the activity of redox processes and disruption of tissue respiration have been shown. Hydrocarbons inhibit cardiac activity, reduce the protein-forming and antitoxic function of the liver, the secretory function of the digestive organs, and disrupt the function of the adrenal cortex, thyroid gland, and ovaries. With chronic exposure to petroleum products, changes in immunobiological reactivity and hematopoiesis are observed.

With chronic exposure to oil and its products, functional disorders of the central nervous system with hypotension, hypothermia, and pain sensitivity disorders of the polyneuritic type are observed. Cardiovascular intoxication syndrome consists of vascular dystonia and myocardial dystrophy. Dystrophic changes in the skin are characteristic: dryness, formation of pigment spots and follicles. When extracting and refining oil, occupational intoxication with gasoline, high-sulfur oil, and hydrogen sulfide is of greatest practical importance.

When inhaling high concentrations (5000-10000 mg/m3) of gasoline vapor, severe symptoms of poisoning appear within a few minutes. Headache, dizziness, unsteady gait, agitation, and delirium quickly appear, the latter quickly being replaced by a state of depression. Convulsions are observed, the pupils are dilated, and there is no reaction to light. The pulse is threadlike, breathing is shallow and rare. Body temperature increased to 40 °C. The development of toxic hemorrhagic meningoencephalitis and gasoline pneumonia is

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possible. Severe acute gasoline poisoning often ends in death. Encephalopathies (epileptiform and schizophrenia-like syndromes) have been described after severe acute gasoline poisoning. Very high concentrations of gasoline can cause instant death.

Persons suffering from diseases of the nervous system, thyrotoxicosis, cardiovascular diseases, tuberculosis, as well as pregnant women are more sensitive to the effects of gasoline.

Gasoline pneumonia usually occurs due to accidental ingestion and aspiration of gasoline. Characterized by a sharp suffocating cough, sometimes there is blood in the sputum. Since some of the gasoline enters the stomach, patients simultaneously notice a sharp pain in the stomach area. Due to the resorption of gasoline, after a few hours, symptoms of a general toxic nature develop: dizziness, nausea, feeling of intoxication, and others.

Chronic gasoline poisoning is manifested by functional disorders of the nervous system. The nonspecific nature of the disease makes timely diagnosis difficult. Patients complain of dizziness, headache, pain in the heart, sleep disturbance, irritability, easy fatigue, weight loss, paresthesia in the limbs, cramps in the calf muscles. In this case, functional disorders of the nervous system are revealed with a predominance of neurasthenic or asthenovegetative syndrome. In the case of severe forms of intoxication, the development of toxic encephalopathy with diencephalic crises and vegetative-sensitive polyneuritis has been described. The severity of neurological manifestations depends on the severity of gasoline intoxication and concomitant diseases. Neurotic disorders are characterized by a change in state of excitement and asthenia, and hysterical or depressive reactions are often observed. Conjunctivitis, chronic catarrh of the upper respiratory tract, bronchitis, and bronchial asthma have been described. There is a decrease in the sense of smell up to anosmia. Mild dyspeptic disorders and liver dysfunction have been described. In the blood there is moderate hypochromic anemia, leukopenia with relative lymphocytosis, accelerated ESR.

Intoxication with polysulfur oil during production and refining is polymorphic in nature and has its own characteristics. Functional disorders of the nervous system occur with a pronounced asthenic state (weakness, fatigue, depression, forgetfulness, lethargy). In some cases, against the background of asthenia, weakness, an unmotivated feeling of melancholy occurs, and a hypochondriacal state is formed. In severe cases of intoxication, signs of organic damage to the central nervous system are observed: narrowing of visual fields, impaired sense of smell. Cardiovascular intoxication syndrome is manifested by vascular dystonia and dystrophic changes in the myocardium. The secretory function of the digestive glands is noticeably reduced, the motor function of the gastrointestinal tract and gall bladder, and the functional ability of the liver and pancreas are impaired.

Changes in the blood are characterized by the development of leukopenia with relative lymphocytosis. Hypochromic anemia and decreased iron levels in the blood serum have been described. An in-depth study of patients with chronic intoxication with polysulfur oil refining products reveals changes in many organs and systems. Atrophic processes in the upper respiratory tract, disturbances in the organ of vision, a decrease in the filtration capacity of the kidneys, and a decrease in the functional activity of the adrenal cortex and thyroid gland were noted.

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