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**DISEASES AMONG WORKERS IN THE GAS AND CHEMICAL INDUSTRY:
ANALYSIS AND PREVENTION METHODS**

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Annotation. *This article explores the occupational health risks faced by workers in the gas and chemical industry, focusing on the most common diseases resulting from chemical exposure and hazardous working conditions. It provides an in-depth analysis of respiratory, dermatological, neurological, and carcinogenic diseases, along with contributing factors such as inadequate protective measures and prolonged exposure to toxic substances. The article also outlines comprehensive prevention strategies, including engineering and administrative controls, personal protective equipment (PPE), and regulatory compliance. Emphasis is placed on the importance of workplace monitoring, health surveillance, and fostering a safety-oriented organizational culture to mitigate health risks and improve worker well-being.*

Keywords: *occupational diseases, gas industry, chemical industry, workplace safety, respiratory disorders, chemical exposure, carcinogens, neurological effects, personal protective equipment, health risk prevention, industrial hygiene.*

Introduction. The gas and chemical industry are a cornerstone of modern industrial development, supplying essential materials for energy production, manufacturing, agriculture, healthcare, and consumer goods. Despite its vital role in the global economy, this sector is also one of the most hazardous in terms of occupational health. Workers are frequently exposed to a wide array of potentially dangerous substances, including volatile organic compounds (VOCs), heavy metals, acids, solvents, and reactive gases. These exposures, often occurring over prolonged periods and sometimes under inadequate safety conditions, significantly increase the risk of developing occupational diseases. Health issues arising in this industry are diverse and can affect nearly every system of the human body. Acute effects, such as chemical burns or inhalation injuries, can occur suddenly due to accidents or exposure to high concentrations of toxic agents. Chronic conditions, including respiratory illnesses, cancers, neurological disorders, and reproductive problems, may develop gradually over years of low-level exposure, often going undiagnosed until serious damage has occurred. The high-risk nature of this industry makes it imperative to identify and analyze the specific health threats faced by its workforce. Furthermore, it underscores the urgent need for effective prevention





MODERN PROBLEMS IN EDUCATION AND THEIR SCIENTIFIC SOLUTIONS

methods, not only to protect worker health but also to ensure regulatory compliance, operational efficiency, and long-term sustainability. This article aims to explore the most prevalent diseases affecting workers in the gas and chemical industry, examine the primary causes of these conditions, and outline proven strategies for prevention and health protection.

Analysis of literature. The gas and chemical industry play a vital role in global economic development, yet it presents significant occupational health hazards. Numerous studies over the past decades have identified a strong correlation between prolonged exposure to industrial chemicals and the development of both acute and chronic diseases among workers. This literature analysis synthesizes findings from key research to highlight the prevailing disease types, risk factors, and preventive measures.

According to several epidemiological studies (e.g., Wang et al., 2018; Petrova et al., 2020), respiratory diseases remain the most common among gas and chemical industry workers. These include chronic obstructive pulmonary disease (COPD), occupational asthma, and chemical pneumonitis, often resulting from inhalation of substances like chlorine, ammonia, or sulfur dioxide. Additionally, skin diseases, such as contact dermatitis, and musculoskeletal disorders due to repetitive manual labor are frequently reported.

Carcinogenic exposure is another critical concern. Long-term contact with benzene, formaldehyde, and vinyl chloride has been associated with leukemia and liver cancer (IARC, 2012). In high-risk sectors such as gas production, neurotoxic effects have also been observed due to solvent exposure (WHO, 2019).

The gas and chemical industry pose serious health risks to workers, particularly in respiratory, dermatological, neurological, and oncological domains. While numerous prevention strategies exist, their effectiveness depends heavily on consistent implementation, worker education, and strong regulatory frameworks. Future research should prioritize developing regions and focus on long-term health tracking and technological interventions to reduce human exposure.

Research results discussion. The findings related to occupational diseases in the gas and chemical industry reveal a troubling yet consistent pattern: prolonged exposure to hazardous substances significantly increases the risk of serious health issues among workers. Respiratory disorders, such as chronic bronchitis, occupational asthma, and pulmonary fibrosis, are among the most prevalent, primarily due to inhalation of dusts, vapors, and gases like chlorine, benzene, and formaldehyde. Long-term data from industrial epidemiology studies confirm a direct correlation between exposure levels and respiratory disease incidence, especially in environments lacking sufficient ventilation or respiratory protection.

Equally concerning is the increased incidence of cancers—particularly leukemia, lung cancer, and bladder cancer—among workers exposed to known carcinogens such as benzene, polycyclic aromatic hydrocarbons (PAHs), and vinyl chloride. These findings





MODERN PROBLEMS IN EDUCATION AND THEIR SCIENTIFIC SOLUTIONS

align with classifications from the International Agency for Research on Cancer (IARC), which designates many substances used in the industry as Group 1 (carcinogenic to humans). While regulations have helped reduce exposure limits in many developed nations, insufficient enforcement or outdated safety practices still pose significant risks in some regions and facilities.

Neurological disorders and skin diseases also represent a substantial burden. Chronic exposure to solvents and heavy metals can lead to cognitive decline, memory impairment, and peripheral neuropathy. Dermatological conditions, such as chemical burns and dermatitis, remain common in situations where personal protective equipment (PPE) is not properly used or maintained. In some cases, symptoms are overlooked or underestimated by both workers and employers, leading to worsening of the condition.

Importantly, the effectiveness of prevention methods is highly dependent on organizational commitment and worker participation. Engineering controls, such as closed processing systems and advanced air filtration, have proven highly effective in reducing airborne hazards. However, their benefits are often compromised by inadequate maintenance or lack of training. Administrative measures—like health surveillance programs and exposure time limits—are underutilized in many facilities, particularly smaller or poorly funded operations.

The consistent evidence across multiple studies highlights that PPE, while critical, should be the last line of defense rather than the primary protective measure. Overreliance on PPE without addressing root causes of exposure can create a false sense of security. Additionally, the variability in PPE usage due to discomfort, poor fit, or lack of proper training further limits its effectiveness.

Ultimately, the prevention of occupational diseases in the gas and chemical industry requires an integrated approach: one that combines technical solutions with a strong safety culture, worker education, and continuous regulatory oversight. Future research should focus on the long-term health outcomes of low-dose chronic exposure, the effectiveness of emerging protective technologies, and the impact of regulatory policy changes on worker health outcomes.

To analyze the health status of the study population, a survey of 1,432 production workers was conducted for the period from 2020 to 2024. The contingent mainly consisted of men, distributed by age and length of service as follows: more than half of those surveyed - 49.1% were over 40 years old, 37.9% were 30-39 years old, and 12.9% were 20-29 years old. A characteristic feature of the distribution of workers by professional experience in production was that 38.5% had 6-10 years, 23.0% had 11-15 years, and 38.5% had more than 15 years. Due to the small number of workers, workers with up to 5 years of experience were not included in the development. The most numerous group was operators - 42.6%, repairmen made up 30.6%, this group included compressor unit (CU) operators and gas-turbine unit operators. The comparison group



**MODERN PROBLEMS IN EDUCATION AND THEIR SCIENTIFIC SOLUTIONS**

consisted of engineers - 26.8%, comparable in age and experience with the persons of the main production groups.

The conducted analysis showed that 98.7% of workers had never been in contact with harmful production factors before. During the examination, 37.23% of individuals did not present any complaints about their health and, upon objective examination using functional and laboratory methods, they were recognized as practically healthy. Various diseases of internal organs were diagnosed in 62.8% of workers. The level of chronic pathology of those examined was mainly determined by the following groups of diseases: diseases of the genitourinary system 11.53, diseases of the eye and its adnexa - 11.04, diseases of the digestive system - 10.7 and diseases of the endocrine systems 7.2. Diseases of the respiratory system, ear and mastoid process, diseases of the blood, hematopoietic organs occurred in a small percentage of cases. Data on morbidity are of interest not only as health indicators, but also as a "total measure" of the volume and nature of medical care provided and its results over time.

According to our data, the total incidence was 1239.41 cases per 1000 of the studied population (Table 1).

Table 1.**Incidence rate (per 1000 of the corresponding age)**

N o.	Years	Incidence rate in ‰
1	2020	1268.17
2	2021	1140.64
3	2022	1191.53
4	2023	1220.67
5	2024	1376.93
	Total	1239.41

In terms of the overall incidence rate (37.0‰), circulatory system diseases are included in the five main classes of diseases, but special attention should be paid to circulatory system diseases, since the incidence of circulatory system diseases begins to increase sharply with age. If at the age of 20-39 they occupied the lowest level, then at the age of 40 years and older (102.6‰). Moreover, among the diseases of the circulatory system, the leading place in terms of the incidence rate was hypertension (18.8‰), chronic rheumatic heart diseases (13.6‰) and ischemic heart disease (3.7‰).

When analyzing the frequency of chronic pathology for individual nosological forms and prevalence in various professional groups, it was revealed that operators and repairmen, compressor unit (CU) operators and gas turbine unit operators were most often diagnosed with diseases of the digestive organs.





MODERN PROBLEMS IN EDUCATION AND THEIR SCIENTIFIC SOLUTIONS

Gastrointestinal diseases (10.4%), primarily biliary dyskinesia, were diagnosed in 19.5% of operators and 17.0% of repairmen and machine operators. Chronic cholecystitis, gastroduodenitis, and peptic ulcer were recorded in a small percentage of cases (2.0-4.4%). Biliary dyskinesia predisposes to the development of inflammatory changes that contribute to the development of cholestasis, leading to changes in the functional state of the liver. The diagnosis was established based on characteristic complaints (bitterness in the mouth, nausea, pain and heaviness in the right hypochondrium), objective data, laboratory tests, and ultrasound of the abdominal organs. Operators presented complaints in $20.0 \pm 3.2\%$ of cases, repairmen and machine operators in $15.4 \pm 3.4\%$ of cases ($p < 0.001$). With increasing length of service in the groups of operators and repairmen, the number of people with biliary dyskinesia increased significantly (Table 5).

The occurrence of pain syndrome in the right hypochondrium and the presence of dyspeptic complaints were associated by workers with their professional activities. A reliable increase in dyspeptic complaints with increasing length of service was revealed in the group of repairmen and machinists. Based on the uniform nature of the complaints, objective symptoms - pain during palpation of the hepatoduodenal zone, coated tongue, no structural changes in the liver and the presence of indirect signs of biliary tract motility disorders according to ultrasound data, in combination with a transient increase in the activity of transaminases, alkaline phosphatase, an increase in the direct and indirect fractions of bilirubin, the syndrome of biliary dyskinesia was established. Biliary dyskinesia was diagnosed in every third operator and every fourth repairman and machinist, which is significantly more often compared to engineers ($p < 0.001$).

According to ultrasound data using a test breakfast, an increase in the motor-evacuation function of the gallbladder was found in $64.0 \pm 3.7\%$ of operators and $56.0 \pm 4.6\%$ of repairmen and machine operators. Disorders of the motor-evacuation function of the biliary system in workers corresponded to dyskinetic processes.

Conclusion. Workers in the gas and chemical industry face significant occupational health risks due to constant exposure to hazardous substances and physically demanding environments. The prevalence of diseases—ranging from respiratory and dermatological conditions to neurological disorders and various forms of cancer—underscores the need for comprehensive workplace health and safety strategies. The analysis indicates that many of these diseases are preventable with the implementation of effective control measures, rigorous safety protocols, and a proactive organizational approach. Prevention must go beyond basic compliance and focus on a multi-layered strategy: integrating engineering controls, enforcing the correct use of personal protective equipment, providing regular health monitoring, and ensuring ongoing worker education. Moreover, fostering a strong safety culture within the organization, supported by management and involving employees at all levels, is essential for long-term improvements in occupational health outcomes. As the industry continues to evolve with new technologies





MODERN PROBLEMS IN EDUCATION AND THEIR SCIENTIFIC SOLUTIONS

and materials, so too must its approach to worker safety. Ongoing research, updated risk assessments, and adaptive health policies are crucial to minimizing the incidence of occupational diseases. By prioritizing prevention and investing in worker well-being, companies can not only reduce health-related costs and liabilities but also create safer, more sustainable working environments for the future.

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