

Emissions of exhaust gases and health of the person

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Abstract. The auto-road complex brings the considerable contribution to pollution and adverse change of environment. Influence of exhaust gases of cars is at the bottom of occurrence and developments of various forms of diseases. Every townsman feels the negative influence rendered by motor transport on himself. The modern city dweller is so accustomed to the smell of exhaust gases that he does not even notice it at all, continues to breathe a poisonous mixture, while neither the car nor the road can be isolated from the habitats of people. The higher the population density, the higher the need for motor transport. The health effects of emissions of exhaust gases and vapors, including regulated and unregulated pollutants, are discussed in this article.

1. Introduction

Pollution of atmosphere by emissions from motor transport becomes the basic disaster for the population of many cities in this connection, special value is got by the researches connected with an estimation of level of pollution of atmospheric air in cities taking into account influence of motor transport as the person every second needs qualitative atmospheric air.

The auto-road complex brings the considerable contribution to pollution and adverse change of environment. Its feature that neither the car, nor road it is impossible to isolate from habitats of people and the more population density, the above requirement for motor transport.

The number of vehicles being driven has increased every year, and has led to severe traffic congestion [1-4], causing high amounts of multiple pollutants to be emitted into the outdoor air. Cars burn a large quantity of fuel from oil products, putting simultaneously notable harm to environment and health of people.

As the great bulk of cars is concentrated in cities, air of these cities not only is impoverished by oxygen, but also becomes soiled harmful components of the fulfilled gases. Motor transport emissions in city building arrive in ground air layer where their dispersion is complicated. Thus, values of concentration of components of automobile exhausts in atmospheric air are subject to the big fluctuations and depend on variety of factors: relations in a mix of air and fuel, modes of movement of motor transport, a relief and quality of roads, a technical condition of motor transport, etc.

Features of operation of the car in a city are [5, 6]: rather low speeds of movement, frequent changes of a direction and the speeds of movement accompanied by repeated braking and dispersals, the short distances of transportations causing work of engines mainly on unsteady thermal modes. When the engine is running on unsteady conditions, the process of mixture formation and combustion is disrupted, which contributes to the increased release of toxic products. Re-enrichment of the fuel mixture in the acceleration mode leads to an increase in the release of unburned fuel, its incomplete combustion products and nitrogen oxides.



The set of priority forms of ecologically dependent diseases in cities is defined by complex influence of all pollutants of atmospheric air and, as a rule, has no expressed specificity that complicates their diagnostics. For all city territories that at adult population, including persons of advanced age, number of groups of the illnesses connected with influence of ecological factors, much more, than at the children's is uniform.

The modern city dweller so gets used to a smell of exhaust gases that already and at all it without noticing, continues to breathe a poisonous mix [7], thus neither the car, nor road cannot be isolated from habitats of people and the more population density, the above requirement for motor transport.

This problem is especially urgent for urban transport drivers, since the source of pollution is practically in the respiratory zone, and the polluted air enters the human body without purification. Unfortunately, this problem to solve completely it is not possible, after all to work with car and not to inhale its exhaust it is impossible. Short, but daily air baths with an impurity of toxins for some years can present the whole bouquet of diseases.

2. Methodology

Studying of questions of pollution of atmosphere by emissions of exhaust gases of motor transport is one of actual directions the theoretical researches [8-10] having important practical value for health of the population.

Environmental problems of road transport in the city of Tyumen have become particularly relevant in the last decade, so the city conducted research on traffic flows in the street and road network and calculations of mass emissions of pollutants in the exhaust gases of traffic flows. Tyumen as an object of research refers to cities with high traffic density, emissions of which amount to more than 80% of the total gross emissions, while the car park is increasing every year.

According to the Resolution of the City administration Tyumen № 49-pk from 7/2/2009 «About the statement of the list of highways of the general using of local value of a city of Tyumen» extent of highways of the general using of local value to which the considerable part of streets [11], makes 861,4 km, from which with a firm covering of 732,2 km. Density of a network of lines of the main transport now - 0,6 km/km², on prospect - 1,4 km/km².

The density and intensity in turn render a great influence on prevailing power setting. At small density, to 10 cars on 1 km, movement with free speed when the engine works in the established mode is possible.

At the raised density, from 10 to 30 cars on 1 km, falling of speed of a stream conducts to additional fuel consumption. At last, at movement in a continuous stream, that is about 30 cars on 1 km and it is more, speed of a stream decreases up to a jam that also leads to additional fuel consumption and increase in emissions of polluting substances.

The list of pollutants in exhaust gases depends on engine types, operating mode, technical condition, fuel quality [12, 13], as well as service classification. Harmful substances in the operation of mobile vehicles enter the air with exhaust gases, fumes from fuel systems and during refueling.

According to the hygienic standard HS 2.2.5.1313-03 "Maximum permissible concentration (MPC) of harmful substances in the air of the work area" the amount of harmful substances should not exceed the established maximum allowable content in the air of the working area. Table 1 lists the maximum allowable concentrations for the components of the exhaust gas - nitrogen dioxide and carbon oxide.

If several unhealthy substances in the air of the working area are simultaneously controlled (according to the conclusion of the state sanitary inspection authorities), the ratio of the actual concentrations of each of them in the air to their maximum allowable concentration should not exceed one.

Requirements Health rules and regulations HRandR 4616-88 "Sanitary rules for the hygiene of motor vehicle drivers" stipulate that sanitary and technical means (ventilation) must ensure the maintenance of permissible concentrations of pollutants in the car's cabin after the beginning of continuous movement of the car.

Table 1. Maximum permissible concentration of harmful substances in the air of the working area

Name of substance	The formula	Maximum permissible concentration of harmful substances in the air of the working area, mg m ³	Hazard class
Nitrogen dioxide	NO ₂	2	3
Nitrogen oxides (in terms of NO ₂)		5	3
Carbon oxide	CO	20	

The above substances are substances with a highly directional mechanism of action, requiring automatic control over their content in the air.

3. Results

The quality of atmospheric air in cities largely determines the health status of the population and is the leading active etiological factor in the development of diseases, primarily children, the elderly, as well as people with chronic respiratory diseases and the cardiovascular system. Pollution of atmospheric air is the cause of the emergence and development of various forms of diseases among the population [14], it accounts for up to 50% of all ecologically caused diseases. In this case, there is a clear relationship between the level of air pollution and the degree of health disorder.

In practice, the toxicity of exhaust gases is often estimated from the content of carbon monoxide. When the duration of work in an atmosphere containing carbon monoxide is not more than 1 hour, the maximum permissible concentration of carbon monoxide can be increased to 50 mg/m³, with a duration of no more than 30 minutes - up to 100 mg/m³, with a duration of no more than 15 minutes - 200 mg/m³. Repeated work under conditions of high content of carbon monoxide in the air of the working area can be carried out with a break not less than 2 hours.

When assessing the pollution of atmospheric air adjacent to the roadway of the city's highways to a height of 1 m, we can conclude: when the concentration of carbon monoxide in the section of the highway is about 50 mg/m³ the content of this toxic substance is 2.5 maximum permissible concentration of harmful substances in the air of the working area; at a concentration of 70 mg/m³ - 3.5 maximum permissible concentration of harmful substances in the air of the working area; at a concentration of 1600 mg/m³ - 80 maximum permissible concentration of harmful substances in the air of the working area. Long-term exposure to polluted air products leads to an overload of the protective systems of the driver's body. And as a result, diseases of the respiratory system develop: allergic asthma, cancer and emphysema of the lungs, chronic bronchitis, the brain begins processes that can easily lead to paralysis. The management is lost. With reduced visibility, it becomes difficult to use the eyes, the strain of vision is lost. The impact of environmental factors (air pollution: carbon monoxide, nitrogen oxides, sulfurous anhydride, etc.) causes the following diseases:

- cardiovascular diseases;
- diseases of the respiratory system;
- diseases of the nervous system, sensory organs and mental disorders;
- diseases of blood and blood-forming organs.

Carbon monoxide, entering the human body with inhaled air, reduces the function of oxygen supply, displacing oxygen from the blood, which leads to oxygen starvation. As a result, attention is weakened, the reaction of the driver slows down, working capacity decreases, direct influence on the cells of the central nervous system takes place. This is due to the fact that the absorption of carbon monoxide by blood is 240 times higher than that of oxygen. Direct influence is exerted by carbon monoxide on tissue biochemical processes, which lead to a violation of fat and carbohydrate metabolism, vitamin balance.

Particular attention should be paid to the phenomenon of chronic poisoning with small doses of carbon monoxide, which can occur at a volume concentration of carbon monoxide of 0.01%. Chronic poisoning is manifested in the appearance of headaches, noise in the ears, shortness of breath, general depression and loss of vitality. Nitrogen oxides are one of the main toxic components of emissions. The accumulation of these contaminants leads to damage to the mucous membranes of the upper respiratory tract, the development of lung diseases: acute respiratory infections, chronic bronchitis, pneumonia. Some studies have revealed a correlation between the incidence of lung cancer and concentrations of sulfur dioxide or nitrogen dioxide in air, although these substances are not classified as carcinogens or mutagens. Sulfuric anhydride irritating acts on the upper respiratory tract. It breaks the protein metabolism and enzymatic processes, causes eye irritation, coughing. The driver's body is stressed. This effect accumulates, as in the city there are no recreational zones in which the air would help the driver to relax and relax. Thus, the main consumers of automobile exhausts are drivers.

4. Discussion

The problem of reducing environmental pollution by toxic components of vehicle exhaust gas: the adjacent area to motorways and the driver's work area is important.

Following the instructions for labor protection for drivers, they are obliged to comply with labor safety requirements to ensure protection from the effects of hazardous and harmful production factors - increased dust content and gas contamination of the work area. The driver should be aware that gases and other toxic substances (nitrogen oxides, carbon monoxide, ethyl mercaptan and others) that get through the respiratory system into the body and lead to severe poisoning are one of the most dangerous factors that can affect him in the course of work. Nitric oxide is about 10 times more dangerous than carbon monoxide by its action on the body.

Published data from a number of scientific studies indicate that, with a high level of air pollution in the city, the number of cases of respiratory diseases increases by 41%, malignant formations by 35% compared with the number of cases in cities with a lower level of pollution. People with chronic cardiac and circulatory diseases suffer heavier air pollution, the number of cases of diseases of the cardiovascular system in cities with a high level increases by 13.2%.

In this connection, the world has faced the need to develop and implement large-scale comprehensive measures to prevent and neutralize the negative consequences that motorization generates [15-19], as well as reduce the toxicity of automobile engines.

The main of the operational measures to reduce the amount of harmful automobile emissions are:

- improvement of engine models and reduction of car bodies in order to reduce fuel consumption;
- constant monitoring of the technical state of the fuel system of the engine;
- control of toxicity of exhaust gases with the help of modern gas analyzers;
- timely replacement of fuel and air filters;
- use of alternative fuels;
- the use of neutralizers in the exhaust system allows the conversion of toxic substances into products that do not have a harmful effect on the environment;
- movement, if possible, at a constant speed;
- the introduction of automated traffic management systems to reduce the running time of automobile engines in idle and set speed;
- creation of a zone of green plantations along roads, which allows to halve the harmful impact of automobile emissions on the environment.

These measures will reduce the amount of toxic components of exhaust gases released by vehicles, thus reducing the negative impact on the environment and human beings.

5. Conclusions

Often operated cars do not meet modern European restrictions on toxicity and throw out harmful substances significantly more than foreign analogues. The operation of such vehicles on city highways

will provide in the air atmosphere the content of harmful substances in concentrations exceeding the maximum permissible concentrations for the air in the work area.

Therefore, it is simply impossible to work with a car and not to inhale its exhaust. Even short, but daily air baths with an admixture of toxins for several years can give a whole bouquet of diseases. The main consumers of automobile exhausts are drivers. The second in this mournful turn is pedestrians.

In this connection, there is a need to clarify and solve the problem of the impact of exhaust emissions from road transport, on public health.

Acknowledgments

We express our gratitude for the shown attention to the research topic and the opportunity to pass an internship to the management and employees of the Federal Budgetary Healthcare Institution "Hygiene and Epidemiology Center in the Tyumen Region".

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