

Railroad construction is changing the look of an unspoiled environment. When railroads are being built in the area, the natural environment loses its beauty, deforestation, change in landscape and so on [1].

The evolution of human development and the creation of industrial management methods have led to the formation of a global technosphere, one of the elements of which is rail transport.

Railways are now the main link in the transport system of the national economy.

The activities of rail transport have an impact on the environment of all climatic zones and geographical zones. But compared with automobiles, the adverse environmental impact of rail transport is significantly less.

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## **SOURCES OF POLLUTION OF THE MAIN ELEMENTS OF THE ENVIRONMENT**

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The transition to environmentally friendly and sustainable development is currently one of the priorities in the development strategy of Kazakhstan. One of its components is the protection of the environment and the basic elements of the environment - water, air and soil.

The country's economy is production. Hundreds of jobs are created at the expense of enterprises and factories. However, environmental damage from their work must be taken into account. CO<sub>2</sub> emissions, waste water, various types of waste. Harmful waste and emissions have serious consequences not only for human health, but also for the environment, including flora and fauna, biodiversity and natural objects.

Indicators of air quality are the degree of pollution. Most air pollution comes from energy use and production. Burning fossil fuels releases gases and chemicals into the air. And in an especially destructive feedback loop, air pollution not only contributes to climate change but is also exacerbated by it. Air pollution in the form of carbon dioxide and methane raises the earth's temperature. That increased heat then worsens another type of air pollution: smog forms when the weather is warmer and there is more ultraviolet radiation. Climate change also increases the production of allergenic air pollutants including mold and pollen. Air pollutants are considered to

be taken into account if the concentration of pollutants in the atmosphere exceeds the maximum quantity. The main sources of pollutants are industry, automobiles, factories, thermal power, weapons testing, spacecraft and airplanes. The above objects undergo chemical or photochemical changes involving air components in the atmosphere. The resulting chemicals enter water, soil and destroy all living things, buildings and building materials.

The constant oxygen and carbon dioxide content in the atmosphere affects the overall air balance. Its source is the process of photosynthesis in the world of green plants. An increase in the level of carbon dioxide in the atmosphere leads to impaired respiration of people and animals. Therefore, the equilibrium amount of the two main gases in the air must be strictly observed. It is from these conditions that the entire atmosphere of the world is undergoing an environmental crisis. Countries around the world make various contributions to air pollution, depending on their level of economic development.[1]

The Scientific Research Institute of Kazhydromet constantly monitors harmful substances and gases released into the atmosphere in our country, as well as other chemical compounds. These indicators are classified annually and quarterly and are published in the Environmental Newsletter.

In the country, air pollution is affected by poor technical equipment in the industry. That is, because of obsolete technological processes, gaseous substances containing solid and liquid particles are released in large quantities, and these chemical compounds are extremely dangerous and toxic. These are mainly sulfur dioxide, carbon monoxide, nitric oxide, hydrogen sulfide, ammonia and various solids and liquids.[2]

Heavy metal pollution of the biosphere is one of the most important problems of scientific and technological progress. According to some estimates, about 20 billion tons of iron, a total of 6 billion tons of various machines, equipment and installations, as well as 14 billion tons of iron, contaminated or contaminated, were mined for the entire human society. In addition, 80-90% of the annually produced mercury and lead is distributed in the biosphere. When burning coal, the amount of some elements that are released into the environment together with ash and various gases exceeds their production. For example, magnesium - 1.5 times, molybdenum - 3 times, arsenic - 7 times, uranium, titanium - 10 times, aluminum, iodine, cobalt - 15 times, mercury - 50 times, lithium, vanadium, strontium, beryllium, cesium - 100 times, gallium and Germany - thousands of times, yttrium - 10 times and so on. Although heavy metals are naturally occurring compounds, anthropogenic activities introduce them in excessive quantities in different environmental matrices, which impose severe threats on both human and ecosystem health. Heavy metals are nondegradable and can bioaccumulate in living organisms; hence, they can contaminate the entire food chain. Remediation of heavy metals requires proper attention to protect soil quality, the ecosystem, and human health. Physical and chemical heavy metal remediation technologies are very expensive, often destructive to the local ecosystem, and require handling of a large amount of hazardous waste.

Air pollution by sulfur compounds is one of the most important issues today. Sulfur has been in the atmosphere for over 5,000 years. Sulfur oxides have a harmful effect on plants, animals and the human body. In the atmosphere, sulfur (IV) oxide is oxidized to sulfur oxide (VI), which, together with water vapor, turns into sulfuric acid. Sulfuric acid precipitates on the ground in the form of acid rain with atmospheric precipitation. Acid rain has a harmful effect on aquatic ecosystems, slows down the growth of trees and crops, and causes great economic damage. The extreme accumulation of heavy metals in the atmosphere in water and soil causes great harm to life. Arsenic and chromium can cause cancer.[3]

According to researchers at Cornell University, about 40 percent of the world's deaths are caused by air, water, and soil pollution. Toxic substances released into the atmosphere kill about 3 million people every year. The main causes of death from air pollution are malignant neoplasms, congenital pathologies and disorders of the human immune system.

Industrial plants and automobiles emit dark smoke and greenish yellow dioxide, which increases the risk of premature death. Even relatively low concentrations of these substances in the atmosphere can lead to 4-22% of deaths under the age of 40 years.

Large industrial cities are covered in dense fog. It is very foggy, such as smoke and gas residues or thick fog with a mixture of toxic gases and highly concentrated aerosols. This phenomenon is usually observed in calm weather. This has become a serious problem for large cities due to damage to people's health. It is especially dangerous for children and the elderly with a weak body, cardiovascular and respiratory diseases. This can cause breathing problems, and in severe cases, even stop. Causes inflammation of the mucous membrane. Concentrations of pollutants in the air are usually observed in the morning, and during the day, they can increase. Bronchial asthma is directly related to air pollution.[4]

Water is a pillar of life, but there is not a single state that does not legally take measures to protect the environment, water or air. Even international treaties have been concluded to protect seawater, regulate emission technologies and minimize waste. These measures must also be strictly enforced. This is because air, water and soil pollution has reached its limit. This problem is especially important in the most populated industrial areas. Toxic substances spread from these places at a distance of thousands of kilometers from the river, sea currents and wind, threatening to reach the farthest corners of the globe.

In recent years, the risk of radioactive contamination of the soil by common types of polluting waste has increased. Moreover, its harmful effects are not limited to a specific area of the earth. Especially dangerous is the addition of industrial waste to water pollution. Depending on the chemical composition of the waste, its effect is different. For example, refined wastes cover the surface of the water with a large shell, which complicates the flow of oxygen. The effects of detergents, called synthetic detergents, which are used in many domestic and industrial applications, are also closely associated with oil residues. It also destroys fish by killing bacteria that decompose organic matter. Other industrial wastes, such as zinc, copper, various salts of lead and phenol, which are formed during the coking of coal, serve as the basis. Others (acids and bases) change the ratio of beneficial and harmful microorganisms to their electrolyte properties.

The largest amount and the widest range concerning properties of contaminants in the environment are generated by industrial operations. Contaminants can reach water resources, both surface and underground waters, by emission of gaseous, liquid and solid materials from different industries, or during transport and uses, e.g. in households, agriculture, of industrial products. Discharges, wastes may contain various inorganic and organic, biodegradable and refractory compounds causing adverse effects in the environment. Whatever these substances may be, they are unknown or only found in small amounts in water. That is why their decomposition is dangerous for the organisms that inhabit water.

The decomposition of water into organic matter occurs mainly with the participation of microorganisms that breathe aerobic oxygen. In this case, simple harmless substances are usually formed. Of course, this process only goes well when certain amounts of organic additives are taken. As the volume of water pollutants increases, a large amount of oxygen is spent on their decomposition. This reduces the concentration of oxygen in the water, and also helps to increase the number of anaerobic microorganisms that carry out the decomposition process without oxygen. In this case, the substances produced have a different quality. There toxic compounds of methane, amino acids, sulfur and phosphorus are formed, and the water begins to become saturated. A decrease in oxygen content and an increase in toxic compounds leads to the death of fish, and then to a reduction in aquatic plants. As a result, the aquatic environment is gradually becoming poorer. Ultimately, the effects of water pollution are borne by man. Currently, the river is the main source of fresh water. And to clean them from organic and mineral additives is very difficult and

expensive. At the same time, the risks to human health are great. Because modern purification systems can also be cleaned of certain substances that are present in water.

In addition to air pollution, industrial enterprises and thermal power plants also pollute water bodies and rivers. As a result, surface water sources are depleted, and the flora and fauna of Kazakhstan is harmful to the environment. It also exacerbates the problem of providing the population with quality drinking water. About 2.5 million tons of industrial waste are discharged into water bodies annually. The hydrochemical condition and surface water quality are monitored at 215 hydrochemical sites, which are located at 85 sites, including 58 rivers, 11 lakes, 12 reservoirs and 3 canals.[5]

Soil resources are one of the most important prerequisites for life on earth. However, its true meaning and role cannot be underestimated.

Soil pollution often cannot be visually perceived or directly assessed, making it a hidden danger — with serious consequences.

It affects food security both by impairing plant metabolism and thus reducing crop yields, as well as by making crops unsafe for consumption. Pollutants also directly harm organisms that live in soil and make it more fertile. And of course soil contaminated with dangerous elements (for example, arsenic, lead, and cadmium), organic chemicals like PCBs (polychlorinated biphenyls) and PAHs (polycyclic aromatic hydrocarbons) or pharmaceuticals such as antibiotics or endocrine disruptors pose serious risks to human health.

One of the components of the soil biosphere is the biochemical environment for humans, animals and plants. This is a very important reserve of self-cleaning mechanisms with high-energy intensity, able to balance direct and indirect effects between soil biota and humans. The necessary conditions for the production of food for humans and animal feed are created only through the soil.

One of the founders of soil science is V.V. Dokuchaev in the XX century. Initially, the soil was considered as a natural-historical body, capable of its own relationships, the laws of existence and self-regulation. He noted that the soil is closely related to the history of the planet and rocks, climate and vegetation.

Very rare trace elements in the soil: cobalt, copper, manganese, boron, iodine, fluorine, bromine, nickel, strontium, selenium, molybdenum, zinc, lithium, barium, etc. The source of inorganic compounds is not only the rocks that form in the soil, but an organic waste of plant and animal origin, which decompose under the influence of microorganisms.[6]

In recent years, the intensive use of arable fertilizers and pesticides to produce high crop yields has had an additional negative impact on the soil. People, in particular, have made many changes to the land. Harmful to the environment when mining extremely hard minerals. During the excavation, the waste rock dump was used as a production site for large-scale production, as well as for domestic purposes. Soil is a natural resource that is durable and indispensable. To date, no artificial material has been found that can replace the soil. Therefore, the challenge facing human society and remaining important is to preserve the process of soil formation and self-healing.[7]

Another important source of environmental pollution are thermal power plants. Such power plants significantly pollute the atmosphere, the hydrosphere and cause great damage to the biosphere. Of all the main types of power plants, heat sources are the most unfavorable for the environment. When fuel is burned at a thermal power plant in large quantities, harmful gaseous products are formed; carbon monoxide, nitrogen oxides, formaldehyde, sulfur dioxide and other harmful impurities are released into the atmosphere. In addition, one of the other harmful factors is the high oxygen consumption through power plants. Oxygen is an element involved in the combustion of power plants, and is required in large quantities.

In addition to harmful gases, any thermal power plant emits a large amount of radiation into the environment. This radiation is caused by the combustion of fuel, mainly coal and fuel oil. Coal

contains a lot of radiation. Therefore, the radiation background around large thermal power plants is constantly growing.

Ekibastuz region is the largest industrial zone not only in Pavlodar region, but also in Kazakhstan and the most important coal deposit in the world. Ekibastuz is connected with the South Siberian Railway, large cities such as Pavlodar, Karaganda, and Almaty. However, as noted above, one of the most urgent problems in the region today is the harmful substances emitted into the atmosphere by power plants, and the lack of clean drinking water.

Inadequate cleaning of ash collectors at local thermal power plants leads to significant emissions of harmful substances into the atmosphere. In addition, many unorganized quarries, landfills, etc. characterize the situation in the city of Ekibastuz, which are powerful sources of air, soil, and water pollution in the surrounding areas. The order of the main pollutants harmful to the air and soil of Ekibastuz is shown in tables 1, 2.[8, 9]

Table 1

The order of the main air pollutants in Ekibastuz.

| Pollutant        | Hazard class | Multiple exceeding the maximum permissible average daily concentration | Sequence of priority pollutants |
|------------------|--------------|--|---------------------------------|
| Nitrogen dioxide | 2            | 0,6  | 1                               |
| Dust             | 3            | 0,8  | 2                               |
| Sulfur dioxide   | 3            | 0,4  | 3                               |
| Phenol           | 2            | 0,1  | 4                               |

Note – materials taken from [32] Bulletin of KazNMU, No. 3 (3) - 2014.

Table 2

The order of the main soil pollutants in Ekibastuz.

| Pollutant      | Hazard class | Multiple exceeding the maximum permissible average daily concentration | Sequence of priority pollutants |
|----------------|--------------|--|---------------------------------|
| Cadmium        | 2            | 0,6  | 1                               |
| Arsenic        | 2            | 0,54   | 2                               |
| Sulfur dioxide | 1            | 0,38   | 3                               |

Materials taken from [32] Bulletin of KazNMU, No. 3 (3) - 2014.

The impact of large-scale industries, factories, factories and human activities. The three main components of the biosphere are air, water and soil cover. For example, when plowing the land, on the one hand, soil fertility increases, and on the other, dust. In addition, the use of toxic chemicals and pesticides in pest control in agriculture has a significant impact on both water and air and soil cover.

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## **PHARMACEUTICAL FUNGICIDE IN THE AQUATIC ENVIRONMENT: DEVELOPMENT OF PREDICTED ENVIRONMENTAL CONCENTRATION OF TERBINAFINE IN RIVERS**

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**Abstract:** This article reviews important aspects of environmental pollution by terbinafine and its different contamination sources as housing sector, hospitals, pharmaceutical companies, veterinary clinics and livestock complexes. The study is focused on terbinafine which represent the greatest threat. PECs were developed by using available information from datasets and statistical data from bulletins about consumption of pharmaceuticals in Kazakhstan in the period of 2013-2019 for a fungicide terbinafine. Furthermore, along with acute and chronic toxicological data, projected environmental rates allowed estimating the risks of anti-fungal medication.

**Keywords:** terbinafine, fungicide, predicted environmental concentrations, environmental risk, acute and chronic toxicity, consumption of pharmaceuticals, pharmaceuticals in aquatic environment.

**Introduction and background:** The production and widespread use of pharmaceutical products and personal care products has led to the emergence of new environmental pollutants [1]. Over the past decade, drugs and their conversion products (metabolites of drug compounds) are detected in environmental objects in many countries of the world [2]. The first reports of pharmaceuticals in the aquatic environment were published in the 1970s, when the presence of drugs and drug metabolites in wastewater effluent was detected. Since then, Work on the determination of pharmaceutical substances in the environment and the development of highly sensitive analytical methods for their determination are being carried out at an increasing pace in the USA, Canada, Brazil, Israel and in many European countries [3]. The main pollution factors are unused medicines falling into the sewage system, drains or vapors of landfills containing unused medicines that are not claimed by private individuals and organizations. As well as, household drains of settlements and clinics containing medicinal substances used by the population and patients, contaminated waters and irrigation of farms can be considered using veterinary drugs[2,3]. In 2008, worldwide pharmaceutical sales totalled US\$ 602 billion, an increase of around 5–7 per cent per year (IMS Health 2009), parallel with the major advances in medical technology and increased health care expenditure [4].

At the beginning of the 21st century, the European Environment Agency (EEA) identified the effects of active pharmaceutical substances to the environment as a new problem requiring a mandatory response[5]. The latest global report provides information on the results of testing 713 drugs for their environmental impact. It was revealed that the concentration of 631 medicinal substances was higher than the maximum permissible norms. In the course of in Germany, research revealed that every year from health care providers about 16,000 tons of drugs are disposed of to the population, of which 60–80% are usually go down the toilet or throw out together with ordinary household waste[6]. In addition to damage for the environment these actions also have extremely negative economic consequences. For example, in the United Kingdom, measures to eliminate medical damage waste, according to some estimates, can cost for the National Health Service in the amount of 100 million to 300 million pounds annually [3,4].