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Environmental impact assessment of the test of the Moscow city

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Abstract The object of the study is the activity of the Moscow CHPP. The purpose of the study is to assess the environmental impact of Moscow's cogeneration plant on the capital's territory within the Moscow Ring Road (hereinafter referred to as the Moscow Ring Road). In the process of work the tasks were solved with the use of graphic, calculation and graphic, analytical methods, etc. As a result of the research:

- The physical and geographical conditions of Moscow within the Moscow Ring Road were considered;

- determined the degree of influence of the CHP on the air basin, hydrographic network and soil cover of Moscow within the Moscow Ring Road;

- the impact of the CHP of Moscow on the environment in general has been assessed.

Scope of application: in practice the work of an environmental engineer.

Keywords: CHP, pollutants, emissions, discharges, waste.

1.Introduction

Ecosystems in Russia have a significant natural resource potential and allow the use of various technical and technological solutions in the field of electricity and heat generation. Generalization of information about the energy potential of ecosystems, the impact of energy facilities on ecosystems is an actual and modern scientific task to preserve the biosphere and improve environmental safety of power plants.

The production activity of the energy complex is one of the most important in the social and economic development of Russia. To ensure the economic growth of the country: the development of industry, agriculture, trade and environmental quality requires an effective energy supply. On urbanized territories with high population density and level of development of production activity of power engineering objects anthropogenic ecosystems with changed sanitary and ecological conditions are formed, which are subject to evaluation and optimization.

Land ecosystems, forest and agricultural ecosystems, urban green space ecosystems, aquatic ecosystems and the biosphere in general are subject to anthropogenic impact.

At present, the heat and power industry is one of the leading areas of energy, the development of which not only has a positive impact on the level of energy supply of enterprises and the creation of comfortable living conditions for the population, but also has a negative impact on the environment. The greatest harm to the environment of cities is caused by thermal power plants operating on coal and fuel oil, whose emissions contain nitrogen and carbon oxides and dioxides, sulphur and nitrogen dioxides, benz (a) pyrene, soot and other harmful substances. It is for this reason that the design and delineation of sanitary protection zones is extremely important.

Environmental pollution from the CHP impact is manifested in the change of properties of nature components (mechanical, chemical, physical, biological, information), which is a consequence of a complex of artificial and natural processes and leads to the transformation of the habitat in the direction of man-made deterioration. It is especially pronounced in urbanized territories.

The scale of ecosystem pollution by CHP emissions is divided into three types: global, regional and local. All three types of pollution are closely related, because pollution begins locally, at one point, growing to regional scales (provided the process develops at a speed exceeding the rate of purification), and then to global (as a consequence of quantitative pollution).

There are 15 cogeneration plants in Moscow and Moscow region, which together give an uneven background of environmental pollution and degrade the ecological situation as a whole.

The urgency of the study lies in the development of measures to reduce the environmental impact in the study area, due to the large-scale emissions from the CHPs. In this work the impact of Moscow CHPs on the environment has been considered.

The urgency of this work is to assess the negative impact of Moscow CHP on the environment, which is one of the environmental problems of our time.

The purpose of the study is to assess the environmental impact of the CHP of Moscow on the territory of the capital inside the Moscow ring road (hereinafter referred to as the Moscow Ring Road).

Objectives of the study:

- To examine physical and geographical conditions of Moscow within the Moscow Ring Road;
- to determine the impact of the CHP on the air basin, hydrographic network and soil cover of Moscow within the Moscow Ring Road;
- to evaluate the impact of the CHP of Moscow on the environment in general.

Subject of study: operation of the Moscow CHPP.

Methods of research: empirical methods - analysis of literary sources, comparative analysis; theoretical methods - analytical; graphic methods - visualization of statistical tabular data.

The charts are compiled in ESRI ArcGIS program. Algorithm "Natural Neighbor", based on background distribution of pollutants in the components of the natural environment, is used for the construction of the maps.

The empirical base of research _ these are laboratory reports, results of surveys of authorized organizations, systematic data, materials of control and supervision bodies studies, materials published in scientific literature.
Structure of the work: in the composition of the graduate qualification work an introduction, the main part of the work including 3 sections, conclusion, list of literature.

2.Research methodology

Empirical methods - analysis of literary sources, comparative analysis; theoretical methods - analytical; graphical methods - visualization of statistical tabular data.
Maps are compiled in ESRI ArcGIS. To build the maps, the “Natural Neighbor" algorithm was used, based on the background distribution of pollutants in the components of the natural environment.
The empirical base of the study is the reports of laboratories, the results of surveys of authorized organizations, systematic data, research materials of regulatory authorities, materials published in the scientific literature.
Heat supply to Moscow consumers is provided by eleven thermal power plants of Mosenergo OJSC located in the city, and two thermal power stations in the Moscow region. At the same time, TPP-21, TPP-23, TPP-25, located in Moscow, provide thermal energy to consumers in the Moscow region. Most of the heat load of the city is covered by CHP-21, CHP-23, CHP-25, CHP-26. Their total capacity is about 62% of the total installed heat capacity.
Thermal power plants have a negative impact on the environment and on the population of the city. Given the large number of CHP plants in the city, the amount of emissions exceeds permissible norms, having a direct impact on the health and quality of life of people.
The population of Moscow is under enormous anthropogenic pressure due to emissions from the public utilities sector (TPP), transport, and industrial enterprises. In recent years, cases of citizens' appeals to medical treatment facilities regarding respiratory diseases have become more frequent (fig. 1).

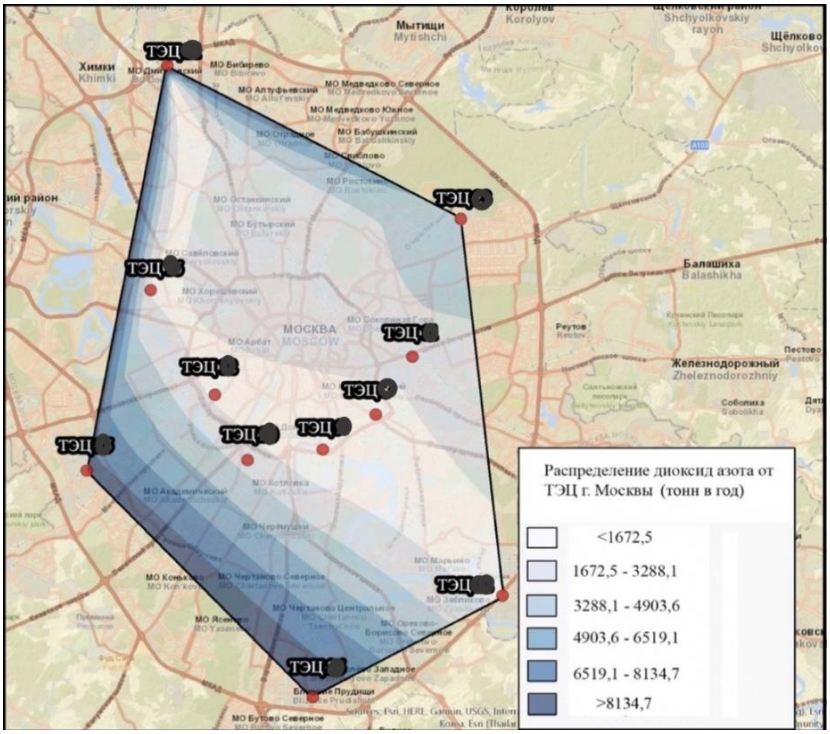

Figure 1 - Nitrogen Dioxide Distribution Chart

The southwestern capital receives the maximum load: the concentration in this area exceeds 8134.7 t / year.

The city center is least affected: the concentration here is less than 1672.5 t / year.

This area is less favorable because for the public and the environment as a whole, large emissions of nitrogen dioxide have a negative impact. Cauterizing effect on the respiratory tract, because of this, chronic diseases can develop. In addition to negative effects on the population, this dangerous substance can inhibit the growth of certain plants (for example, tomatoes). Nitrogen dioxide contributes to poor visibility and plays an important role in the formation of photochemical smog (fig. 2).

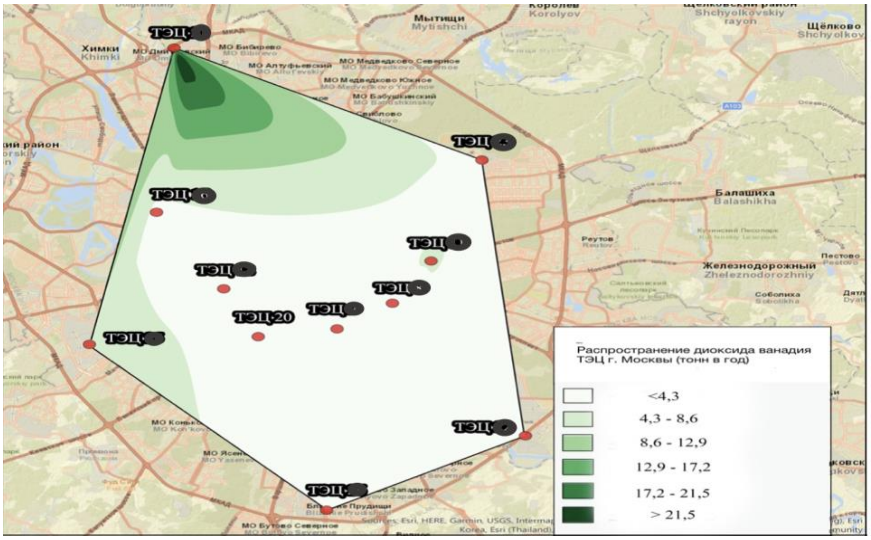

Figure 2 – Vanadium Dioxide Distribution Chart

Excessive vanadium in the atmosphere leads to the appearance on the skin, mucous membranes of the eyes, respiratory tract, inflammatory reactions and allergies.
Animals also suffer, they begin to grow poorly, and their offspring perishes. Symptoms of toxicity in plants include the appearance of pale green stripes on the leaves and stunted growth (fig. 3).

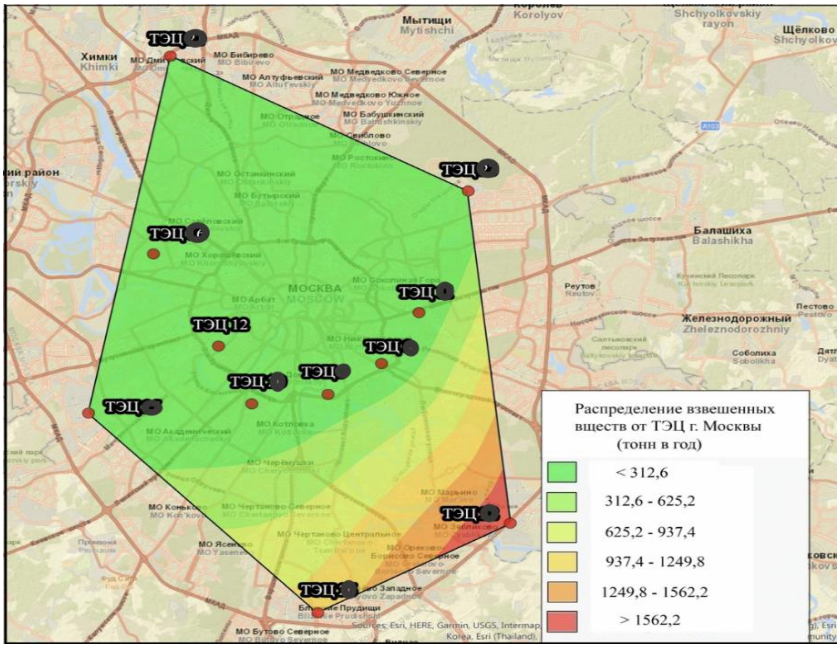

Figure 3 - Chart distribution of suspended solids

Suspended materials include: dust, ash, soot, smoke, sulfates, nitrates and other solid elements. Many elements of suspended solids function as irridants, provoking irritation of the mucous membranes of the respiratory tract and entail the inhibition of the local immunity system, which leads to the development of frequent bronchial and colds.
High concentrations of suspended particles lead to local climate change, as they reflect solar radiation and impede heat transfer. A high concentration of suspended solids in the air reduces the transparency of the atmosphere, impairing visibility and preventing the effective distribution of light (fig. 4).

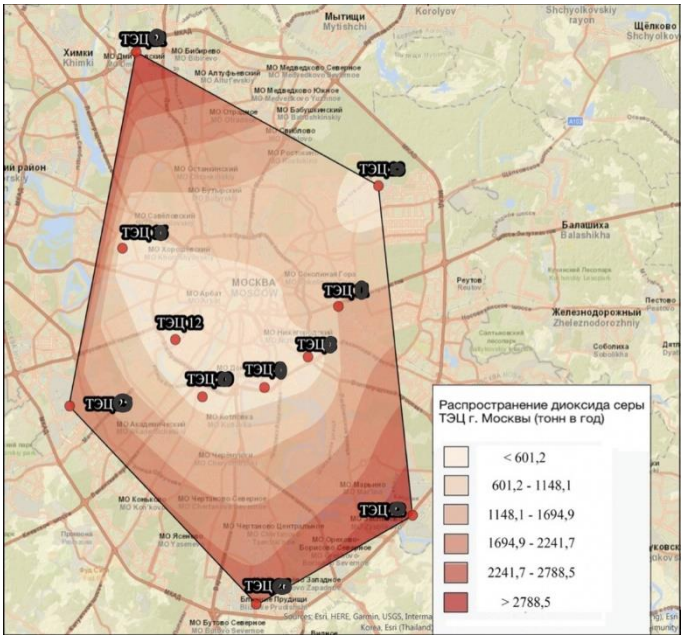

Figure 4 – Sulfur dioxide distribution map

With an increase in the level of sulfur dioxide in the air, diseases of the respiratory tract become more frequent, for example: bronchitis, inflammation of the nasopharynx, trachea, cough becomes more frequent, hoarseness and sore throat are possible.
The plants begin to show a yellow tint, even if the concentration of SO_2 is average and is 0.1 mg / m^3. Coniferous and deciduous forests are most sensitive to sulfur dioxide. At a high concentration of SO_2 in the air, pine shrinks.

3.Results and Evaluation

In the course of studying the environmental situation in Moscow, several environmental measures can be distinguished in the following areas:
- reduction of air pollution;
- improving the quality of drinking water supply;
- reduction of soil pollution.

To reduce the technogenic load of the CHPP on the environment, it is necessary to develop and implement a system of additional measures:
1) Thermal disposal of the following wastes: oiled textiles (rags, clothes), sawdust contaminated with oils, trapped petroleum products, oil sludge, used transformer oil, used turbine oil, used industrial oil, used engine oil, used transmission oil, used activated carbon waste absorbing and filtering materials of treatment facilities;
2) Waste transfer to a specialized organization for the disposal of the following wastes: construction and repair waste, sludge wood processing waste, sludge from washing filters of treatment plants, waste from equipment and piping lining, solid household waste, plastic waste and scrap, electronic scrap waste, scrap and waste abrasive products, spent ion-exchange resins;
3) Realization by third parties for the processing and recycling of the following wastes: waste and scrap of ferrous metals, waste and scrap of brass, waste and scrap of copper, waste and scrap of aluminum, residues and cinders of welding electrodes, batteries of lead-acid batteries;
4) Transfer to a specialized organization for the disposal of the following wastes: used mercury lamps and scrap, used air filters, used oil filters, used pneumatic tires, waste rubber products.
The action plan for the protection of water bodies and the rational use of water resources provides:
1) Carrying out current repairs of wastewater treatment plants for surface wastewater to achieve MPC R.h. on petroleum products.
2) Identification and elimination of sources of wastewater pollution of auxiliary equipment and achievement of MPC for petroleum products.
The activities of energy facilities are accompanied by risks for protected areas, while individual heat and power plants are located within the boundaries of protected areas. Energy facilities affecting national parks and reserves adjacent to protected areas are constantly growing.
In order to fulfill the requirements of the international convention and preserve the biosphere, it is necessary to take into account the requirements for maintaining biodiversity in the development of energy strategies and energy development plans in the Russian Federation.

4.Conclusion

Economic and thermal energy is a vital industry in the city. In Moscow, 12 CHP plants are concentrated. All of them provide the city with warmth and energy. For the operation of the CHPP, environmentally friendly fuel is used - natural gas, but even this does not solve the problem of the negative impact on the environment and the city population.
The negative impact of cogeneration plants on the state of the city's hydrological networks is associated with wastewater discharges and thermal pollution. The greatest danger to water bodies is water contaminated with oil products.
Measures to improve the quality of discharged water:
- modernization of obsolete equipment

- closed water cycle

Waste also affects the soil cover, poisoning the soil with heavy metals, such metals include cadmium, lead, arsenic, nickel, zinc, iron, mercury, cobalt, manganese. The increased content falls on copper, manganese, nickel and is noted one and a half kilometers from the source of pollution. Most soils are affected by pollution by lead, manganese and nickel.

It is possible that in the near future thermal energy will not stop its development and will only gain momentum in development. But it is important to maintain a balance in natural-technological progress.

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