MODERN ECO-FRIENDLY PRACTICES AND PROSPECTS FOR ENVIRONMENTAL PROTECTION

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ASSESSMENT OF THE ENVIRONMENTAL HAZARD OF PRYDNIPROVSK TPP COAL COMBUSTION WASTE

ОЦІНКА ЕКОЛОГІЧНОЇ НЕБЕЗПЕКИ ВІДХОДІВ СПАЛЮВАННЯ ВУГІЛЛЯ ПРИДНІПРОВСЬКОЇ ТЕС

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Environmental hazards are threats to the natural environment, health of people and other living beings, which may arise due to various types of activities, such as industrial production, agriculture, transport and others. This can include water, air, and soil pollution, as well as the destruction of biodiversity and climate change.

Environmental hazard assessment includes the following steps:

– identification of possible threats to the natural environment;

– assessment of the impact of these risks on the environment and human health;

– vulnerability assessment; identifying which ecosystems or groups of people are most at risk;

– development of a strategy to minimize risks or eliminate threats.

Threats identification. On January 1, 2018, the Directive 2001/80/EC on limiting emissions of certain pollutants into the air from large combustion plants began to be implemented in Ukraine. The agreement regulates SO_x, NO_x and PM_{10} emissions from existing thermal power plants. The parties to the agreement are the EU and nine Contracting Parties, including Ukraine. Coal contains nitrogen and sulfur. Accordingly, in the process of its burning, such pollutants as carbon monoxide CO, sulfur dioxide SO_2, nitrogen dioxide NO_2, as well as fly ash in the form of suspended fine particles containing up to 30% of PM_{10} are released into the atmospheric air [1]. A feature of fly ash particles is a highly developed specific surface, which is formed under the influence of high temperatures during coal combustion [2]. Due to this, ash particles intensively absorb molecules of various compounds, including toxic ones (boron, vanadium, arsenic, strontium, beryllium, etc.), from the flow of flue gases. During the long-term accumulation of large volumes of coal combustion waste in the ash storage facility, toxic compounds contained on the surface of fly ash particles, under the influence of external factors, enter the natural environment, creating a threat to it.

Impact assessment. A significant part of the existing TPP ash storage facilities was designed in the 1960s and 70s of the 20th century, so almost all of them have exhausted their design capacity for waste accumulation. However, at a notable number of the ash storage facilities, particularly at the Prydniprovsk TPP, the accumulation of fly ash continues, which currently significantly exceeds the design indicators. Under such conditions, the presence of heavy metals and toxic substances in fly ash particles contributes to the pollution of the soil and groundwater of the surrounding areas. This can affect local ecosystems and lead to a loss of biodiversity, including a change in plant species composition, as well as a decrease in crop yields. At the same time, fly ash is a finely dispersed material. When the beaches of the ash storage facilities dry out, the particles easily change to a suspended state; under favourable conditions, they are lifted by the wind quite high and transported to considerable distances. The expansion of the area of ash storage facilities leads to an increase in wind erosion from the surfaces of dry beaches due to pretty high values of the average annual surface wind speed, which are characteristic of the Dnipropetrovsk Oblast in general and the city of Dnipro in particular [3]. Accordingly, the increase in wind erosion of fly ash leads to significant pollution of the atmospheric air of the city of Dnipro with suspended PM_{10} and $PM_{2.5}$ particles, as well as increases the sedimentation of

suspended particles in the areas adjacent to the ash storage facilities. Thus, over time, ash storage facilities become sources of secondary pollution of the environment since the content of harmful substances in them gradually but steadily increases.

Vulnerability assessment. An area of soil, atmospheric air, and water contaminated with compounds of heavy metals and toxic substances is formed around the TPP ash storage facilities, which accumulate pollution for many years due to the lack of processing of the stockpiled fly ash [4,5]. According to the results of studies [6,7], long-term exposure to such pollutants can lead to a severe deterioration in the health of the population living in this area. In particular, the risk of respiratory and allergic diseases, diseases of the cardiovascular and central nervous systems increases, as well as the risk of genetic damage. People with a weakened immune system and existing chronic diseases are the most vulnerable to the effects of such pollutants.

Strategy to minimize risks. According to various estimates, up to 500 million tons of coal combustion waste have been accumulated in the ash storage facilities of Ukrainian thermal power plants. According to research materials [8], the utilization rate of coal combustion waste in Ukraine is about 30%. The strategy for minimizing environmental risks associated with the accumulation of enormous amounts of coal combustion waste products in TPP ash storage facilities consists of the development of an environmentally safe and waste-free technology for processing the stockpiled fly ash, the implementation of which will allow the complete processing and utilization of the accumulated coal combustion waste products. In particular, this technology should provide, in addition to the processing and utilization of the carbon-containing product, the extraction and utilization of the iron-containing fraction of the stockpiled fly ash [9,10].

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