

CONDITION AND ISSUES OF ACCUMULATION OF MINING WASTE IN LARGE MINING REGIONS OF UKRAINE

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We have carefully analyzed government statistics on the generation and management of industrial waste by type of economic activity in 2020 for Ukraine as a whole, as well as for Dnipropetrovsk Oblast and the city of Kryvyi Rih in particular [1, p. 107; 2, p. 1]. The volume of industrial waste from the iron-ore industry of the city of Kryvyi Rih was found to be 96.02% of the total volume of waste accumulated in Dnipropetrovsk Oblast and 64.3% of the whole of Ukraine. As of 2020, 10.847 billion tons of wastes have been accumulated around the city of Kryvyi Rih. These data indicate the powerful importance of the city of Kryvyi Rih and the Kryvyi Rih Iron-ore Basin as a whole in the large-tonnage industrial waste generation both in Dnipropetrovsk Oblast and in Ukraine and, accordingly, the technogenic burden on the environment and residents of the city of Kryvyi Rih.

In terms of waste utilization, the leader is Dnipropetrovsk Oblast, where in 2020, out of 100.5 million tons of waste utilized in Ukraine, 87.1 million tons (or 87.1%) were utilized [2, p. 1]. The waste utilization level in Dnipropetrovsk Oblast is the highest among all oblasts in Ukraine (Figure 1), but remains a low enough for significant improvement of the state of the natural environment. Over the past 5 years, the waste utilization level has fluctuated between 28–35%.

Figure 1 analysis for the period 2016–2020 shows an exponential increase in the volumes of wastes generated and a slight linear trend of increase in their utilization in Dnipropetrovsk Oblast, of which a significant part (96%) is waste from the iron-ore industry.

The Regional Waste Management Plan for Dnipropetrovsk Oblast until 2030 notes [3, p. 106] that the increase in waste generation volumes and insufficient utilization level are caused by the fact that waste generators, such as iron-ore enterprises, do not pay due attention to environmental protection issues and rational natural resource management in the Kryvyi Rih region. Low environmental tax rates for waste dumping in specially designated areas or facilities (landfills, tailing dams, sludge dumps), unsatisfactory work of environmental authorities, environmental and social organizations do not

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contribute to improving the environmental situation in the region. According to [4, p. 15], first of all, it is necessary to prevent the waste generation, to increase the volume of its reuse in other types of activities and recycling.

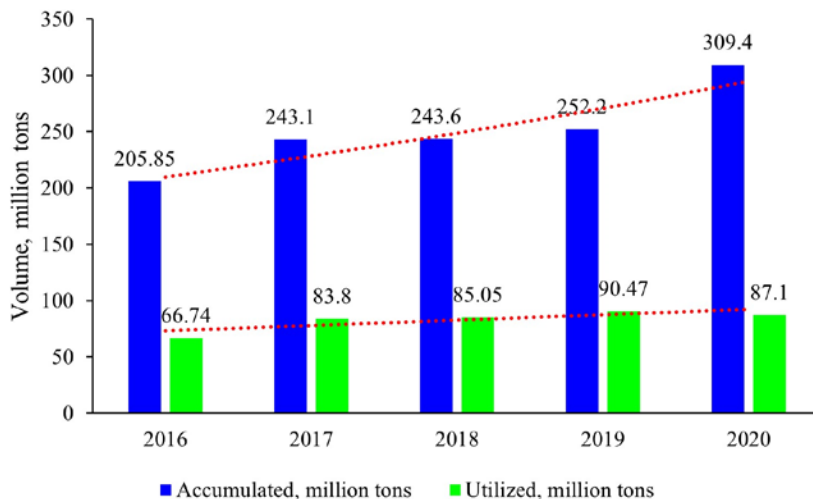


Figure 1. Level of generation and utilization of I-IV hazard class waste in Dnipropetrovsk Oblast for 2016-2020

If we pay attention to the statistical data on the volume of industrial waste utilization in Dnipropetrovsk Oblast by cities, then out of 87.1 million tons, 79.9 million tons or 91.7% were utilized in the city of Kryvyi Rih. Compared to the total volume of waste generated, the volume of waste utilized is at the level of 1/3, which, on the one hand, is insufficient, but, on the other hand, indicates that there are effective and existing directions for reducing its accumulation on the earth's surface.

The main directions for the iron-ore industry waste utilization, implemented by waste-generating enterprises in the Kryvyi Rih Iron-ore Basin to date, are:

- the use of overburden and hard rocks for the production of construction crushed stone;
- the use of overburden and hard rocks for the construction of technological roads and railway tracks in accordance with building regulations;
- use of overburden and mine waste rocks for mining-technical land reclamation (filling of closed quarries, mine failure zones);

– the use of pulp thickening technology at one of the mining-beneficiation plants, which makes it possible to reduce the volume of pumping pulp to tailing dams.

The lack of large-scale utilization technologies leads to an increase in the volume of generation and subsequent storage of mining waste on the earth's surface of the Kryvyi Rih region. In addition, the design capacity of some waste storage sites (dumps, tailing dams) is gradually becoming depleted, which forces enterprises to develop projects for the creation of new facilities and obtain state permission to allocate new land areas.

Thus, since 2022, ArcelorMittal Kryvyi Rih, PJSC mining enterprise has received permission and is building a new tailing dam, Tretia Karta. Active tailings dams, such as Myrolyubiv and Obiednane, are planned to be closed after the commissioning of a new tailing facility. The design volume of the tailing dam is planned to be 280 million m³, for which more than 500 hectares of land area have been allocated. ArcelorMittal Kryvyi Rih, PJSC has also begun construction of a new rock dump, Stepovyi-2. The area occupied by the facility will be 271 hectares, and the total capacity is designed for 51.38 million m³ of dumped rocks. Figure 2 illustrates the location of these facilities.

It should be noted that the construction of these facilities caused social tension in the city of Kryvyi Rih, due to the discontent and indignation of residents and public environmental organizations. In the period of 2020–2022, several court hearings were held to cancel decisions on the construction of facilities. Public environmental organizations note that projects for these facilities were developed in violation of environmental legislation and will have an impact on the flora, fauna and health of city residents.

However, to date, the construction of facilities continues. Dumps and tailing dams in the region, in addition to the alienation of land areas, significantly threaten the surrounding settlements with dust pollution, and there is always a risk of dam breaks during the operation of tailings dams. There have also been cases of resettlement of residents from settlements to expand previously built dumps.

The problem of industrial waste accumulation from the iron-ore industry requires an urgent solution to prevent further environmental pollution, increase in the level of social tension in the region, and the development of a technogenic-environmental disaster. A promising method for utilization of large-tonnage industrial wastes can be their use as backfill materials for the formation of backfill masses in surface technogenic cavities (depleted quarries, mine failure zones) in order to restore the disturbed earth's surface level [5, p. 36]. Industrial waste from mining activities can be successfully considered as a potential backfill material, the reserves of which in the region

are sufficient. The strategy should be based on the formation of a backfill mass, which will ensure the stability and geomechanical reliability of the earth's surface and make it possible to use restored land areas in industrial infrastructure projects. This direction is currently insufficiently developed and studied both in Ukraine and the world. The current practice in the region of filling waste rocks into mined-out cavities does not guarantee long-term geomechanical stability, as well as the further use of the restored earth surface at the site of filled-in quarries and failures in the construction directions of reclamation is quite risky.

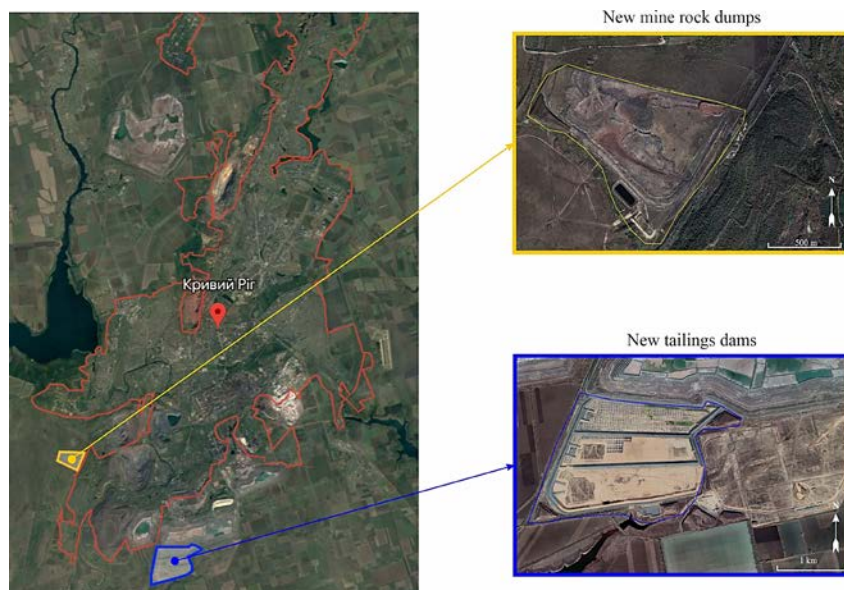


Figure 2. Location of storage sites for industrial mining waste that are under construction

The formation of a reliable backfill mass can be effective from an environmental point of view, optimal use of the restored earth's surface and economic benefits, promoting infrastructure development and investment in the industrial region.

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References:

1. Statistical collection “Environment of Ukraine” (2021) Kyiv: State Statistics Service of Ukraine, 189 p.
2. Main Department of Statistics in Dnipropetrovsk Oblast. Available at: <http://www.dneprstat.gov.ua/statinfo/> (accessed September 28, 2023).
3. Regional waste management plan in the Dnipropetrovsk Oblast until 2030. Available at: <https://oblrada.dp.gov.ua/region> (accessed September 28, 2023).
4. National waste management strategy in Ukraine until 2030. Available at: <https://zakon.rada.gov.ua/laws/show/820-2017-%D1%80#Text> (accessed September 28, 2023).
5. Petlovanyi M., & Sai K. (2023) Problems of the earth’s surface disturbances by mining operations in the conditions of the Kryvyi Rih iron-ore basin. *Modern Science: Processes of Globalisation and Transformation*, 35–39. DOI: <https://doi.org/10.30525/978-9934-26-309-5-11>