UKRAINE – Mykolaivska Oblast - Voznesensk
Fire at a solid waste landfill (06-10 July 2022)

For humanitarian purposes only
Production date: 15 August 2022

Overview

Russian invasion of Ukraine on 24 February 2022 led to the rapid expansion of the territories affected by the conflict. Due to the war, a significant part of the population of Ukraine, amounting to **6.645 million people or 15% of the total**, was internally displaced (link). This situation, among other problems, caused an additional burden on the existing infrastructure, in particular on the waste disposal system in internally displaced persons (IDP) hosting regions. The massive destruction of infrastructure as a result of military actions engendered a large amount of waste, which are likely to be buried in existing or new landfills since the mechanism of their disposal is still unclear (link).

Despite a significant decrease in the population over the past two decades (**10 million or 20% of the total population**), the rate of waste generation in Ukraine continues to increase (Graph1).

Indicators of household waste management in Ukraine in 2021 (link)
- **9.4** million tons or **92.4%** of household waste are disposed of landfills
- **230** or **3.8%** landfills have exhausted their capacity for waste disposal
- **824** or **13.8%** of landfills do not comply with the rules of waste landfills operation (link)

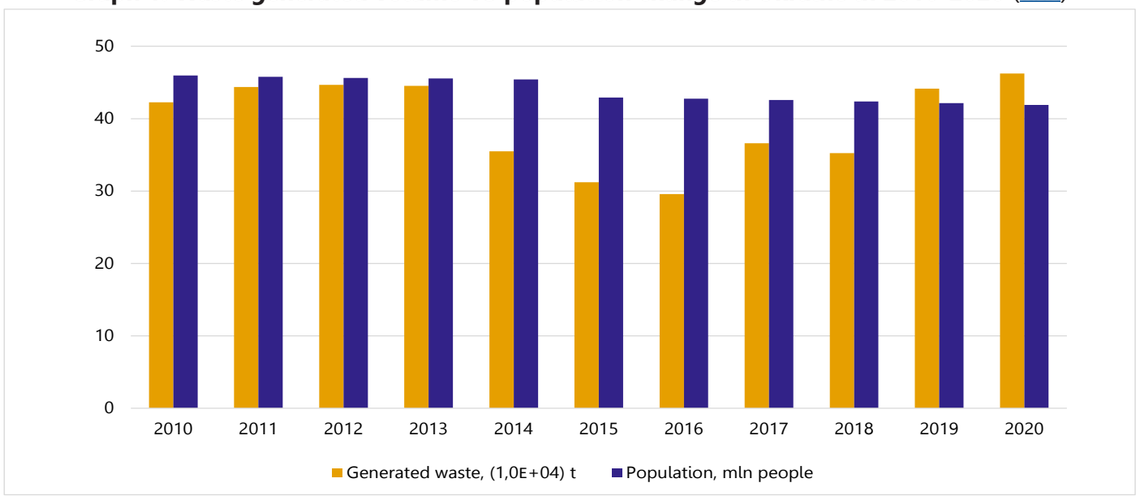
More than **10 million tons** of household waste was generated in 2021 alone, which is disposed at **6,000 landfills** with a total area of almost **9,000 ha** (link).

30 solid waste landfill burning events over the whole of Ukraine have been recorded by Impact using open data sources including data from State Emergency Service of Ukraine (SESU), **since 24 February 2022**. Ground hostility creates risks of large-scale fires both due to the direct hits and the inability to ensure proper maintenance of such facilities by local services as, for example, at the Voznesensk landfill in Mykolaivska oblast, where fires occurred repeatedly (link). **The fire at the Voznesensk landfill started on 06 July 2022, lasted for more than 5 days** (Image 1, 2), **and involved a burning area of at least 2 ha** (link).

The Voznesensk landfill, which is typical for Ukraine, is intended for the disposal of unsorted waste (including organic) from the Voznesensk and surrounding villages. Over 50 years of existence it accumulated more than 0.5 million tons of waste, although it isn't equipped with leachate and biogas collection systems, and according to the results of the local State Emergency Service inspection, it doesn`t meet the environmental safety requirements (link).

Such cases are an extra burden on emergency response services and a source of worsening living conditions for residents.

Graph 1. Waste generated volume VS population change in Ukraine in 2010-2020 (link)



Impact on atmosphere

Solid waste landfills are a kind of energy facility due to the formation of biogas as a result of the anaerobic decomposition of organic substances. **Biogas from solid waste landfills** in Ukraine **consists of** more than **50% of methane**, **the greenhouse effect of which is 25 times greater than CO2**. But the greatest damage to the environment and people is caused by fires since the solid waste burning led to a significant amount of toxic emissions (link).

Table 1 shows the potential composition and amount of pollutants, which impact calculated, based on the burned area and minimum thickness (25 cm) of incinerated waste (link). Among these emissions, sulfur dioxide creates the most concerns in terms of the potential released amount and toxicity. According to the Flash Environmental Assessment Tool (FEAT 2.0) (link) , the release of toxic gases like sulfur dioxide presents a **threat to life** and has severe health consequences for people within **5 km of the landfill**. Contamination can be channeled through the air, soil, groundwater, and rivers, and is **very toxic to aquatic life**, with long-lasting effects in **areas within 10 km**. The map on page 2 shows the areas of exposure that are dangerous to human health and the environment.

Table 1. Potential emission due to solid waste burning at Voznesensk landfill

Pollutants	Amount of pollutants kg
Carbon dioxide	1816250.0
Carbon monoxide	47500.0
Methane	4625.0
Ethylene	1575.0
Benzene	1125.0
Polyciclic aromatic hydrocarbons (PAHs)	375.0
Ammonia	1400.0
Sulfur dioxide	625.0
Nitrogen oxides	4675.0
PM2.5	12250.0
PM10	14875.0
Black carbon (BC)	812.50
Mercury (Hg)	0.262500
Polychlorinated biphenyls	0.387500

Impact on human health

Given that the harmful substances can impact human health at a distance of 5 km from the source of pollution, the estimated number of the **potentially affected population is about 21,000**. Most of them are inhabitants of Voznesensk city. However, a wind rose pattern suggests that settlements situated to the south of the landfill have been the most exposed to air pollution, namely Rakove and Yastrubynove.

Impact on water ecosystems

There are **113 km of streams and riverbeds** located within 10 km of the landfill, including the Pivdennyi Buh River. The Pivdennyi Buh River is located only 2 km from the landfill, while the upstream part of the nearest watercourse which also flows into Pivdennyi Buh is less than 1 km from the landfill. Other water bodies which might be the most impacted by the fire on the landfill are Mertvovid, Balka Rakivska and Vyzyrianska (see map on page 2).

Impact on soil and land

The south of Ukraine is mostly an agricultural region, therefore **77% of lands** affected by pollution from landfill burning are used for crop production. About 10% of the land within 10-km soil exposure area of the landfill is covered by built-up areas, about 6% is represented by semi-natural grassland and meadow, and only less than 5% of forest cover. In total, about **33,000 ha** of croplands is under the threat of contamination caused by prolonged landfill fire near Voznesensk city.

Impact on biodiversity

The impact on human health might be boosted by the fact of scarce natural and semi-natural vegetation that helps to clean polluted air, soils and water. There are nine protected areas (PA) within the 10 km buffer around the landfill with a **total area of around 220 ha**, but the area of six PAs within 5 km is estimated as 9 ha. Moreover, there is a natural spring in less than 900 m downhill the landfill – a natural site of local importance that is under the hight threat of contamination. It might be used as a source of drinking water by the citizens of Rakove village. In addition, one part of the Emerald network site (Image 3), Nyzhnie Pobuzhzhia, is also within 10 km of the landfill. It lays downstream and according to the prevailing wind direction might be affected more than other sites. Three other sites, proposed for the inclusion in the Emerald network with a total area of **6,600 ha are also under the threat** of being affected by harmful substances from landfill burning at the landfill.

Conclusions

The introduction of best waste management practices will contribute to the reduction of the amount of waste entering solid waste landfills and reduce the negative impact on the environment. In addition, according to UNEP (link) research, the redirection of waste streams from landfills to specialized energy facilities can reduce the amount of environmental pollution.

Risk mitigation measures:
- implementation of 3R principles (reduce, reuse, recycle)
- separate collection and sorting before disposal
- composting of organic waste
- awareness building about rational consumption and best waste management practices

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Image 1. Planet satellite image of the fire at Voznesensk landfill on 8 July 2022 (link)

Image 2. Photo of the fire at the Voznesensk landfill on 8 July 2022 (link)

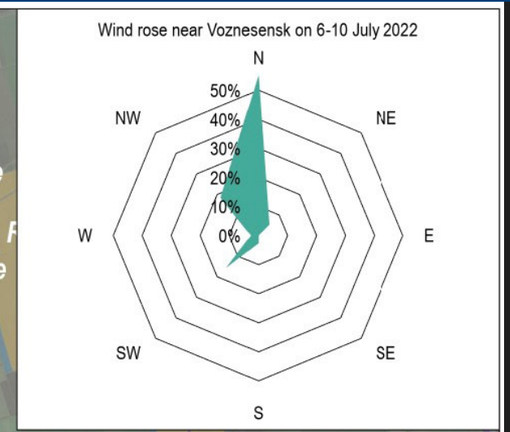

Image 3. Emerald Network of Areas of Special Conservation Interest (link)

The Emerald Network is an ecological network made up of Areas of Special Conservation Interest, implementation was launched by the Council of Europe as part of its work under the Bern Convention, with the adoption of Recommendation N16 (1989) of the Standing Committee to the Bern Convention (link)

Voznesensk landfill
Rivers and streams
Flow direction
5 km zone of human health exposure to hazard
10 km zone of soil and river exposure to hazard
Rakove 702 Settlement name and population impacted
Protected areas
Adopted Emerald sites
Proposed Emerald sites

Data sources:
Protected areas - State cadastre of protected areas of Ukraine, Ministry of Environmental Protection and Natural Resources;
Emerald network sites - European Environment Agency;
Rivers and streams - ©OpenStreetMap contributors;
Population data - OCHA;
Weather data - Ventusky web application.

Coordinate System:WGS 1984 UTM Zone 35N

Note: Data, designations and boundaries contained on this map are not warranted to be error-free and do not imply acceptance by the REACH partners, associated, donors mentioned on this map.