REACH's Hazardous Events Monitoring Initiative

Assessing the health, environmental and livelihoods impacts of conflict incidences to Ukraine's industrial facilities

REACH Informing more effective humanitarian action

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The Hazardous Events Monitoring Initiative

Rationale

Ukraine is heavily industrialised with metallurgy, mining, machinery, chemical and petrochemical, power generation, among others.

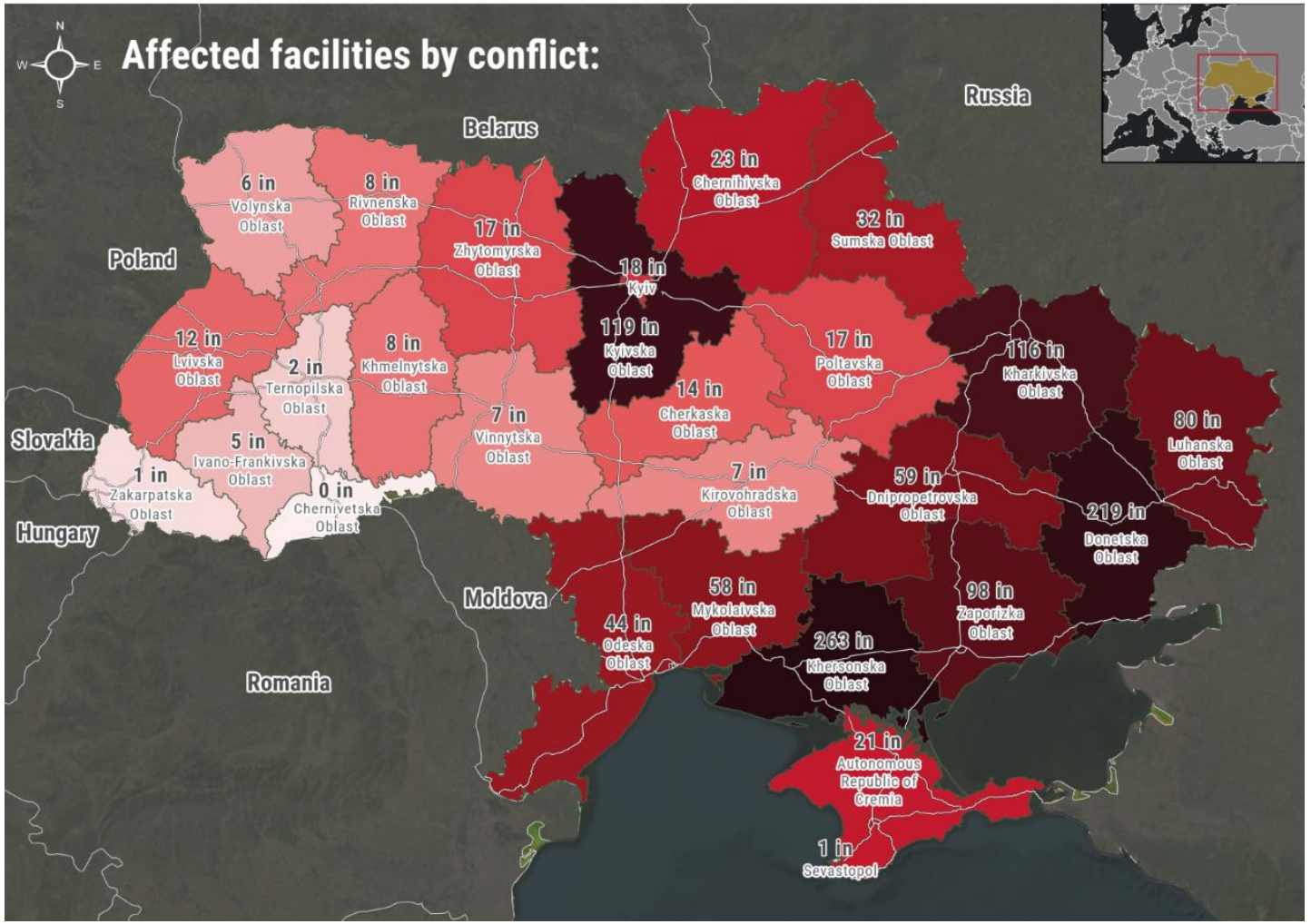
Many industrial facilities are directly impacted by hostilities (damaged, destroyed, dismantled, etc.), leading to the release of hazardous substances into the environment, posing significant threats to human health, productive natural assets and ecosystems.

Event- and facility-specific information is crucial to address immediate and long-term environmental and health hazards.

This presentation provides an overview of environmental contamination and public health hazards emanating from conflict-affected industrial facilities in Ukraine since the start of the invasion in February 2022.

Infrastructure and transport facility in Kyivska oblast, damaged in March 2022 and containing kerosene.

REACH's Hazardous Events Monitoring Initiative



Number of recorded conflict-related incidents in industrial facilities per oblast (February 2022 to October 2023).

Objective

Inform humanitarian and early recovery actions that address the impacts of conflict-related incidents to hazardous industrial infrastructure on the environment, human health and livelihoods.

Methodology

01

Media monitoring

Baseline data from Zoï Environment Network's Ecodozor.org. It consolidates multiple sources to monitor war-induced environmental impact, cataloging disruptions to infrastructure and utilities, with expert analysis and satellite verification, categorizing and geo-locating incidents in an updated database.

02

Remote sensing

Planet Labs' high-resolution satellite imagery: Inspect conflict-affected facilities to confirm damage, assess severity, and identify traces of environmental contamination.

03

Primary data

Area-based assessments: key informant (KI) interviews with local authorities, environmental experts, conflict-impacted enterprises, and residents.

Insights from KIs were triangulated with secondary data, remote sensing and FEAT analysis.

04

Flash Environmental Assessment Tool

Helps to identify existing or potential acute environmental impacts that pose a threat to humans and ecosystems, following sudden-onset natural hazards and conflicts.

Limitations: Media-based monitoring can result in biases in the amount of attention certain incidents receive as compared to others. Results from remote sensing are also limited by the availability of high-resolution imagery and cloud cover.

Data utilization

Local authorities

Gain a localized understanding of hazardous events' impacts on people and the environment, to develop adapted impact mitigation and recovery measures.

Donors

Strategic allocation of funds to key areas such as ecosystem restoration, healthcare, and sustainable economic recovery.

Environmental NGOs

Develop targeted interventions for environmental restoration, advocate for resources, support affected communities with nature-based livelihoods.

Operational actors (State Emergency Service of Ukraine)

Develop emergency response and evacuation plans adapted to identified hazards to ensure rapid response to hazardous events.

Local humanitarian NGOs

Tailor localized response efforts addressing specific environmental, health, and livelihood challenges in affected communities.

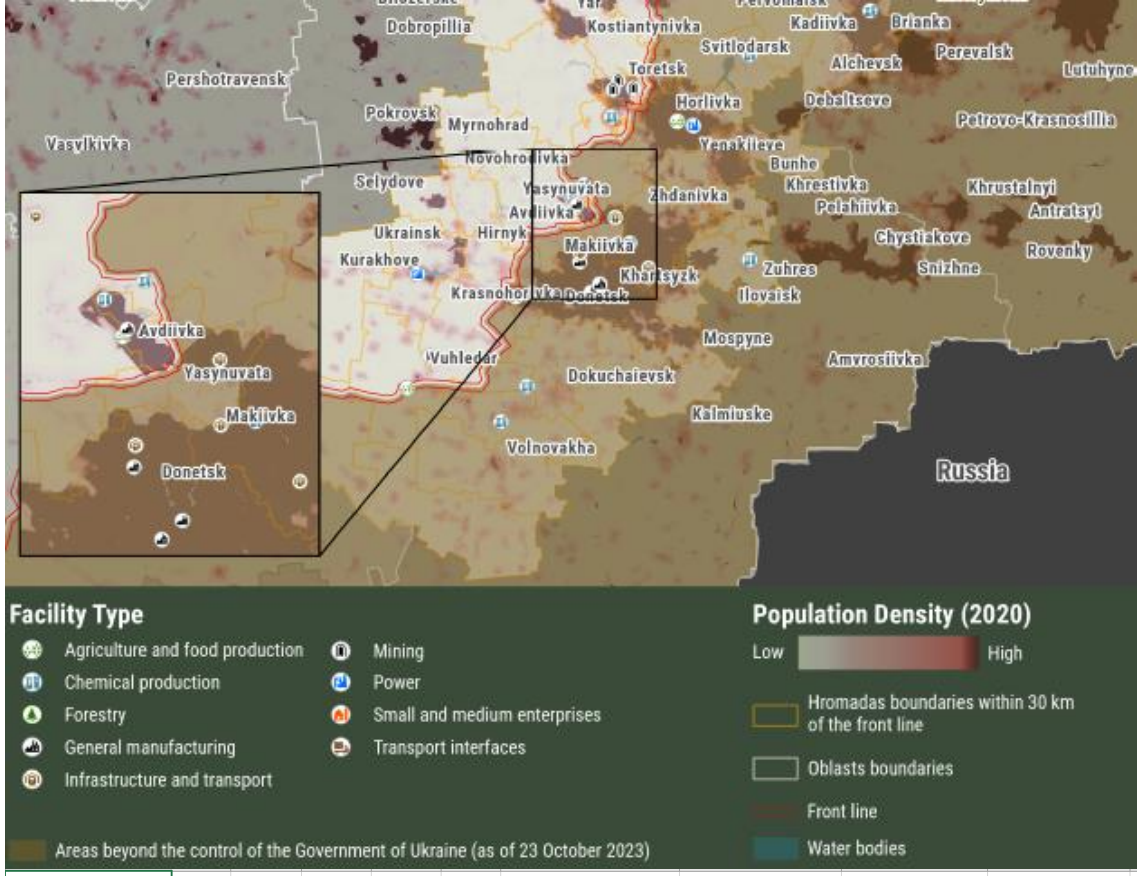
International humanitarian community

Coordinate and prioritize interventions, focusing on the most urgent environmental, health, and livelihoods-related needs.

The data informing REACH's Hazardous Events Monitoring Initiative is considered sensitive, and therefore not publicly available. This database is updated monthly.

Upon request, **REACH can bilaterally share reports, datasets and customized maps** with humanitarian and recovery actors.

Please contact us at impact.ukraine@impact-initiatives.org



Areas_of_control	Unique_F	Date_of_firs	Date_of_lat	Number_of	Number_(	Name_UKR	Name_EN	Facility_Type (Zoi)	Facility_Type_Matrix (Zo
government-controlled	1	28/05/2022	17/09/2022	4	3	Слов'янська ТЕС	Slovyansk Thermal Power Pl	Thermal power	Thermal power generati
non-government-controlled	12	19/03/2022	15/08/2022	34	32	Вуглегірська ТЕС	Vuhlehirsk Thermal Power	Thermal power	Thermal power generati
government-controlled	15	05/04/2022	15/06/2023	5	5	Торецький фенольний завод	Toretsk Phenol Plant	Chemical and coke-chem	Production of basic chen
non-government-controlled	17	03/03/2022	13/07/2023	11	6	Маріупольський металургійни	Ilyich Iron and Steel Works	Metallurgy and metal prc	Pig iron, steel, and ferro
government-controlled	18	13/03/2022	20/10/2023	81	79	Авдіївський коксохімічний зав	Avdiivka Coke and Chemical	Chemical and coke-chem	Production of basic chen
non-government-controlled	20	19/03/2022	21/03/2023	3	0	Шахта ім. О. О. Скочинського	O.O. Skochynskyi Mine	Mining	Coal mining and process
non-government-controlled	50	03/03/2022	26/05/2023	47	44	Металургійний комбінат «Азс	Azovstal Metallurgical Plant	Metallurgy and metal prc	Pig iron, steel, and ferro
government-controlled	64	08/09/2022	31/10/2023	22	21	Курахівська ТЕС	Kurakhove Thermal Power	Thermal power	Thermal power generati
government-controlled	68	29/05/2022	21/10/2023	3	2	Шахта «Торецька»	Toretska Mine	Mining	Coal mining and process
non-government-controlled	76	18/04/2022	18/04/2022	1	1	Бахмутський аграрний союз	Bakhmut Agricultural Union	Agriculture	Livestock and poultry far
government-controlled	100	03/06/2022	03/06/2022	1	1	Красногорівський вогнетрив	Krasnohorivka Refractory Pl	Construction	Construction materials
non-government-controlled	108	02/03/2022	02/03/2022	2	1	Єнакіївський металургійний з	Yenakiieve Iron and Steel W	Metallurgy and metal prc	Pig iron, steel, and ferro
non-government-controlled	111	29/05/2022	29/05/2022	1	1	Донецьккокс	Donetskcoke	Chemical and coke-chem	Production of basic chen
non-government-controlled	114	01/03/2022	14/07/2022	22	19	Сєвєродонецьке об'єднання	Severodonetsk Association	Chemical and coke-chem	Production of basic chen
non-government-controlled	115	02/03/2022	02/03/2022	1	1	Стахановський завод феросп	Stakhanov Ferroalloy Plant	Metallurgy and metal prc	Pig iron, steel, and ferro
non-government-controlled	120	21/02/2022	23/02/2022	3	3	Луганська ТЕС	Luhansk Thermal Power Pla	Thermal power	Thermal power generati
non-government-controlled	127	15/06/2022	30/06/2022	2	2	Лисичанський содовий завод	Lysychansk Soda Plant	Chemical and coke-chem	Basic inorganic chemical
non-government-controlled	139	02/03/2022	13/03/2022	3	3	Попаснянський вагоноремонт	Popasnyansky Wagon Repai	Machine building	Machinery manufacturin
non-government-controlled	142	18/03/2022	21/04/2022	2	1	Завод «Азовмаш»	Azovmash Factory	Metallurgy and metal prc	Machinery manufacturin
non-government-controlled	149	22/03/2022	14/08/2023	21	21	Лисичанський нафтопереробн	Lysychansk Oil Refinery	Chemical and coke-chem	Petroleum refining and
non-government-controlled	159	28/02/2023	01/03/2023	2	2	Стахановський вагонобудівни	Stakhanov Wagon-Building	Machine building	Machinery manufacturin
non-government-controlled	176	05/03/2022	05/03/2022	1	1	Шахта ім. Д. Ф. Мельникова	D.F. Melnykov Mine	Mining	Coal mining and process
government-controlled	182	27/03/2022	19/08/2023	7	6	Новокраматорський машино	Novokramatorsky Machine	Machine building	Machinery manufacturin
non-government-controlled	186	05/04/2022	11/05/2022	3	3	НВП «Зоря»	Zorya Scientific and Product	Chemical and coke-chem	Explosives manufacturin
government-controlled	206	14/03/2022	10/03/2023	6	1	Карлівська фільтрувальна ста	Karlivka water treatment pl	Water and waste water	Drinking water supply
government-controlled	208	24/04/2022	24/04/2022	1	1	Насосна станція III підйому ка	Pumping station III of the Si	Water and waste water	Drinking water supply
non-government-controlled	212	24/04/2022	24/04/2022	1	0	Насосна станція I підйому Пів	Pumping station I of the Sou	Water and waste water	Drinking water supply
non-government-controlled	307	09/03/2022	01/04/2022	4	2	Шахта «Золоте»	Zolote Mine	Mining	Coal mining and process
non-government-controlled	311	24/02/2022	06/06/2023	20	13	Каховська ГЕС імені П. С. Нєпс	Kakhovka Hydropower Plant	Hydropower	Hydropower generation

02

Key findings

Key findings

Between the 24 February 2022 and the 31 October 2023, **1,353 incidents were recorded in 871 industrial facilities** in areas under the control of the **Government of Ukraine**.

While areas near the front line are most affected by hazardous events, **infrastructure damage and environmental contamination threats are present on the entirety of Ukraine's territory**. Oblasts with the **highest number of hazardous conflict-affected facilities** are Donetska, Khersonska, Zaporizka, Kyivska, Luhanska and Kharkivska.

Most conflict-affected hazardous facilities are located within populated settlements, or near a populated area. This increases the possibility of high impacts on livelihoods, particularly in agricultural areas. This suggests a need for ongoing monitoring of hazardous events to understand and mitigate impacts on communities.

The data presented is this presentation covers the period from February 2022 to October 2023. REACH's Hazardous Events Monitoring Initiative database is updated monthly. Please contact REACH to the access latest data.

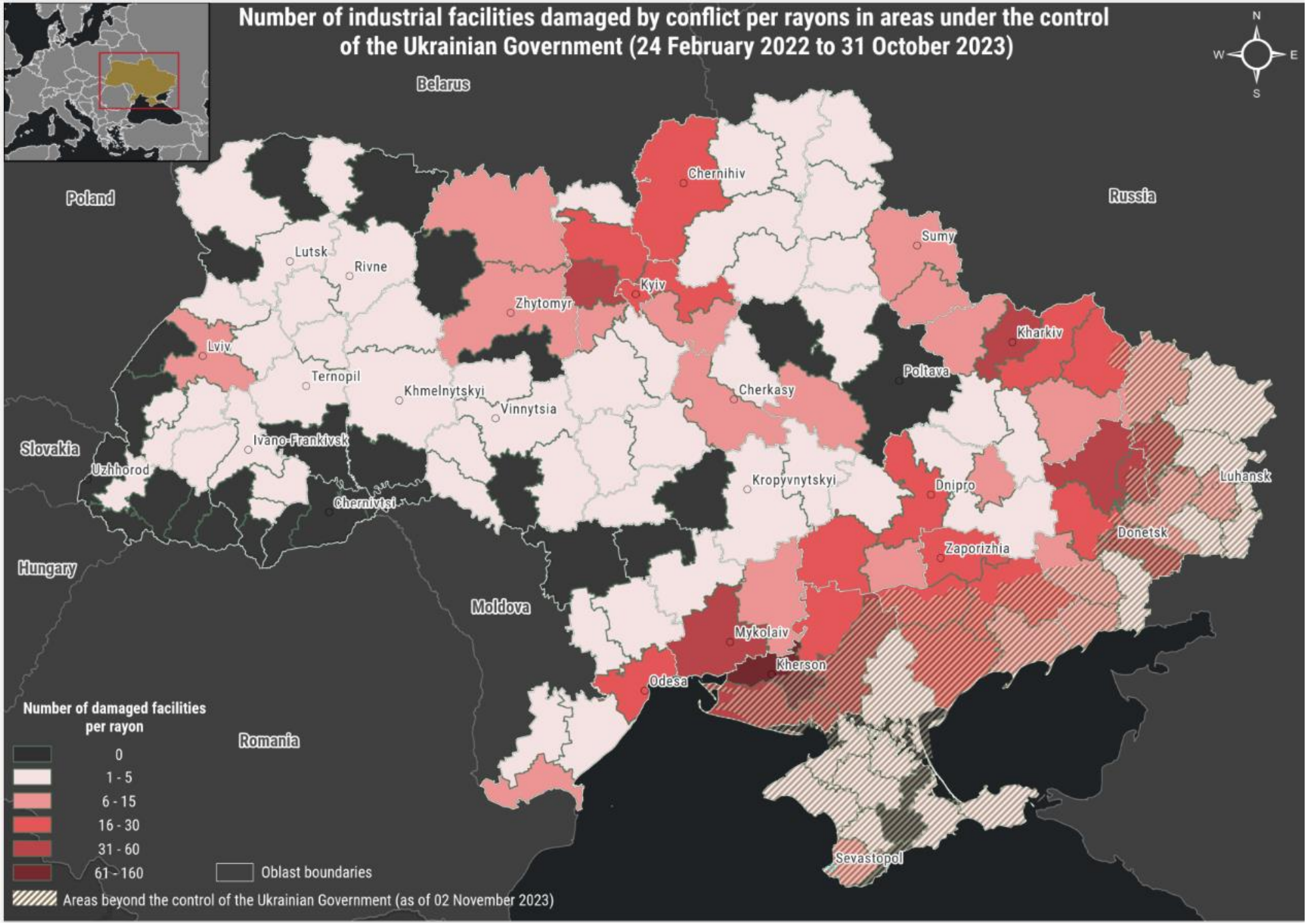
Key findings

Clusters of industrial facilities in urbanised, densely populated areas such as Kyiv, Mykolaiv, Kharkiv, Kramatorsk and Sloviansk **represent hazards with the potential for grave negative environmental and health consequences** in the event of damage/disruption. Humanitarian and recovery actors should consider further analysis of possible localised contamination in areas where such incidents are known to have taken place.

The **most common hazardous substances** found in conflict-affected industrial facilities are **petroleum products, oils and solvents, ammonia and isopropyl alcohol**. These substances can generate both immediate and long-term environmental and health consequences, suggesting the importance of local responders' awareness regarding substance-specific impacts and mitigation measures.

03

Conflict-related incidents at industrial facilities



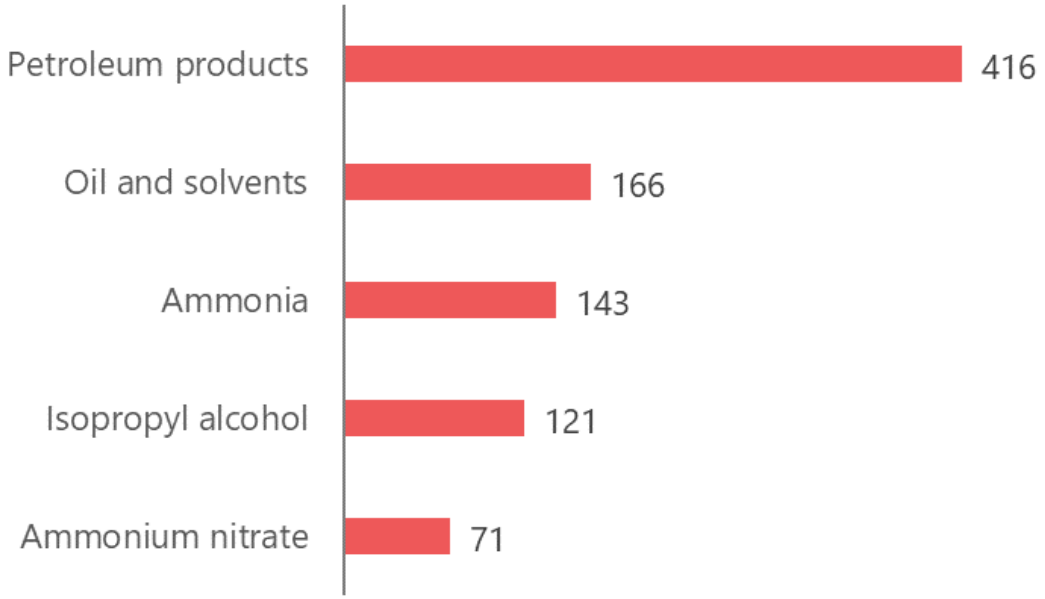
Conflict-affected industrial facilities in Ukraine

Conflict-related incidents at industrial facilities

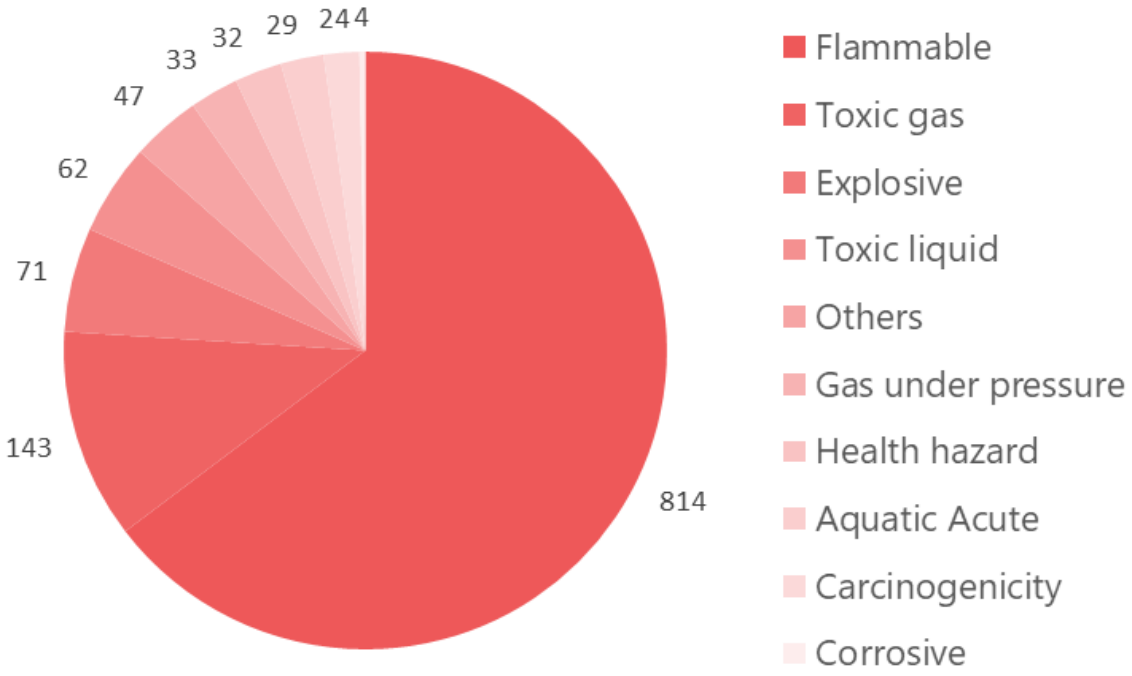
2,373 conflict-related incidents

1,259 **hazardous industrial facilities** were recorded between February 2022 and October 2023 in **all Ukraine**.

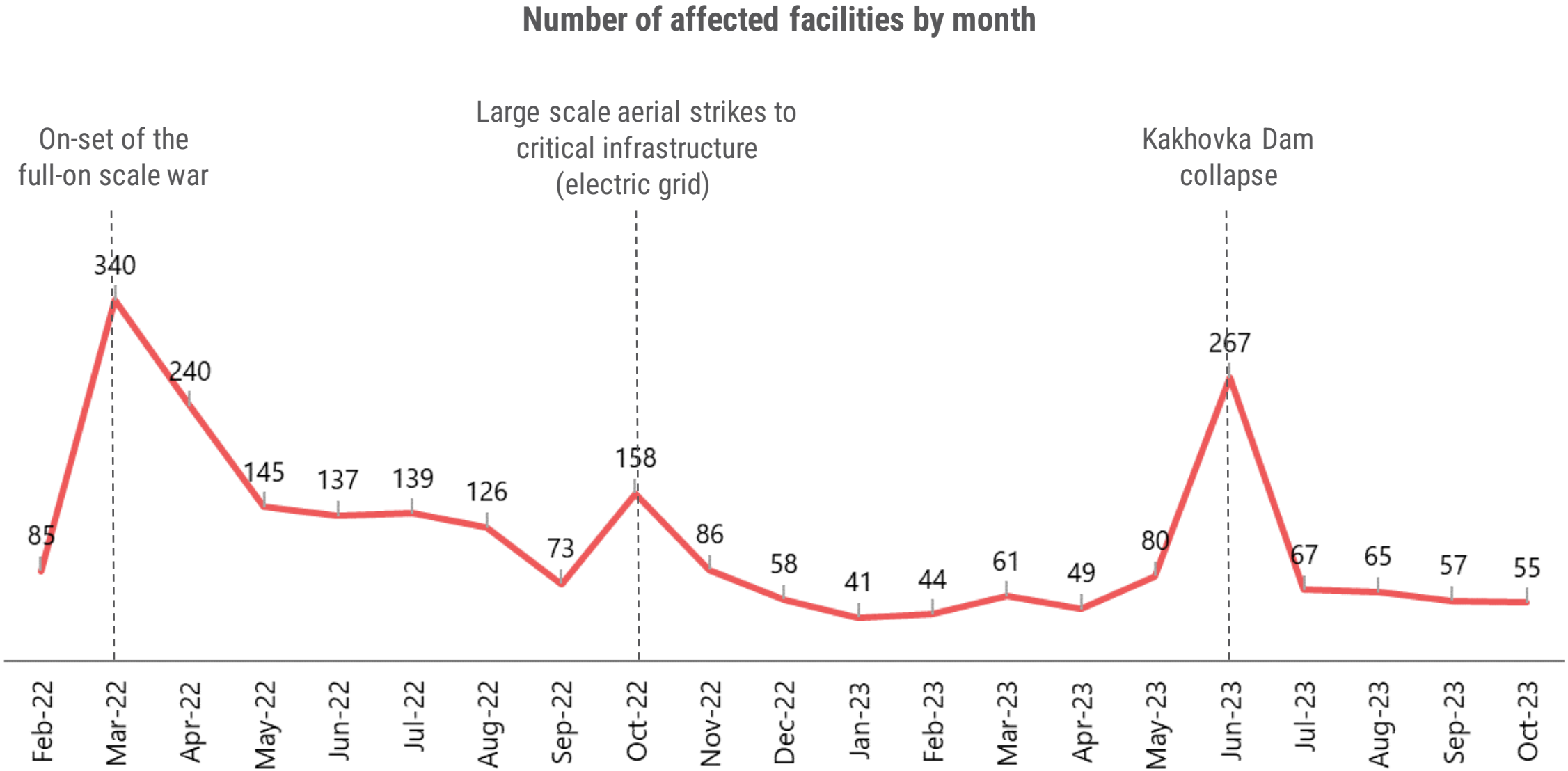
Most common hazardous substances contained in conflict-affected industrial facilities (by no. of facilities, top 5)



Hazard categories of substances contained in conflict-affected facilities (by no. of facilities)



Evolution of conflict-related incidents over time



Impacts of hazardous substances on health and environment (top 3)

Hazardous substance	Health Impacts		Environmental Impacts
	Negative impacts on:		
Petroleum products (Gasoline and Lubricating oils)	• Nervous system • Respiratory system • Cardiovascular system • Gastrointestinal tract • Liver • Kidneys • Blood • Skin • Eyes	• Reproductive functions	**Gasoline** pollutes the atmosphere, water, and soil with hydrocarbons that remain in the air for a long time and can be transported over long distances. **Lubricating oils** cause changes in the physical, chemical, and biological properties of water, soil and natural habitat.
Oil and solvents		• Endocrine system	**Oil** changes the physical, chemical, and biological properties of water, soil and natural habitats. It is toxic to aquatic organisms. **Solvents** are toxic to aquatic organisms, disrupts the ecological balance when entering water and suppresses many species of bacteria.
Ammonia		• Throat and lungs • Spleen	**Ammonia** disrupts the acid-base balance when entering in water bodies or soil. It is extremely toxic to aquatic organisms with long-term effects, alters the organoleptic properties of water, and impairs its self-purification.

04

Conflict-driven environmental impacts in Ukraine

As of January 2024, REACH conducted two in-depth area-based assessments in Mykolaiv and Kherson oblasts. Their findings can illustrate repercussions of hazardous events on the environment, as presented in this section as illustrative examples.

Impact on the atmosphere (air)

Main threats:

- **Air pollution caused by fires** in urban and natural areas, releasing toxic gases, and particulate matter.
- **Shelling** of buildings, military vehicles, infrastructure and industrial facilities. Such incidents result in the release of **airborne pollutants**, such as: **heavy metals, toxic gases and particulate matter**.
- The presence of **illegal landfills, exacerbated by the war**, contributes to air pollution, with waste and building debris burning releasing harmful substances.

On March 2022 forest fires erupted near the Chernobyl Nuclear Reactor. The Ukrainian Government claimed that the Russian invasion and control over the abandoned power plant challenged the efforts to control the flames. The fires were a source of concern due to the associated risk of mobilising radioactive particles deposited since the reactor's meltdown decades ago.*

Photo: https://www.bbc.com/ukrainian/news-51961108

* The Guardian, Forest fires erupt around Chernobyl nuclear plant in Ukraine, March 2022.

Impact on water resources

There are **several ways** in which **active hostilities may have impacted groundwater**, which in Ukraine is a **vital source** of drinking water given the **poor quality** of surface **water**.

Hazardous facilities

- **Many hazardous industrial facilities** are in direct proximity to the river and its anabranch.
- The Dnieper Riverbanks host several grain handling facilities, which **may store hazardous substances** such as **fertilizers** or **pesticides**.
- For example, the Kakhovka Dam breach released around **150 tons of oil** in the Dnieper River*.

Wastewater

- **Strikes** on wastewater treatment plants can cause harm to aquatic ecosystems, **increasing the threat of waterborne diseases**.
- **Challenges in repairing** treatment facilities, pumping stations and the sewer network **due to frequent shelling**.
- **Fresh water is being contaminated with sewage discharge** increasing the threat of diseases such as cholera**.
- Issues related to **wastewater treatment** may continue for **several more decades** in the absence of appropriate funding.

* Newsweek, Ukraine's Kakhovka Dam Explosion Released 150 Tons of Oil Into River, June 2023.
** EuraciTV, Cholera outbreak: A new health concern in war-torn Ukraine, May 2022.

Impact on water resources

Water supply

The availability of drinking water has been impacted by **damage to water infrastructure**, surface water pollution and groundwater pollution. **Main threats:**

- **Pollution of the Dnieper River** can impact the groundwater and, consequently, the water accessed by households.
- Potential **pathway for the contamination** of vital groundwater resources through decaying **UXOs and war remnants.**
- **Risk of contamination** with heavy metals and other hazardous substances.

Fauna

Main threats:

- **Shelling and pollution** of the Dnipro river, which **threatens local red-listed species**, such as the otter.
- The aquaculture production in Ukraine has been heavily affected*.
- **Heightened hazard** that current conditions will **not support fish spawning**.

> *"Unfortunately, there is lack of potable water in Mykolaiv, and it is a huge problem which arose due to the war. We did not have any problems with water before."*
>
> **- KI from the Mykolaiv local authorities**

* Eurofish, The war in Ukraine has severely affected fisheries and aquaculture production, October 2022.

Impact on land and soil

The primary environmental impacts of the conflict on soils and land:

- **Mined zones** encompassing agricultural lands, industrial areas, and natural environments.
- **Pollution** from fragments of reinforced concrete, glass, and plastic materials.
- **Soil contamination** through the leakage of petroleum products and sunflower oil.
- **Combustion-related damage** to fields.
- Presence of **cattle carcasses**.
- The **war had degraded** an estimate of **10.5 million hectares**, or approximately a quarter, of Ukrainian agricultural land*.

These factors collectively contribute to soil degradation, including compaction and erosion of upper layers, diminishing its quality and productivity.

In December 2022, Russian missiles struck an oil storage facility in Kryvyi Rih releasing around one million gallons of oil into the soil. Hence polluting the land and increasing the risk of water contamination.**

* Reuters, Insight: Soils of war: The toxic legacy for Ukraine's breadbasket, March 2023.
** The Washington Post, The war in Ukraine is a human tragedy. It's also an environmental disaster, March 2023.

05

Impact on community and livelihoods

Impact on community and livelihoods

Disruptions to water supply for households and businesses

Mines and UXOs pose acute threats to the life and health of people

Displacement and **relocation**

Disruptions to transportation networks, for example, the destruction of railway networks and bridges halted food and grain transportation across Ukraine

Reduced access to productive natural assets due to mines and UXOs (agricultural lands and forests, drinking water, recreational areas, water bodies and beaches, river coasts, etc.)

Overall **decrease in living standards** and **increased psychological stress** due to military operations and safety concerns

Constant artillery shelling causes **air pollution** and **soil contamination** affecting agricultural lands

06

Mitigation and recovery measures

Recommended response measures

When feasible, **collecting substances** released into the environment.

Collection and removal of debris to prevent the accumulation of broken glass, plastic, and fragments of shells in the environment.

Demining to restore access to natural resources and industrial areas.

Provide clear information regarding contaminated areas and protective measures to affected population.

Restoration of fresh water supply and sewage systems.

Prepare **contingency measures** to rapidly control critical situations such as fires and leaks of hazardous substances.

These measures were identified by key informants interviewed by REACH in Mykolaiv and Kherson oblasts under previous HEMI assessments. Key informants include representatives from local authorities, civil society organisations, environmental experts and residents.

REACH's HEMI reports are not publicly available due to the sensitive information they contain. However, **they can be shared bilaterally upon request** with humanitarian and governmental actors to enable the inclusion of industrial risks in sectoral programming, support operational preparedness and response, and inform recovery activities. Currently available products are:

- National overview
- Kherson area-based assessment (Eng, Ukr)
- Mykolaiv area-based assessment (Eng, Ukr)
- Front line assessment

REACH is also able to **share extracts of its hazardous events database** and **produce customized maps** upon request.

To access these products, share information or collaborate, please contact REACH at impact.ukraine@impact-initiatives.org

Thank you for your attention

Please contact IMPACT for the full reports and data at

impact.ukraine@impact-initiatives.org

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