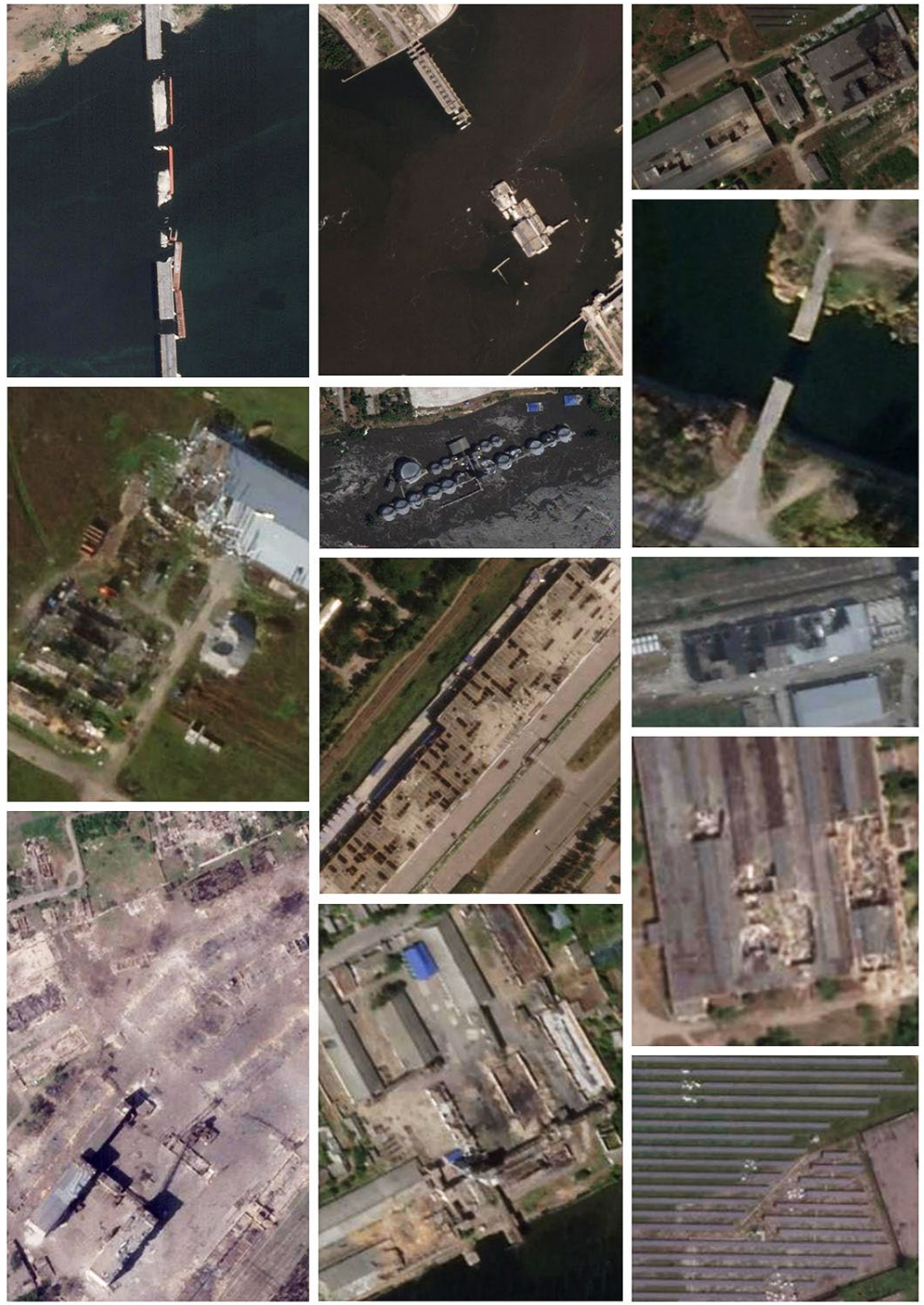
Conflict-driven environmental and health risks in Kherson region

Findings from area-based Assessment

November 2023



REACH Informing more effective humanitarian action

zoï environment network

Contents

01

The Hazardous Events Monitoring Initiative

Rationale

Ukraine is heavily industrialised (metallurgy, mining, machinery, chemical and petro-chemical, energy generation, etc.)

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

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

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

REACH's Hazardous Events Monitoring Initiative

Objective

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

Methodology

- Media monitoring
- Secondary data review
- Primary data collection & analysis
- Remote sensing (satellite imagery)
- Environment modelling
- Flash Environmental Assessment Tool (FEAT)

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.

Operational actors (SESU)

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

Environmental NGOs

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

International humanitarian community

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

Local humanitarian NGOs

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

Donors

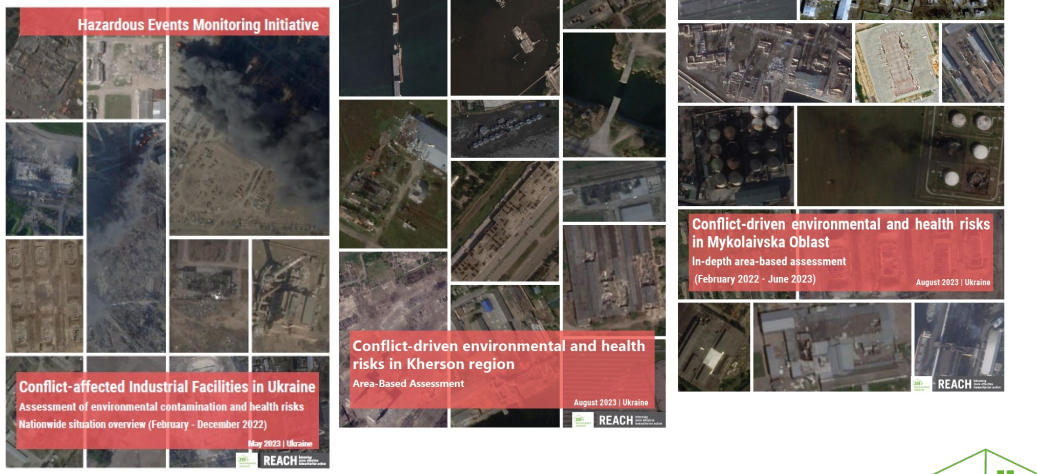
Strategic allocation of funds to key areas such as ecosystem restoration, healthcare, and sustainable economic recovery.

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

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

Please contact us at…

impact.ukraine@impact-initiatives.org



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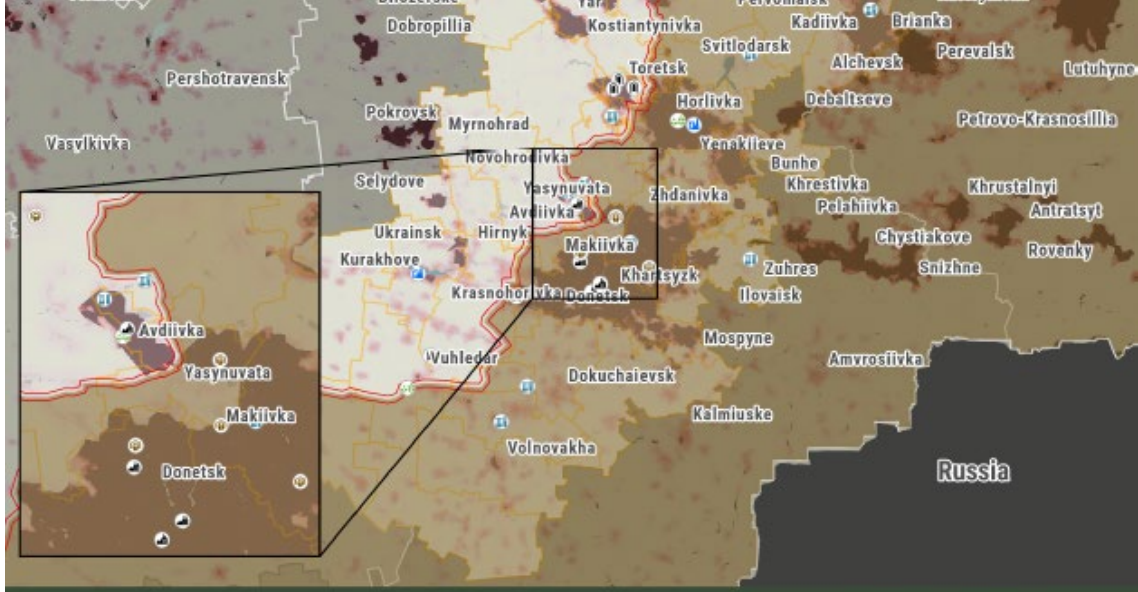


Areas_of_control	Unique_F	Date_of_firs	Date_of_lat	Number_of	Number_(	Name_UKR	Name_EN	Facility_Type (Zoi)	Facility_Type_Matrix (Zo
government-controlled	1	28/05/2022	17/09/2022	4	3	Слов'янська ТЕС	Slovyansk Thermal Power P	Thermal power	Thermal power generati
non-government-controlled	12	19/03/2022	15/08/2022	34	32	Вуглегірська ТЕС	Vuhlehirsk Thermal Power F	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 металургійні	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 F	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 вогнетривк	Krasnohorivka Refractory Pl	Construction	Construction materials a
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	Донецькокс	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 p
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 машинос	Novokramatorsky Machine B	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. Непс	Kakhovka Hydropower Plant	Hydropower	Hydropower generation

02

Kherson Region: Background

Background

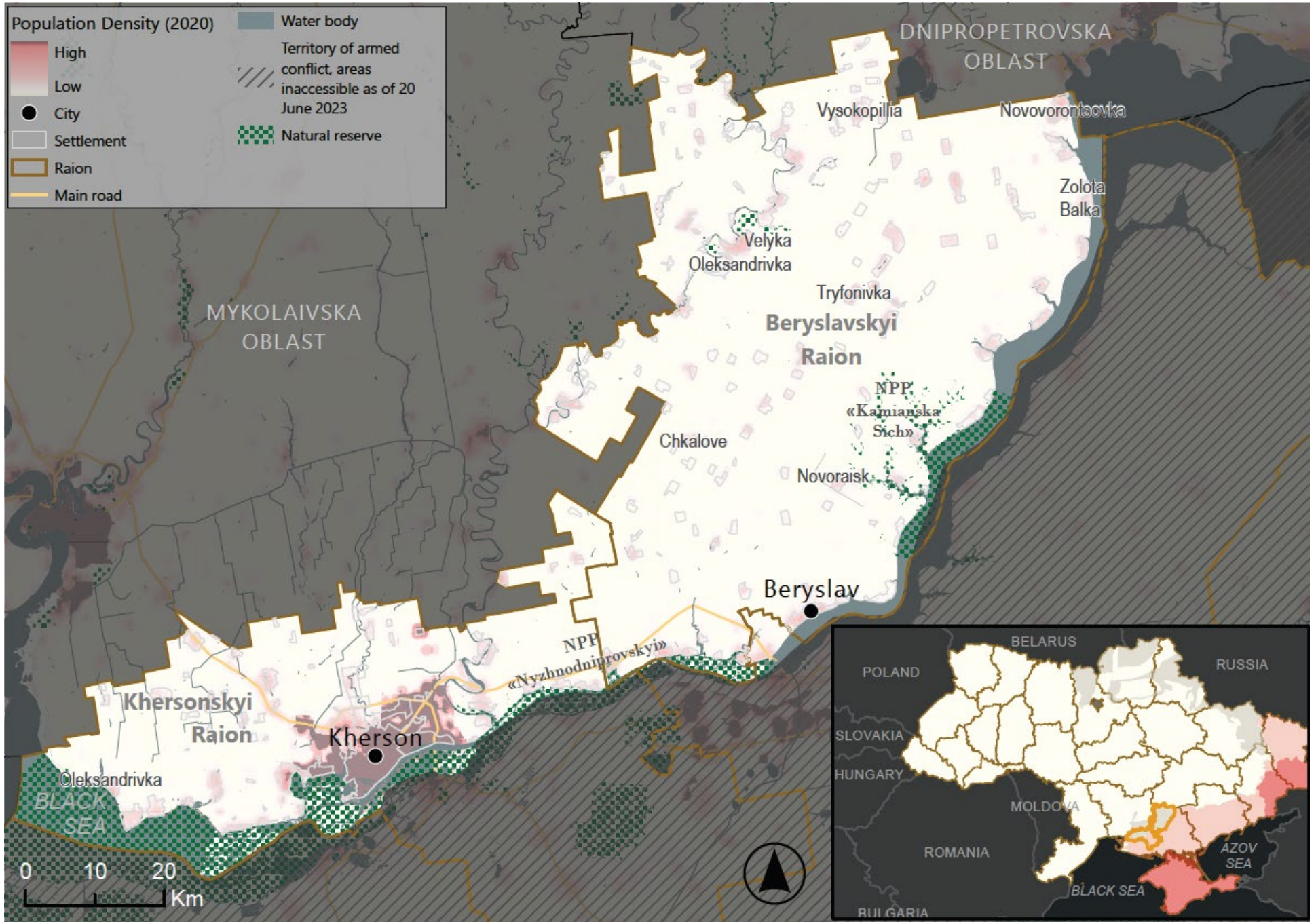
Kherson City's **population dropped to half its pre-war figure** of 300,000 during Russian occupation (March-November 2022).

Agricultural land makes up 70% of Kherson Oblast, spanning **2 million hectares**. The importance of the agricultural sector renders the region's prosperity vulnerable to environmental contamination.

Kherson's **location at the mouth of the Dnipro River** grants it **strategic and logistical significance**, Black Sea access, and supplies for Crimea's irrigation.

Kherson, a logistics hub by the Dnipro River with heavy industries like metallurgy and shipbuilding, faces **heightened risks of environmental contamination and threats to human safety** from potential releases of hazardous materials, exacerbated by conflict-related incidents at nearby facilities.

Aim: Inform localized preparedness, impact mitigation and recovery measures through an in-depth assessment of environmental, health and socio-economic impacts emanating from conflict-related hazardous incidents in Kherson region since the start of the invasion of Ukraine by the Russian Federation in February 2022.



Areas of Kherson Oblast controlled by the Government of Ukraine

Methodology

01

Media monitoring

Baseline data derived from Zoï Environment Network's Ecodozor.org, which consolidates multiple sources to monitor Ukraine's war-induced environmental impact, cataloging disruptions to infrastructure and utilities from public and authority reports, with expert analysis and satellite verification, categorizing and geo-locating incidents in a continuously updated database since 24 February 2022.

02

Remote sensing

When relevant, identified conflict-affected facilities were visually inspected using Planet Labs' high-resolution satellite imagery to confirm damage, assess its severity, and identify traces of environmental contamination. While facility damage can be used as a proxy to assess contamination, it is not always possible to confidently infer a causal relationship between damage and contamination.

03

Primary data

16 key informant (KI) interviews with representatives of local authorities (4), local environmental experts (3), conflict-impacted entreprises (3) and residents (5). Insights from key informants were triangulated with secondary data, remote sensing and FEAT analysis to develop a holistic understanding of local impacts.

04

Flash Environmental Assessment Tool

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

Key findings

In the areas of Kherson Oblast under the control of the Government of Ukraine (as of July 2023), **70 conflict-related events impacted 36 hazardous industrial facilities** between 24 February 2022 and 30 June 2023, resulting in severe impacts on the environment, human health and livelihoods.

The vast majority **(69%) of impacted hazardous facilities are located within the densely populated areas of Kherson City and in direct proximity to water bodies**, suggesting elevated risks of contamination and consequences on people's health (immediate and long-term).

Kherson region's productive natural assets have been severely contaminated with hazardous substances, mines, unexploded ordnances (UXOs), and degraded by military activities. Most impacted are Kherson's fertile agricultural lands and the Dnipro River, which is likely to have a long-term impact on livelihoods that they sustain, particularly farming, fisheries and the tourism industry.

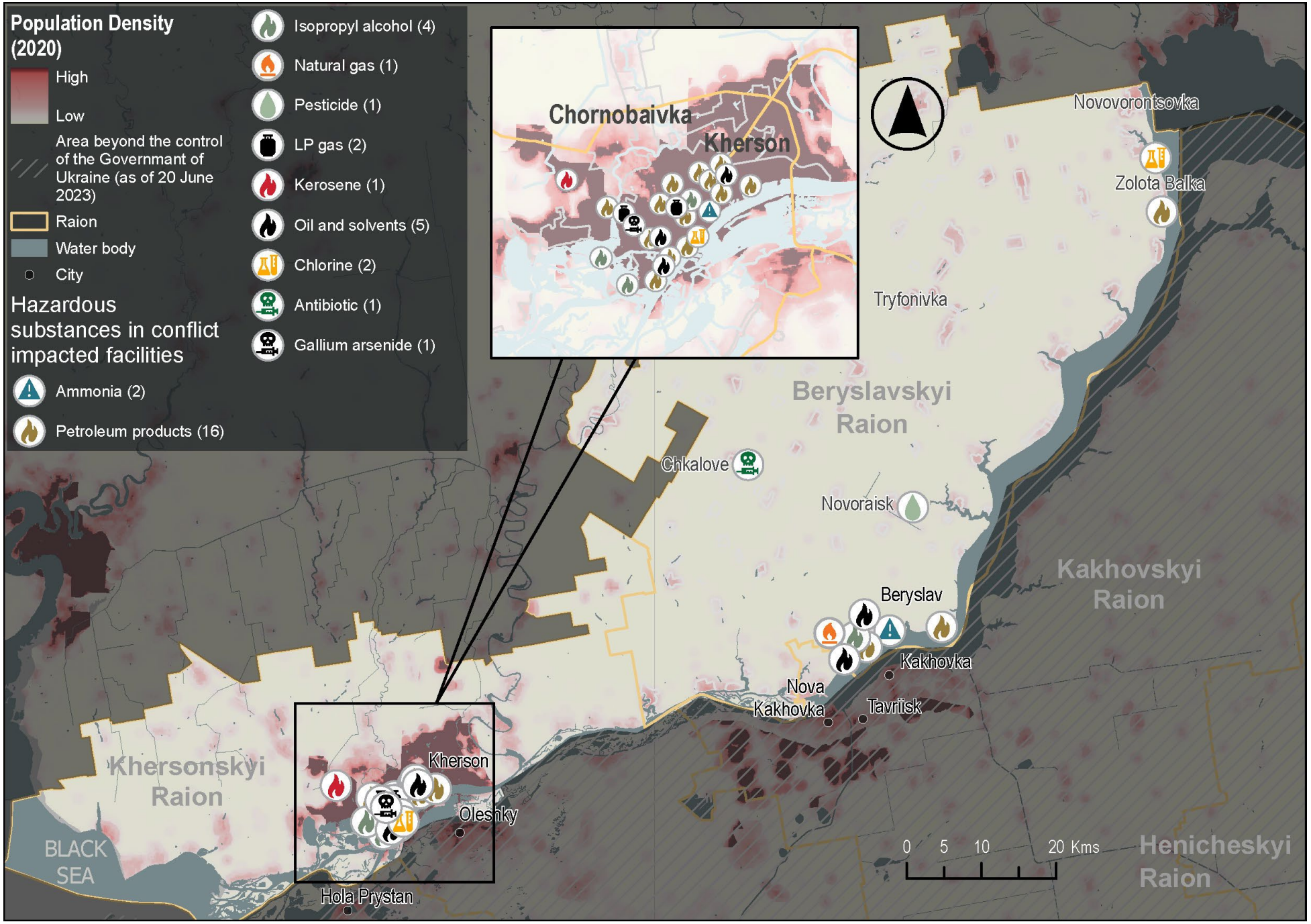
Key findings

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

Given the extent of environmental contamination, threats to human health, and disruptions to livelihoods, **the implementation of localised impact mitigation and recovery measures is critical.** However, ongoing military activities and the presence of mines and UXOs limit access to impacted assets and areas, thereby hindering stakeholders' ability to implement the required measures.

03

Hazardous facilities and critical infrastructure



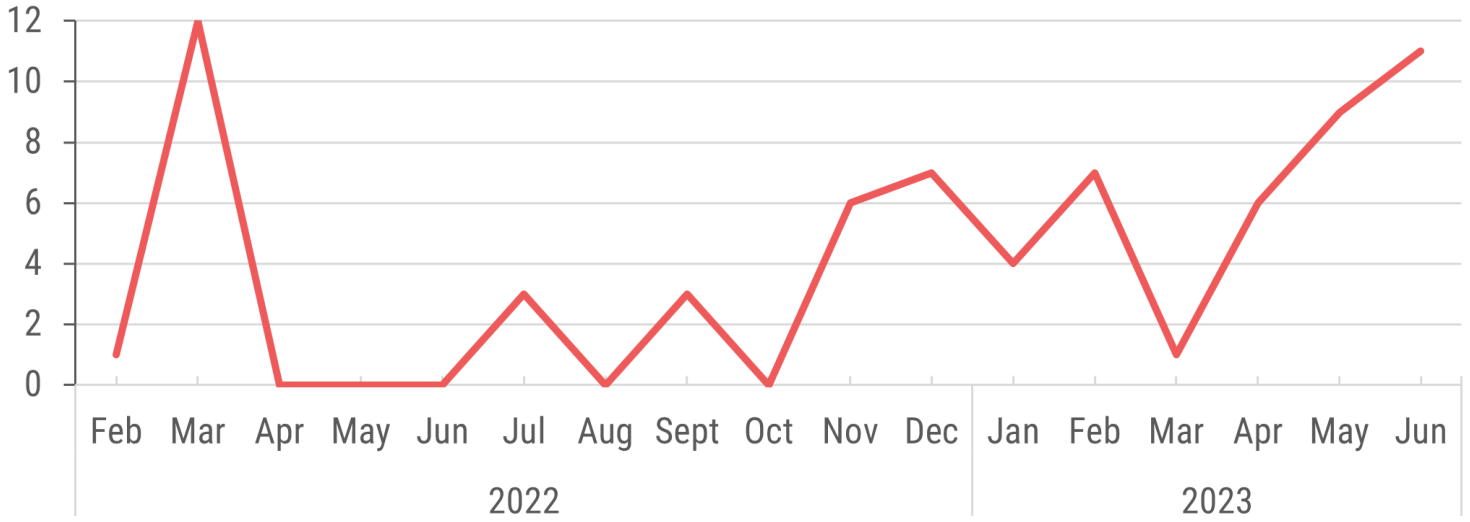
Conflict-affected hazardous facilities in the areas of Kherson Oblast under the control of the Government of Ukraine

Hazardous facilities and critical infrastructure

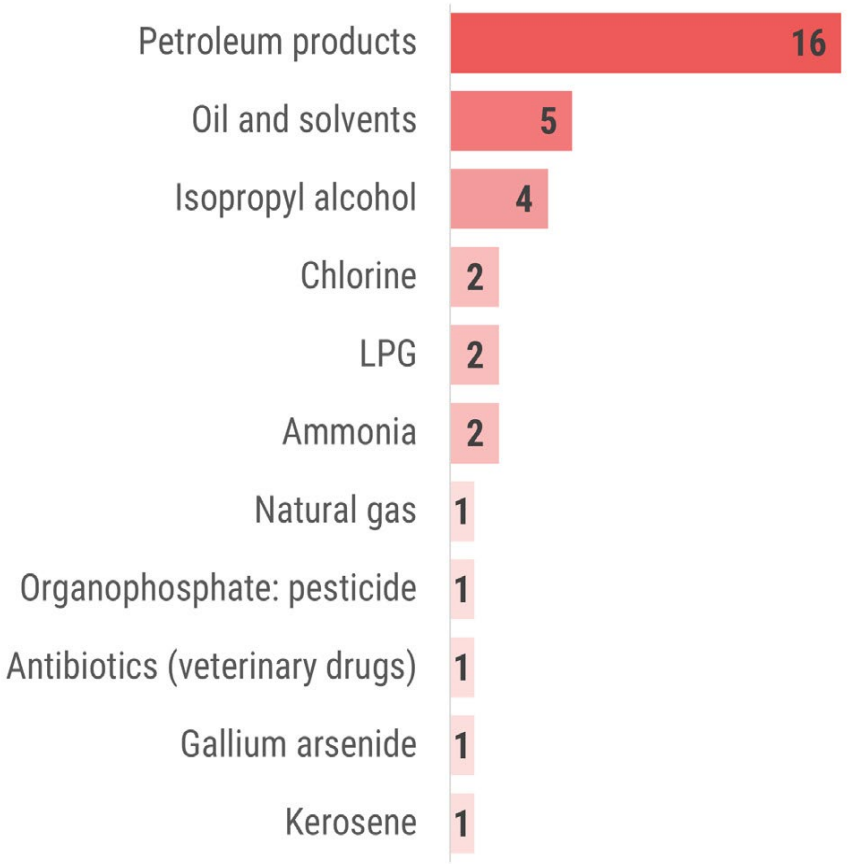
70 **conflict-related incidents at** **36** **hazardous industrial facilities were recorded** in Kherson between 24 February 2022 and 30 June 2023.

The majority of incidents have involved infrastructure destruction, often carrying repercussions for people's health, livelihoods, and natural assets.

Petroleum products represent the most common substances present in 16 facilities, followed by **oil** and **solvents** (5 facilities) and **isopropyl alcohol** (4 facilities).



Reported number of conflict-affected industrial facilities in the Kherson region, by month



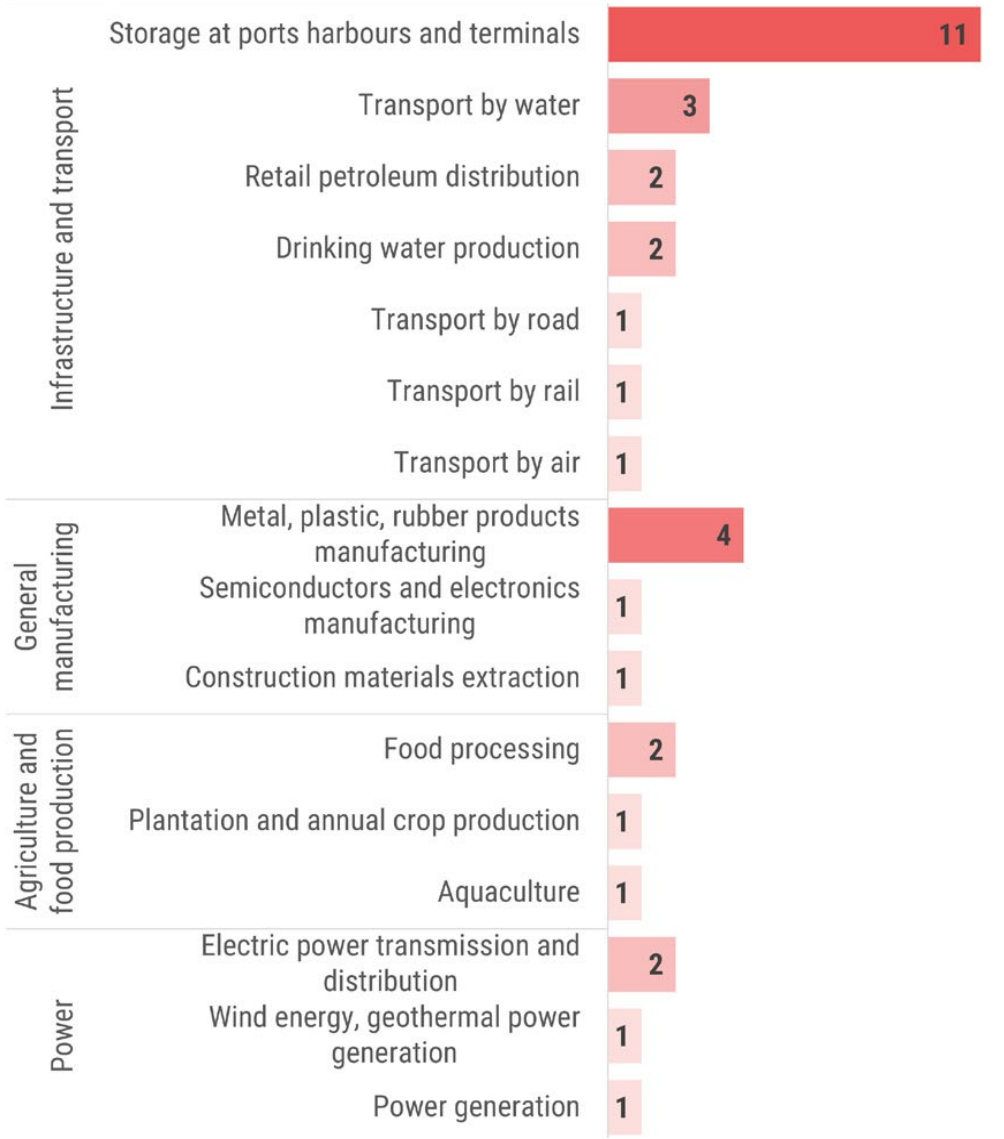
Reported number of conflict-affected industrial facilities in Kherson region, by **most common hazardous substances contained**

Hazardous facilities and critical infrastructure

- In the areas of Kherson Oblast controlled by the Government of Ukraine, 11 conflict-affected facilities are classified as **storage at ports**, **harbors** and **terminals**.
- Among these, **Kherson Airport** was impacted 8 times, making the **most severely impacted** facility.

Conflict-related incident at Kherson Airport on 15 March 2022

Reported number of conflict-affected industrial facilities in the Kherson region, **by operational types**



Impacts of hazardous substances on health and environment

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 into water and suppresses many species of bacteria.
Isopropyl Alcohol		• Spleen • Heart • Narcotic effect • Causes excitement followed by depression and a decrease in reaction to external stimuli	**Isopropyl alcohol** can have a toxic effect on warm-blooded organisms when it enters water bodies. It causes the death of fish and their food resources, deterioration of water taste, and fish meat odour.

04

Localised environmental, health and socio-economic impacts

Localized environmental, health and socio-economic impacts
WATER

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

Hazardous facilities

- **Many hazardous industrial facilities** are located in direct proximity to the river and its anabranch;
- As a result of the shelling, a large amount of **fuel** and **lubricants** leaked into the river.
- The Dnipro River banks host a number of grain handling facilities, which **may store hazardous substances** such as **fertilizers** or **pesticides.**

> *"There is an oil depot in Korabel district that was shelled several times and a large quantity of petroleum products leaked into the water body."*
>
> ***- KI***

Wastewater

- **Strikes** on wastewater treatment plans can cause harm to aquatic ecosystems and **increasing the risk of waterborne diseases**.
- **Challenges in repairing** treatment facilities, pumping stations and the sewer network **due to frequent shelling.**
- **Sewage discharge** has been described as the **main threat** to the Dnipro.
- Issues related to **wastewater treatment** may continue for **several more decades** in the absence of appropriate funding.

Localized environmental, health and socio-economic impacts
WATER

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 Dnipro 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

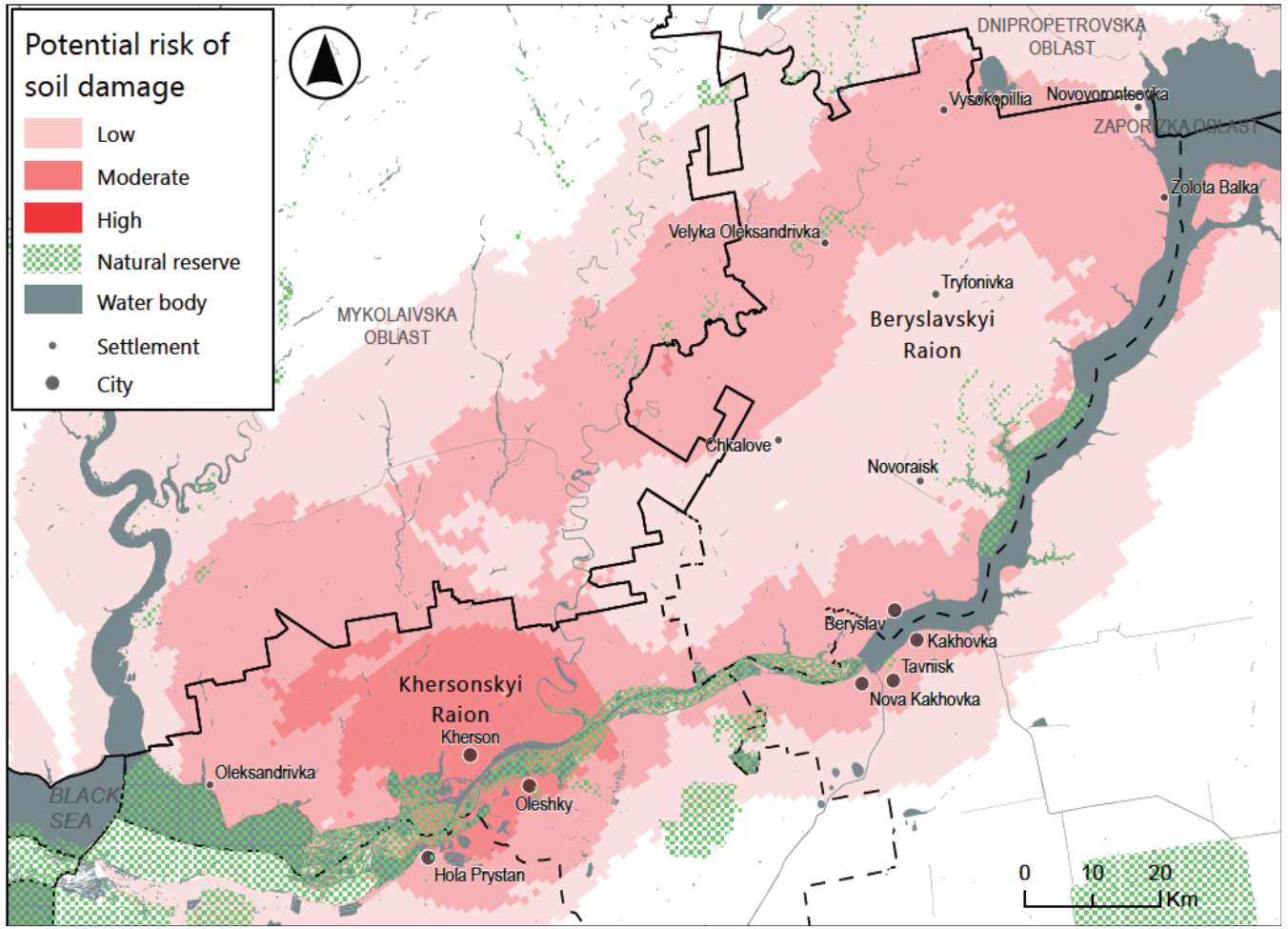
Main threats:

- **Shelling and pollution** of the Dnipro river, which **threatens local red-listed species**, such as the otter
- A **drastic reduction of the bighead carp** stock was recorded as a result of intensive shelling
- **Heightened risks** that current conditions will **not support fish spawning**

> *"When the water level rises or falls and groundwater mixes with water in rivers, both the water in wells and in the upper levels become polluted."*
>
> ***– Local government official***

> *"Explosions that occur in the shallow parts of rivers cause the death of all living organisms."*
>
> ***– KI***

Localized environmental, health and socio-economic impacts
LAND



Potential risk of soil damage in Kherson region

The severity of soil damage is determined using two indicators: **intensity of hostilities** and **proximity to the front line.**

Main threats:

- **Chernozem** is usually not found deeper than 1,5 meters, making it highly **sensitive to erosion and pollution**
- The **war had degraded** at least **10.5 million hectares**, or approximately a quarter, of Ukrainian agricultural land
- Large quantities of **mines and UXOs**
- Plots of land with vegetation, such as high grass, **requires clearing the vegetation** before proceeding with **demining operations**.

> *"Soldiers started mining the fields during occupation. We cannot do our work due to that. In addition, hostile shelling strikes at our facility happen almost every week and they do not always explode..."*
>
> ***– Representative of an agricultural enterprise***

Localized environmental, health and socio-economic impacts
AIR

Main threats:

- **Air pollution caused by fires** in urban and natural areas, shelling of buildings, vehicles, and industrial facilities, releasing heavy metals, 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.


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

> *"There was a large fire in one shop after 4 air bombs hit there. There was mastic on the roof with several layers of ruberoid roofing felt that melted and was burning for a long time. The firefighters extinguished the fire, but it rekindled. The SESU had been extinguishing the fire at the premises for 3 days. The roof had collapsed inside the building. Hazardous substances leaked into the air."*
>
> ***– KI***

> *"In Tavriiskyi district, where a municipal solid waste landfill is located, there were frequent fires during the occupation, which not only impacted soil and groundwater, but also the local residents that breathed the polluted air."*
>
> ***– KIs***

Localized environmental, health and socio-economic impacts
LIVELIHOODS

Agriculture

- Key **obstacles** to agricultural livelihoods in Kherson are **mines** and **UXOs** that lie scattered in agricultural fields.
- **56 casualties** from mine-related incident were recorded in Kherson oblast during the period March-May 2023.
- **Over 90%** of surveyed agricultural enterprises in government-controlled area of Kherson Oblast reported an increase in production costs, largely driven by land contamination.
- The State Emergency Services of Ukraine have estimated **the area contaminated by mines and shells in Kherson Oblast at 300,000 hectares.**
- **Contaminated farmland** may deter some buyers and decrease land prices, with a negative flow-on effect on regional economy.

Fisheries

- There are **24 fisheries** located in Kherson Oblast and **all of them have seen their business impacted.**
- After the **collapse** of the Kakhovka dam, **fishing was prohibited** in Kherson region, effectively putting many fisheries **out of business**.

Tourism

- **It is expected that the tourism sector** will not fully recover **for many years** after the war's end.
- **Pollution and security** risks posed by war remnants **may discourage visitors** from visiting Kherson in the future.

> *"In the coastal areas of Kherson, many people depend on tourism for their livelihoods. They earn their living owing to tourists who go to the sea."* ***– KI***

Localized environmental, health and socio-economic impacts
HUMAN HEALTH

- **Low availability of healthcare** due to insecurity and damage infrastructure, hindering residents' ability to seek healthcare to address the war's consequences on human health.
- The health consequences resulting from **environmental pollution** are not always immediately visible and **may take years to surface.**
- **Water from wells may also be hazardous to the health** of those who consume the water unprocessed, which is particularly common among the elderly.
- Much of the contaminated lands are used for subsistence farming, which means that **toxic chemicals** can be consumed by people potentially unaware of the resulting consequences.
- **Air pollution** is a cause of **premature mortality** and particularly affects vulnerable groups, including older people, young people and people with pre-existing **health problems**.

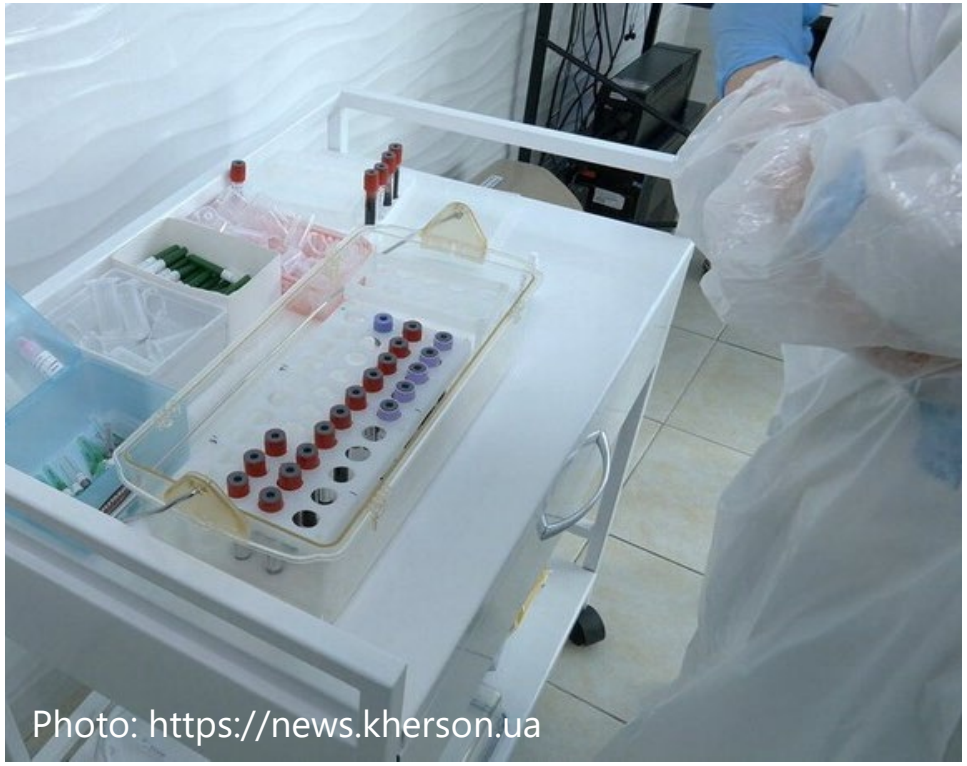


Photo: https://news.kherson.ua

> *"Now, people take water from wells and boreholes, but this water is often polluted due to military operations in this area. Unfortunately, elderly people do not use filters and drink polluted water."* ***– KI***

> *"All residents of Kherson region felt the impact of pollution. Everyone drank polluted water and breathed polluted air."* ***– KI***

05

Mitigation and recovery measures

Mitigation and recovery measures

Priority measures for mitigation and recovery identified by KIs

- Demining
- Restoring and enhancing wastewater infrastructure
- Comprehensive monitoring of the Dnipro river basin
- Leveraging bioengineering methods to enhance self-purification assimilation of the river ecosystem
- Removal of debris from streets
- The establishment of local committees to assess damage
- Removal of deceased humans and animals
- The development of a comprehensive environmental strategy for restoring the Dnipro river
- In-depth environmental assessments
- Measures to support abandoned animals
- Ensuring full functionality of all wastewater treatment facilities
- Increased availability of water filters and disinfectant tablets for water purification

Obstacles hindering mitigation and recovery measures:

mines

shelling

UXOs

lack of human and financial resources

> *"Now, people take water from wells and boreholes, but this water is often polluted due to military operations in this area. Unfortunately, elderly people do not use filters and drink polluted water."* ***– KI***

> *"As of now, the only possible measure is gradual de-mining of the territory."* ***– KI***

The full report is not publicly available due to the sensitive information it contains. **REACH can share the report bi-laterally upon request** with humanitarian actors to enable the inclusion of industrial risks in sectoral programming, support operational preparedness and response, and inform recovery activities.

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

To know more, please contact REACH at…

impact.ukraine@impact-initiatives.org

zoï environment network

Thank you for your attention

Please contact IMPACT
for the full report and data at
impact.ukraine@impact-initiatives.org

REACH Informing more effective humanitarian action