DONBAS TAILINGS STORAGE FACILITIES

OSCE Organization for Security and Co-operation in Europe

Ministry of Energy and Environmental Protection of Ukraine

AUTHORS:

Iryna Nikolaieva – PhD, Head of a Research Group for Current State of Tailings Storage Facilities (TSFs), Environmental Safety Expert, Leading Environmental Auditor

Hanna Lenko – Environmental Engineering Expert, Environmental Auditor

Oleksandr Lobodzinskyi – Junior Researcher, Hydrologist, Ukrainian Hydrometeorological Institute of the State Emergency Service of Ukraine and the National Academy of Sciences of Ukraine

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Project management: ***Alla Yushchuk, Iryna Loik, Yaroslav Yurtsaba***

Artwork and design: ***Yuliia Madinova***

EXECUTIVE SUMMARY

RESEARCH OF THE DONBAS TAILINGS STORAGE FACILITIES CURRENT STATE AND THEIR POSSIBLE EMERGENCY IMPACT ON WATER BODIES UNDER THE MILITARY ACTIONS

PJSC AVDIIVKA COKE PLANT

SCIENTIFIC AND MANUFACTURING ASSOCIATION "INKOR AND CO" LLC

PUBLIC COMPANY "DZERZHYNSKA PROCESSING PLANT"

KYIV – 2019

The research materials and recommendations are intended to be presented to:

- **TSF operators:** PJSC "Avdiivka Coke Plant", Scientific and Manufacturing Association "Inkor and Co" LLC, Public Company "Dzerzhynska Processing Plant" (hereinafter in this Summary "PJSC Avdiivka Coke Plant", "SMA Inkor & Co", and "Dzerzhynska Processing Plant")
- **competent authorities of Ukraine:** Ministry of Energy and Environmental Protection of Ukraine, Ministry of Defense of Ukraine, State Emergency Service of Ukraine, State Agency of Water Resources of Ukraine, Siverskyi Donetsk Basin Water Administration, State Environmental Inspectorate of Ukraine, State Labor Service of Ukraine, Verkhovna Rada Committee on Environmental Policy and Nature Management, Regional State Administrations (Department of Ecology and Department of Civil Protection), local governments (district, city, village councils); and
- **international organizations dealing with safety issues in the armed conflict area**

The measures developed to maintain TSF safety are divided into three categories:

- measures recommended for implementation by TSF operators (Sections 1.5, 2.5, and 3.5)
- recommendations related to the impact of military actions and which require participation and cooperation of various agencies and relevant organizations (Section 5)
- legislative and regulatory, and organizational recommendations for the competent authorities (Section 6)

The developed recommendation package is designed to systematically improve the level of environmental and technogenic safety, prevent the risks of emergencies and reduce the threat of water pollution in the Siverskyi Donets sub-basin. TSFs put a significant anthropogenic pressure on the surface and groundwater and should be a separate subject to consider in the development of River Basin Management Plans (RBMPs). The proposed recommendations can be used in the drafting of the Don River RBMP and other programs related to the region's environmental and technogenic safety.

The purpose of this Summary is, first and foremost, to inform the state authorities and international organizations about certain challenges identified that the TSF operator has to face in the armed conflict area, as well as to call for considering opportunities and resources in the "state-business" interaction to prevent environmental disasters on the national and transboundary scale which can be caused by high-level threats from TSF operation, especially in the context of military actions.

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LIST OF ABREVIATIONS

AEP	Accident Elimination Plan
ALEP	Accident Localization and Elimination Plan
BWA	Basin Water Administration
CPP	Central Processing Plant
DPSIR	an analytical scheme to describe the interaction of society and the environment (According to the English designation of the scheme: Driver – Pressure – State – Impact – Response)
HF	hydraulic facilities
JCCC	Joint Center for Control and Coordination of Ceasefire and Stabilization of the Demarcation Line
LPRLA	labor protection regulatory legal act
MAC	maximum allowable concentration
MCA	Military Civil Administration
MD SES	Main Department of the State Emergency Service
MSW	municipal solid waste
OSCE	Organization for Security and Co-operation in Europe
OSCE SMM	OSCE Special Monitoring Mission to Ukraine
PC	Public Company
PJSC	private joint stock company
RBMP	River Basin Management Plan
RSA	Regional State Administration
SESU	State Emergency Service of Ukraine
SF	Storage Facility
SMA	scientific and manufacturing association
SWB	surface water body
TSF	Tailings Storage Facility
UkrCPRI	Ukrainian Civil Protection Research Institute
WDS	waste disposal site

INTRODUCTION

One of the high-hazard objects for water resources of Ukraine are tailings storage facilities (TSFs) – facilities storing the liquid multi-tonnage waste of various industries. These are earthen reservoirs, natural or artificially made in the natural environment, for industrial waste which is moved from its production places mainly by hydraulic means through pipelines and stored in a liquid, sludge- and paste-like state.

When any TSF system fails, the liquid component of the waste penetrates the protective functions of the enclosing constructions, comes out and causes destruction.

The most large-scale accidents occurred at the TSFs of a mining company in Brumadino, Brazil (2019), Ridder Mining and Processing Plant "Kazzinc" LLC, Kazakhstan (2016), Talvivaara in Finland (2012), an aluminum production sludge storage facility in Colontar, Hungary (2010), and a tailings storage facility in Baia Mare, Romania (2000)[1].

In Ukraine, accidents occurred at the TSFs of the mining and chemical company "Polimineral" (1983), the potassium plant in Kalush (2008) causing industrial waste to escape into the Dniester river, and at the alumina plant TSF near Mykolayiv (2001), with the spread of fine waste particles (red dust) across dozens of square kilometers[2].

The international community has been making significant efforts to improve the TSF safety. The legal framework for measures to reduce the risk of transboundary water pollution as a result of industrial accidents is laid down in two UNECE treaties, namely: the Industrial Accidents Convention[3] and the Water Convention[4]. The conventions promote cross-border cooperation in the field of sustainable use of water resources, prevention of industrial accidents, as well as preparedness and response to such accidents.

Thus, in 2008, within the framework of these Conventions, the Joint Expert Group on Water and Industrial Accidents, with support of the UNECE Secretariat, developed a document "Safety Guidelines and Good Practices for Tailings Management Facilities"[5] (hereinafter "the UNECE Guidelines").

From 2013 to 2017 two international projects were implemented in Ukraine to develop and test the "Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety" (hereinafter "the Methodology") based on the UNECE Guidelines, with financial support from the German Environment Agency and leading experts in the area[6].

Following a large-scale TSF accident in Brazil in 2019, the UN Development Program, International Council on Mining and Metals, and Principles for Responsible Investment[7] initiated development of a Global Tailings Standard aimed at preventing catastrophic accidents at such facilities[8].

1 Based on the website materials of the «The Global Tailings Review» initiative and the document «Safety guidelines and good practices for Tailings Management Facilities»

2 Accidents are stated in the «Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety»

3 Full title "Convention on the Transboundary Effects of Industrial Accidents"; the information is posted on UNECE website

4 Full title "Convention on the Protection and Use of Transboundary Watercourses and International Lakes", UNECE website

5 Safety guidelines and good practices for Tailings Management Facilities

6 2013-2015 project Improving the safety of tailings management facilities based on the example of Ukrainian facilities. 2016-2017 project (Raising Knowledge among Students and Teachers on Tailings Safety and its Legislative Review in Ukraine)

7 United Nations Environment Programme, International Council on Mining and Metals, Principles for Responsible Investment

8 More information about Global Tailings Standard at Global Tailings Review

TSFs are complex facilities with long-term functionality, exposed not only to the environment, but also to many socio-political and economic factors (e.g.: military actions, forced change of business partnership, policy of adjacent enterprises and local authorities, quality of legislative regulation and methodology, distribution of responsibilities in emergencies, human factor, etc.).

Thus, TSF management is a dynamic, complex, and interconnected system that requires a comprehensive "state-business" approach for environmental protection from the devastating consequences of accidents throughout the TSFs entire life cycle.

As of 2019, there are 465 TSFs in Ukraine storing over 6 bln tons of waste from various industries[9], the vast majority of facilities being concentrated in eastern Ukraine *(Fig. 1)*.

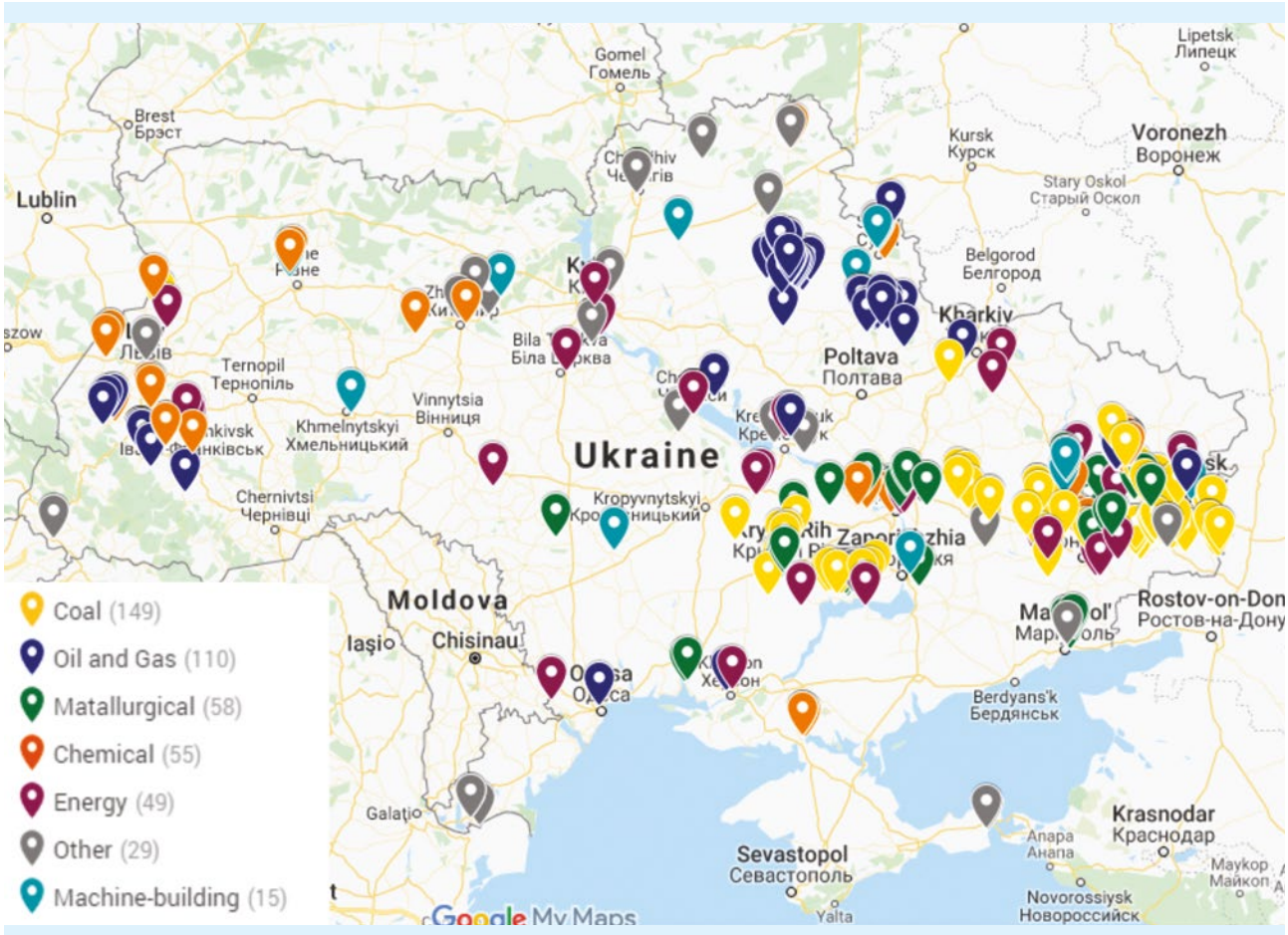

Figure 1. Map of the tailings storage facilities in Ukraine

9 Identification of 465 TSFs in Ukraine was carried out in the framework of the GEF/ UNDP/ OSCE/ UNECE project "Enabling Transboundary Cooperation and Integrated Water Resources Management in the Dniester River Basin" with support of the Ministry of Energy and Environmental Protection of Ukraine. Data sources: information received from State Regional Administrations (2018-2019). The holder of the database and TSF map of Ukraine is the Ministry of Energy and Environmental Protection of Ukraine (GEF project beneficiary)

ABOUT THE PROJECT

The armed conflict in the Donbas in the eastern region of Ukraine has disrupted the work of a large number of industrial enterprises which are sources of potential hazard to the environment.

Following the identification completed in the Donetsk and the Luhansk Regions, there are **200 TSFs storing 939 mln tons of industrial waste; of these, 75 facilities are located in the territory controlled by the Government of Ukraine** *(Fig. 2)*.

In 2019, within the OSCE Project Co-ordinator in Ukraine project "Assistance in the Donbas Environmental Monitoring System Expansion" the priority enterprises with TSFs were identified for further research: all Donbas TSFs were ranked using the potential hazard index method[10], which takes into account the hazard class and the amount of waste stored in the facility. Then, selection of the facilities was guided by the criteria "proximity to the contact line" and "proximity to the water bodies". The list thus obtained was agreed with representatives of the central and local authorities[11]. Also, the choice of enterprises with TSFs took into account the results of the OSCE Project Co-ordinator in Ukraine project activities in 2018[12].

In 2019, from the agreed list of priority TSF operators, the current state of 7 TSFs at 3 enterprises of the Donetsk Region was researched regarding their possible accident impact on water bodies under the military actions. The enterprises are located within the Siverskyi Donets river sub-basin in the most vulnerable area of the armed conflict *(see Fig. 2)*: **❶ PJSC Avdiivka Coke Plant**, **❷ SMA Inkor & Co**, **❸ Dzerzhynska Processing Plant**.

The research used European methodological tools for TSF safety, adapted to Ukrainian legislation[13], guidelines for analysis of anthropogenic pressure on water bodies[14], as well as expert assessment methods to identify threats in accident scenarios.

Figure 2. Donbas TSFs map indicating the facilities researched (No. 1-3)

Experts' conclusions are based on the results of visual inspections, staff interviews, analysis of enterprise documentation and other sources of information.

The research materials include a study of the current state and anthropogenic pressure of the facilities on water resources, threats identification and consideration of probable accident scenarios, review of the enterprises' emergency preparedness and implementation of the state policy on emergency prevention and response at TSFs during military actions, as well as recommendations with measures to improve TSF safety.

This Summary presents the main results of the research, which are set out in detail in the Reports for each TSF operator.

The list of references to data sources used for the conclusions and recommendations (company documentation, state registers, information system data, regulations, etc.) is provided in the Reports on each enterprise and is available upon request.

10 In line with the "Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety"

11 Minutes of the Kick-off Meeting on Safety of Donbas TSFs, 1 August 2019, Kyiv

12 State of the Siverskyi Donets Basin and Related Risks under Military Operations. Technical Report (OSCE, 2018)

13 "Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety", the text in English is available on the German Environment Agency (UBA) web-page at the link

14 The Guidelines were approved by Protocol No. 2 at the Scientific and Technical Council meeting of the State Water Resources Agency of Ukraine on 27 November 2018

1.

TAILINGS STORAGE FACILITIES RESEARCH

PJSC AVDIIVKA COKE PLANT

1.1.

TSF OPERATOR LOCATION

PJSC Avdiivka Coke Plant is part of the "Metinvest" group of companies and is located in the northeastern part of Avdiivka, Donetsk Region. The company produces 30 types of coke and chemical products, the main of which is blast-furnace coke for metallurgy.

The plant has two TSFs on its balance sheet – a sludge storage facility (sludge SF) and a chemical storage facility (chemical SF). The facilities are located in the area of the Siverskyi Donets river sub-basin.

Linear scheme of the hydrographic network in the TSFs location area: Creek in the Poshtovyi Loh beam – the Skotovata (Kamianka) river – the Ocheretova river – the Kryvyi Torets river – the Kazennyi Torets river – the Siverskyi Donets river – the Don river.

Adverse climatic conditions and geological processes, typical for the territory of TSFs location, are:

- precipitation of rainstorm and local character, which can cause TSF overflow if the impoundment gets filled to a critical level
- seasonal storm winds which create an additional risk of environmental pollution due to small particles blown off the upper layer of "dry beaches" – areas with solid fractions of the TSF waste

Other features of the TSFs location – proximity to the creek of the Poshtovyi Loh beam, which flows into the Skotovata river, residential houses and transport communications of the villages Vesele and Krasnohorivka.

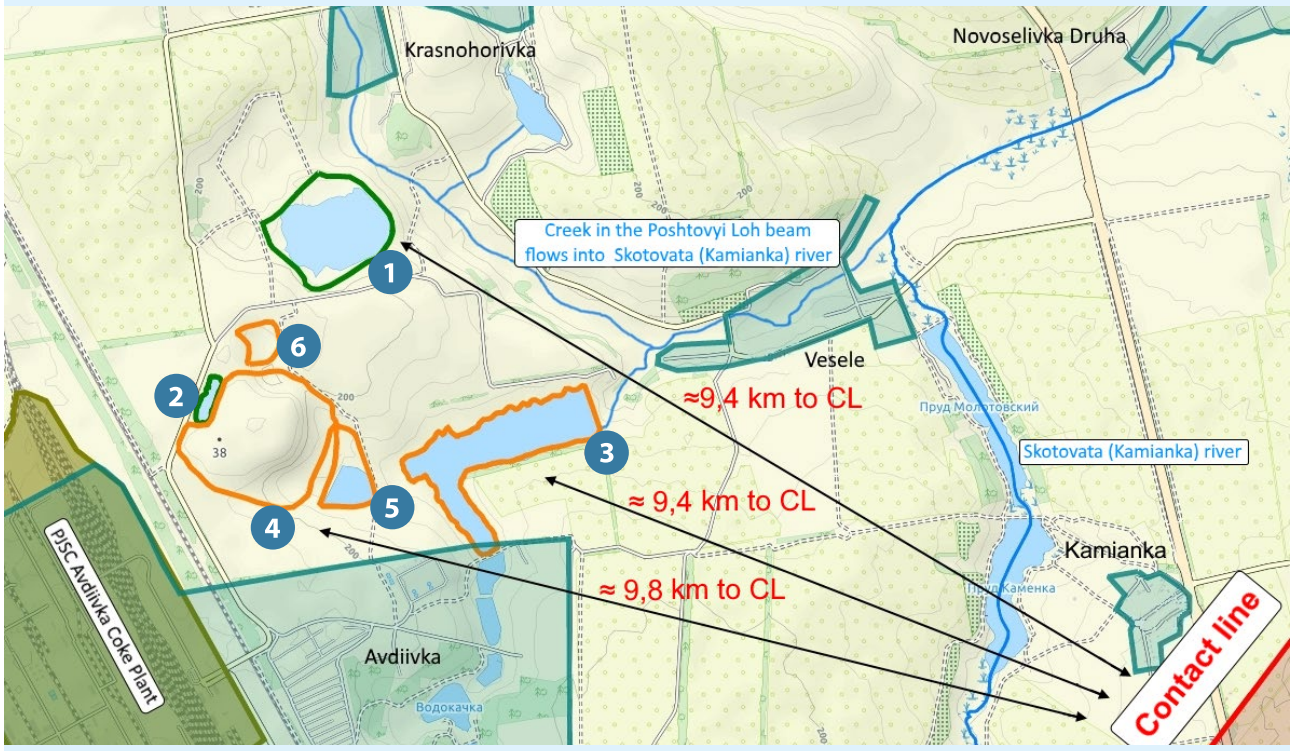

Figure 3. Location of the TSFs and other facilities of PJSC Avdiivka Coke Plant in relation to the contact line.
Legend: ❶ sludge SF, ❷ chemical SF, ❸ storage pond, ❹ waste heap, ❺ decant pond of the waste heap bypass, ❻ solid municipal waste landfill.

Proximity to other waste disposal sites (WDS) – the chemical SF is surrounded with a waste heap on three sides and a solid municipal waste landfill is in 215 m in the north-eastern direction.

Other features of the TSFs location – proximity to the creek of the Poshtovyi Loh beam, which flows into the Skotovata river, residential houses and transport communications of the villages Vesele and Krasnohorivka.

Proximity to other waste disposal sites (WDS) – the chemical SF is surrounded with a waste heap on three sides and a solid municipal waste landfill is in 215 m in the north-eastern direction (*Fig. 4*).

The PJSC Avdiivka Coke Plant TSFs are located in the Joint Forces Operation area, approximately 9.4-9.8 km from the contact line (*Fig. 3*): artillery shelling range, the territories have been mined since the active military actions in 2014-2015.

Figure 4. **Objects of PJSC Avdiivka Coke Plant:** ❶ chemical SF, ❷ waste heap, ❸ solid municipal waste landfill, ❹ PJSC Avdiivka Coke Plant industrial site. Photo: OSCE, 2019

1.2.

TSFs CURRENT STATE

As of 2019, the sludge SF and the chemical SF[15] contain 6.5 mln tons of coal-processing sludge (Waste Hazard Class IV) and 443.1 thous tons of chemical waste (Waste Hazard Classes II-IV) respectively[16].

Since 2008, the company has not disposed waste into the sludge SF, and since 2018, the activities on sludge extraction and process have been ongoing followed by rehabilitation of the disturbed lands (*Fig.5*).

The chemical SF has not been replenished since 2001 and is registered by the state as a closed WDS (*Fig.6*).

The chemical SF waste, whose lower layer is **resinous waste, has toxic properties and is hazardous to human health**. In essence, it is a mechanical mixture of a large number of organic compounds that can affect the blood circulatory system, the functions of the central and peripheral nervous system, kidneys and liver.

Figure 5. Sludge SF of the PJSC Avdiivka Coke Plant and settlement. Photo: OSCE, 2019

15 Commissioning years: sludge SF – 1972, chemical SF – 1968.

16 Coal fuses, acid tar of sulphate separation, spent desulfurization solution, biochemical plant resin, etc. (total 7 waste types)

The compounds have mutagenic activity, irritate and cause burns of the upper respiratory tract mucous membranes, can lead to respiratory dysfunction, burning in the eyes and overall body poisoning[17].
The TSFs survey in September 2019 allowed to determine the peculiarities of the facility locations and visually inspect their current state. Main visual observations.

Main visual observations:

SLUDGE SF

- availability of dead wood, which, together with formation of sludge drying beds due to separation of the sludge useful fraction, creates additional fire hazard at the facility
- the sludge SF is located at a higher elevation than the settlement (village Krasnohorivka) and other facilities (pump station, highways)

CHEMICAL SF

- the dam, which was raised from rocks of waste coal residues, has signs of instability and crumbles inside (*Fig. 6, 7*) the impoundment
- signs of burning of the waste heap, which surrounds the chemical SF on three sides
- signs of leaking of an unknown substance from the surface of the waste heap into the chemical SF

Additionally, there is a potential threat to the environment from another enterprise facility – **the storage pond** (*Fig. 8*). As two service water lines were damaged under the military actions, the company has to repeatedly recycle the storage pond water, which has become extremely mineralized (up to 5 g/dm^3).

The lack of fresh service water leads to a shortage of steam production, which can cause the shutdown of the plant's chemical shops and, consequently, the

Figure 6. Chemical SF of the PJSC Avdiivka Coke Plant. Photo: OSCE, 2019

17 Information on the toxic effects of waste substances is provided per 1998 "Toxicological and Hygienic Passport of Resinous Waste from the Coke Plant Storage Facilities in Ukraine" and the chemical reference book "Harmful substances in industry. Handbook for Chemists, Engineers and Doctors". Ed. 7th, revised and enlarged. In three volumes. Volume I. Volume II. Organic substances. Ed. Honored Scientist, Prof. N.V. Lazareva and Dr. of Medicine E.N. Levina, L., "Chemistry", 1976

the termination of coke oven gas purification resulting in high levels of air pollution. If the storage pond facilities fail (due to the domino effect or military actions), about 4 mln m³ of mineralized water can flood the agricultural lands of the village Vesele located at a lower elevation, settlements and other infrastructure facilities, and get to the tributaries of the cross-border Siverskyi Donets river. Therefore, in this regard, there is a need for repair and restoration of the two service water lines, located on the fifth rise of the Donetsk Regional Production Office of Communal Enterprise "Donbas Water" near the city of Horlivka.

The analysis of the company's operating documentation demonstrated that in general the company pays sufficient attention to data documenting: the operating documents and the results of the sludge SF visual inspections are available. However, no instrumental observations and inspections of the hydraulic facilities are performed; therefore, the data is unavailable and the passport of the sludge SF's hydraulic facilities is not updated. The chemical SF, which is registered by the state as a "closed" WDS, has no facility design and construction documents with the facility technical parameters.

Figure 7. Chemical TSF dam from rocks of waste coal residues

Figure 8. Storage pond, general view from the dam

Table 1. Results of categorical evaluation of PJSC Avdiivka Coke Plant TSFs operation (values below 50% are highlighted)

№	Category	Results of safety criteria compliance, %		Category significance[18]
		Sludge SF	Chemical SF	
I	Geological, climatic and local conditions	26.3	**27.5**	non-critical
II	SF location plan	61.5	**48.1**	non-critical
III	Substances (waste volume and toxicity)	79.5	**15.7**	critical
IV	Dam and screens	59.1	**37.0**	critical
V	Transport and infrastructure	59.3	**33.3**	critical
VI	Water flow management	67.9	**9.0**	critical
VII	Environmental impact assessment	63.5	**26.7**	critical
VIII	Emergency Response Plan	**34.0**	**2.0**	critical
IX	Monitoring	**46.7**	**30.9**	critical
X	Training and personnel	59.3	59.3	non-critical
XI	Verification and reporting	81.3	**29.2**	non-critical
XII	Closure and rehabilitation	90.7	**11.1**	critical
	Overall result	**60.8**	**27.5**	–

18 Critical categories are extremely important TSF safety categories, which relate mainly to technical aspects of facility operation and safety maintenance. Detection of non-compliance with the safety requirements in these categories requires urgent action. Non-critical categories relate to issues mostly concerned with documentation management and reporting and the facility personnel qualification level

Application of the "Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety"[19] based on the analysis of visual observation data, staff interviews and documentation, demonstrated that the relative safety level of **the sludge SF and the chemical SF is 60.8% and 27.5% respectively** *(Table 1)*.

The assessment demonstrates that the lowest rate on compliance of TSF operational safety with the requirements of the environmental safety standards is evaluated in the categories "Emergency Response Plan" and "Monitoring" for both sludge and chemical SFs, and for the chemical SF almost all categories (11 out of 12) are rated below 50%.

The list of all the TSF operational non-compliances found during research and the measures on maintaining the facilities safety are provided in the Report on enterprise in the tabular form according to the scheme: "identified non-compliance" – "legislative criterion" – "corresponding recommendation". **Measures recommended for implementation by PJSC Avdiivka Coke Plant are provided below in Subsection 1.5. Issues related to the military actions are outlined in Section 5.**

1.3.

CONSIDERATION OF THE ANTHROPOGENIC PRESSURES FROM TSFs ON THE STATE OF WATER BODIES

The surface water body (SWB) of the Skotovata (Kamianka) river[20], the Siverskyi Donets river sub-basin, is subject to the pressure from TSFs operation of PJSC Avdiivka Coke Plant (*Fig. 9*).

The company discharges wastewater after the storage pond through Outlet No. 1 and drainage water from the sludge SF through Outlet No. 2 along the Poshtovyi Loh beam to the Skotovata (Kamianka) river. As of 2019, Outlet No. 1 had not been used for discharging since 2016 due to reuse of water for production purposes.

According to the wastewater quality data monitored by the enterprise, the MAC values for Outlet No. 1 after the storage pond in 2016 were exceeded for ammonium nitrogen, nitrates, sulfates, phosphates, and chlorides.

For Outlet No. 2 of drainage waters from the sludge SF in 2016-2018, the MAC values were exceeded for chlorides and sulfates. According to the results of the surface water quality monitoring in the sludge and chemical SFs area (data of the WDS Passports) for 2014-2017, which are provided only for one station on the Skotovata (Kamianka) river below the PJSC Avdiivka Coke Plant discharge, no exceeded MAC values were detected.

Because of the mined areas, unimpeded safe access to the observation wells is unavailable, and the groundwater status has not been monitored since 2015. According to the observations in 2013-2015, provided in the WDS Passports, no exceeded MAC values were recorded in groundwater of the sludge SF and the chemical SF area.

19 "Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety", the text in English is available on the German Environment Agency (UBA) web-page at the link

20 SWB individual number – UA_M6.5.1_0282. SWB type code is a preliminary heavily modified water body by the regulation criteria and change of morphology

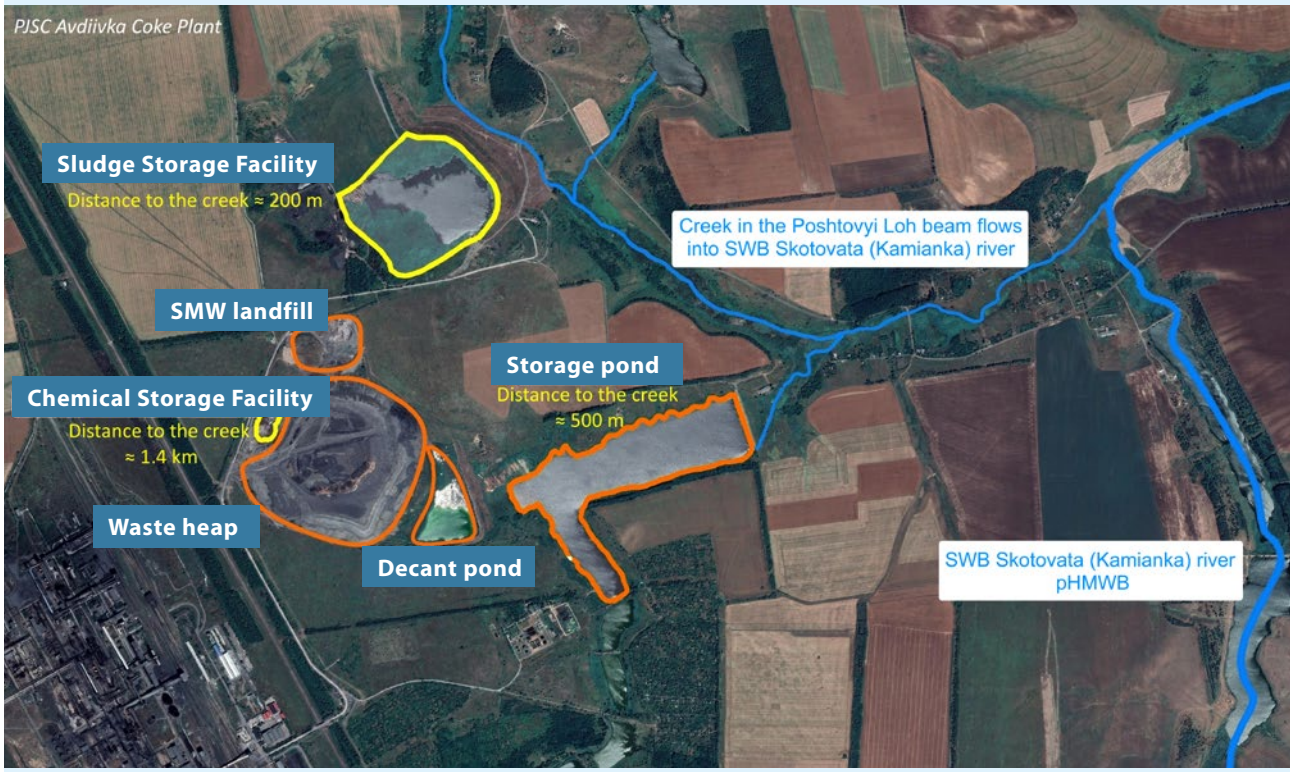

Figure 9. Location of PJSC Avdiivka Coke Plant TSFs in relation to the hydrographic network

However, in recent years no data has been available on the wells in the chemical SF area and one well near the sludge SF, which does not allow to fully assess the nature and level of groundwater pollution. According to the WDS Passport of the chemical SF, the state of groundwater in the facility area in 1999-2000 was critical: in Well No. 1a the exceeding of MAC was recorded for rhodanides (800 times), ammonia (255 times), phenol (45 times), iron (28 times), and petroleum products (8 times).

The analytical scheme by the DPSIR indicators: Driver – Pressure – State – Impact – Response (provided in the Report on enterprise) is formed based on the results of a comprehensive study of PJSC Avdiivka Coke Plant TSFs (review of natural conditions and their location, waste volume and toxicity, study of the facilities' current state, analysis of the available monitoring results, Sections 1.1-1.3) and their anthropogenic pressures on the water bodies.

According to an expert opinion, the SWB Skotovata (Kamianka) river is at risk of failing to achieve the environmental objectives[21] due to the pressure and impact from TSFs operation of the PJSC Avdiivka Coke Plant.

Measures recommended to the TSF operator (Subsection 1.5) and the competent authorities (Section 6) may be taken into account when developing the Don River Basin Management Plan for water body protection.

21 The term according to the Guidelines for Determining the Main Anthropogenic Pressures and Their Impacts on the State of Surface Waters, was approved by Protocol No. 2 at the Scientific and Technical Council meeting of the State Water Agency of Ukraine on 27 November 2018

1.4.

THREATS IDENTIFICATION UNDER THE PROBABLE ACCIDENT SCENARIOS AT TSFs

Due to the location of the PJSC Avdiivka Coke Plant industrial facilities near the contact line, the plant repeatedly came under fire and the industrial site areas were mined. Such external military hazard drivers caused disruptions in the enterprise operation and numerous emergencies – during the armed conflict hundreds of mines fell on the plant territory. The plant buildings and facilities, gas and steam pipelines, and power lines were damaged. In addition, significant damage was caused to the company rolling stock and vehicle fleet. Avdiivka Coke Plant shut down and restarted 15 times; it was de-energized more than 200 times. Twelve workers were killed and over 60 were wounded.

The research identified and mapped threats under the probable accident scenarios at TSFs, taking into account the location of the facilities in the area of military actions.

The PJSC Avdiivka Coke Plant sludge and chemical SFs containing explosive and toxic substances in the waste and located in the armed conflict zone as a source of threat pose **hydrodynamic, explosive, fire, chemical, and environmental hazards with a domino effect, especially in the armed conflict area** (*Fig.10*).

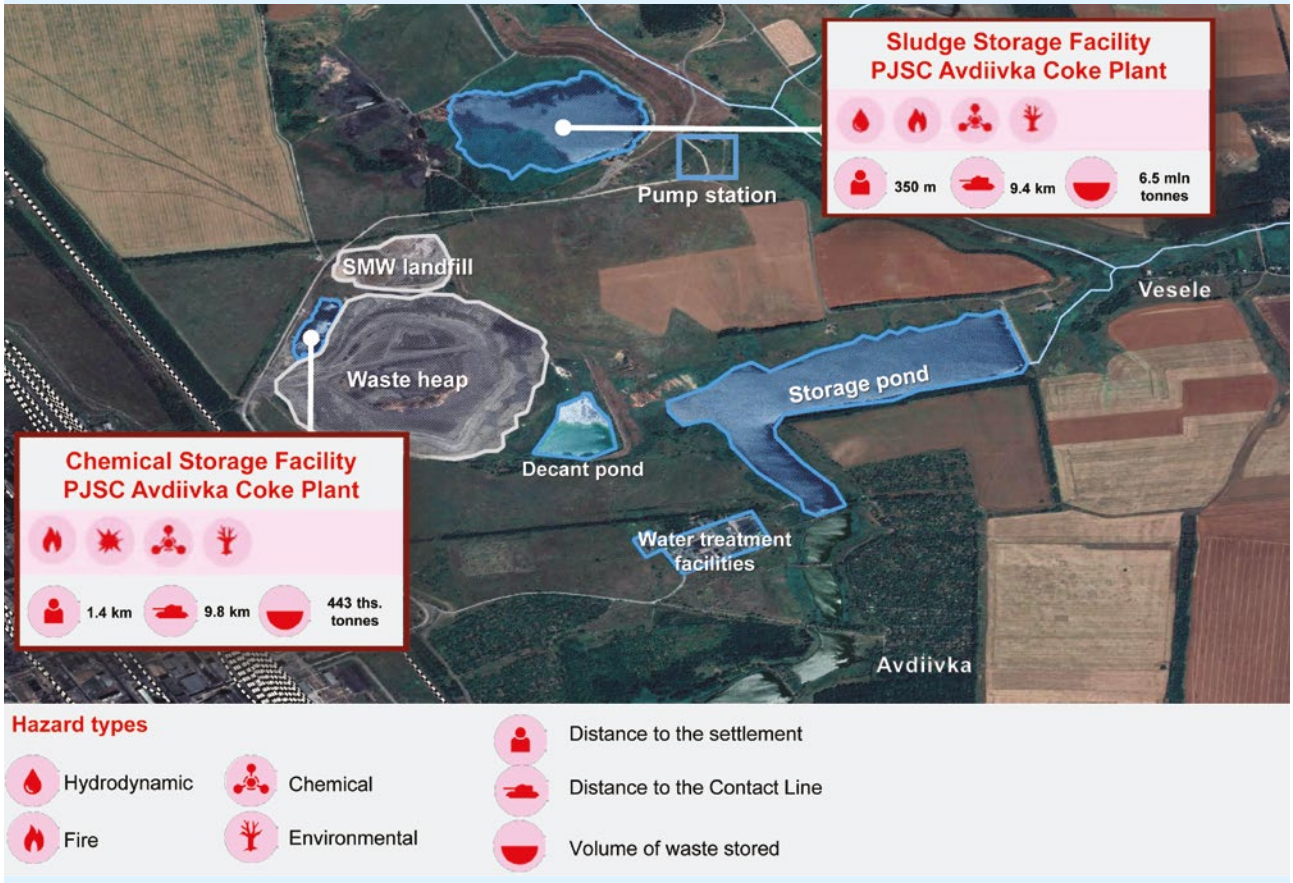

Figure 10. Types of hazards of PJSC Avdiivka Coke Plant TSFs

These types of hazards can lead to accident scenarios at TSFs, the most probable of which are:

AT THE SLUDGE SF:

- fire
- dam local failure
- dam failure with a domino effect

AT THE CHEMICAL SF:

- dam local failure
- fire with a domino effect

Occurrence of the **sludge SF** dam failure scenario can lead to a **domino effect** (*Fig. 11*): failure of the storage pond located at a lower elevation, with further pollution of water bodies (the rivers Skotovata (Kamianka), Ocheretova, Kryvyi Torets, Kazennyi Torets, Siverskyi Donets), Nature Reserve Fund sites ("Krovetska" ravine), damage of transport communication elements (bridges, vehicle roads, railroads), destruction of residential and industrial buildings (village of Krasnohorivka, village of Vesele, village of Novoselivka Druha, township of Verkhnotoretske, village of Troitske, village of Novoselivka, township of Novhorodske), failures in the electrical grids (transformer substations, power transmission lines).

Availability of the waste heap and the solid municipal waste landfill near the **chemical SF** poses a potential threat of a **domino effect:** if the liquid in the chemical SF ignites (including through the shell hit), which is due to the flammable nature of the substances in the waste, there is a possibility that the "fire" accident scenario will be transferred to the waste heap and the solid municipal waste landfill.

In the event of the above accidents, the spread of threats through groundwater and surface water, soil, and air will lead to poisoning of the environment components, flooding of territories, destruction of residential and industrial buildings of settlements and elements of the transport infrastructure. Experts of the Siverskyi Donets BWA calculated that **the pollutants flow time from the TSFs to the drinking water intake will take 14-15 days**[22].

A review of the company's emergency preparedness at the TSFs showed that the **Accident Localization and Elimination Plan of PJSC Avdiivka Coke Plant**:

- does not consider the probable accident scenarios for the chemical SF
- provides the following two scenarios for the sludge SF:
  - disturbance of the sludge SF dam soil, and
  - flooding of the sludge SF pump station

The Plan does not take into account all the existing types of threats from the TSFs, including consideration of their location in the armed conflict area. Therefore, it is recommended that the Accident Localization and Elimination Plan be supplemented with probable accident scenarios specified in this research:

- for the chemical SF: "dam local failure" and "fire with a domino effect"
- for sludge SF: "fire" and "dam failure with a domino effect"

There is no information on identification of the chemical SF as a potentially hazardous facility. Despite the fact that the chemical SF is not operated, it is a source of potential hazard, because under certain conditions (occurrence of natural hazards, shelling, accidents at neighboring industrial facilities, etc.) it can cause an emergency.

It was not possible to perform the analysis and comparison with the Emergency Response Plans developed by the government authorities (at the region, district, and city levels) in the framework of this research due to lack of access to the said documentation[23].

22 State of the Siverskyi Donets Basin and Related Risks under Military Operations. Technical Report (OSCE, 2018).

23 The requests to the executive authorities and local governments (Main Office of the State Emergency Service of Ukraine in the Donetsk Region, Donetsk Regional State Administration, Toretsk and Avdiivka Military-Civil Administrations, Yasynuvata District State Administration) did not result in receiving any Emergency Response Plans from any agency

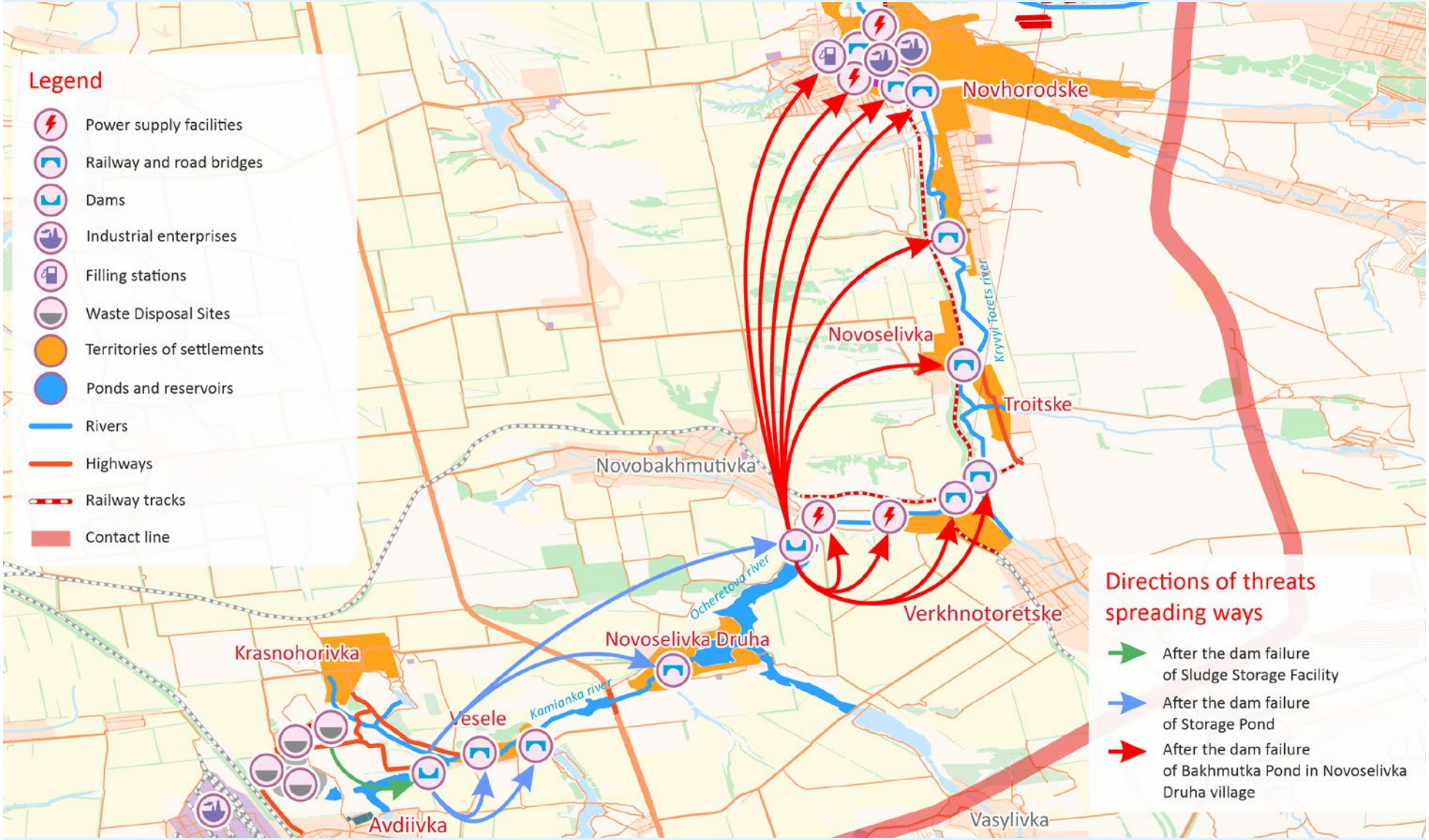

Figure 11. Domino effect under the dam failure of the PJSC Avdiivka Coke Plant sludge SF

1.5.

MEASURES RECOMMENDED FOR IMPLEMENTATION BY PJSC AVDIIVKA COKE PLANT

1. **Establish interaction with the relevant agencies to obtain safe access to the entire infrastructure of the sludge SF, including observation wells, in accordance with the generally accepted procedures in the armed conflict area.**

2. **Proper operation:**

   - OF THE SLUDGE SF

   2.1. Take measures to keep the liquid waste component in the sludge SF at a level not exceeding the maximum allowable one[24].

   2.2. Ensure the conducting of the Environmental Impact Assessment of the "sludge storage facility rehabilitation", for which the Project was developed in 2019, pursuant to the Law of Ukraine "On Environmental Impact Assessment" (Art. 3, Part 3, Clause 11).

   - OF THE CHEMICAL SF

   2.3. Maintain the appropriate water level in the chemical SF to prevent air pollution with evaporation of hazardous substances contained in the waste (hydrogen sulfide, ammonia, phenol, pyridine, naphthalene) and provide the staff with individual protection means when working at the chemical SF.

   2.4. Regularly control and monitor the condition of the chemical SF dam slopes, and, if necessary, develop and take measures to ensure stability of the structure.

   2.5. Prevent unauthorized disposal of waste and entering other substances into the chemical SF.

   2.6. Determine the current composition and properties of the waste deposited in the chemical SF (mixture of different waste types) and the degree of waste hazard to the environment and human health. Develop, agree, and approve the waste passport according to the results.

   2.7. Implement organizational, scientific, technical, and technological measures for maximum decontamination/ disposal of the waste deposited in the chemical SF, further closure or reconstruction of the facility, and consideration of using the released impoundment.

3. **Install the appropriate warning signs in the TSFs area ("danger zone", "passage and entry of unauthorized persons is prohibited").**

4. **Ensure the preparedness of the enterprise for emergencies at the sludge and chemical SFs**

   4.1. Revise and supplement the "Accident Localization and Response Plan of PJSC Avdiivka Coke Plant" taking into account the results of threat identification under the probable accident scenarios at the sludge and chemical SFs provided in the Report on enterprise. Additionally, it is recommended to perform a flood risk assessment in case of emergency (modelling of the dam failure or overflow scenario).

24 According to the company's documentation, the level of the liquid waste component, which in March 2019 was 191.98 m with a maximum of 192.5 m, is close to critical.

2.

TAILINGS STORAGE FACILITIES RESEARCH

SMA INKOR & Co

2.1.

TSF OPERATOR LOCATION

A chemical industry enterprise Scientific and Manufacturing Association "Inkor and Co" LLC (former Phenolic Plant) is part of the Metinvest group of companies and specializes in the processing of phenol- and naphthalene-containing raw materials. The plant has three industrial waste storage facilities (hereinafter – sludge SFs), located in the Yasynuvata District of the Donetsk Region of Ukraine, in the Siverskyi Donets river sub-basin.

Linear scheme of the hydrographic network in the sludge SFs location area: the Zalizna river – the Kryvyi Torets river – the Kazennyi Torets river – the Siverskyi Donets river – the Don river.

Adverse climatic conditions and geological processes, typical for the territory of TSFs location, are:

- precipitation of rainstorm and local character, which can cause TSF overflow if the impoundment gets filled to a critical level
- seasonal storm winds which create an additional risk of environmental pollution due to small particles blown off the upper layer of "dry beaches" – areas with solid fractions of the TSF waste
- the groundwater belongs to the unprotected category, i.e. vulnerable to pollution

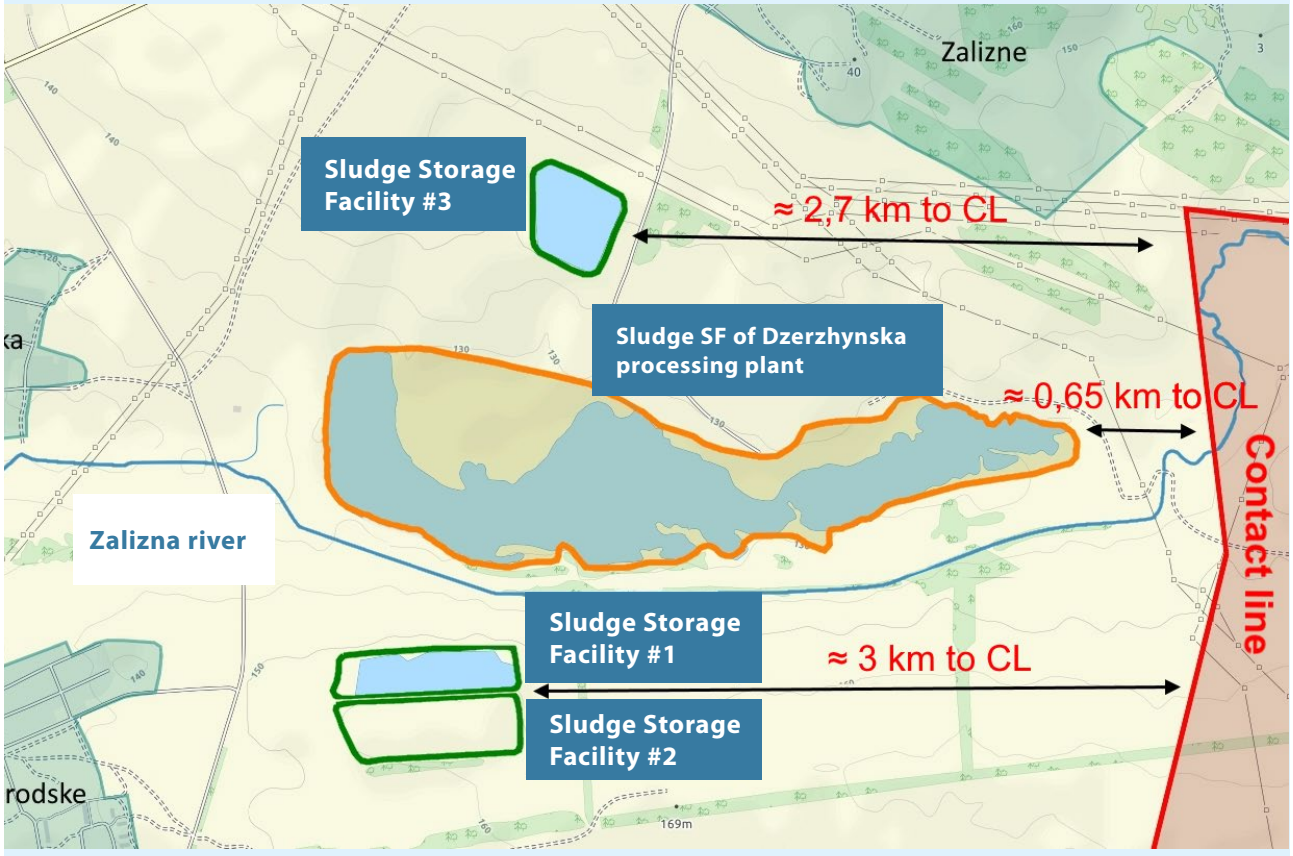

Figure 12. Location of SMA Inkor & Co sludge SFs and other facilities in relation to the contact line

- excavation voids in the territory of sludge SF No. 2 and sludge SF No. 3 location, which poses a threat of waste entering the voids during ground subsidence under the sludge SFs

Other features of the sludge SFs location include proximity to the water body, the Zalizna river, which flows into the Kryvyi Torets river, residential houses and transport communications of such settlements as township of Novgorod, township of Nelipivka, town of Zalizne, location of the Dzerzhynska Processing Plant sludge SF in the lowlands between the two Inkor sludge SFs *(Fig. 13)*, and downstream location of the nature reserve fund facilities – "Kleban Byk" regional landscape park and "Krovetska Ravine" national geological landmark.

Since the beginning of the armed conflict in the Donbas, the SMA Inkor & Co sludge SFs came under the risk of destruction, as the facilities are located about 2.7 – 3 km from the contact line (*Fig. 12*), immediately on the first line of defense, with the facility sites and access roads being within the line-of-sight range of the illegal armed groups.

Figure 13. SMA Inkor & Co sludge SFs (1-3) and Dzerzhynska Processing Plant sludge SF (4). Photo: OSCE, 2019

2.2.

TSFs CURRENT STATE

The three SMA Inkor & Co sludge SFs[25] contain in total 1.04 mln tons of hazardous waste from phenolic and naphthalene production (*Table 2*).

Table 2. General information about the SMA Inkor & Co sludge SFs

Company TSFs	Sludge SF No. 1	Sludge SF No. 2	Sludge SF No. 3
Commissioning year	1959	1967-1989 closed WDS	1985
Total amount of deposited waste	276,622.97 tons	403,777.16 tons	363675.556 tons
Aggregate state of waste	mixed – solid, sludge- and paste-like	solid	sludge- and paste-like
Waste type	Ammonium sulfate, resinous residues, laboratory washes, carbonate sludge, etc. – a total of 42 items Gas emissions: phenol, naphthalene, formaldehyde	Carbonate sludge, suspended solids	Carbonate sludge, soda solution, sludge sediments, etc. – a total of 5 items
Waste hazard class	II-IV	IV	III-IV

As of 2019, the actual amount of waste over 60 years of sludge SF No. 1 operation and over 34 years of sludge SF No. 3 operation was 67% and 88% of the design volume, respectively. Sludge SF No. 2 has not been used and is registered by the state as a closed WDS.

The TSFs survey in September 2019 allowed to determine the peculiarities of the facilities' locations and visually inspect their current state.

Main visual observations (*Fig. 14-17*):

SLUDGE SF No. 1

- there was a persistent pungent odor of chemicals; experts felt nausea and dizziness; a few hours after the visit there were signs of inflammation and swelling of the mucous membranes of the eyes, nasopharynx, and respiratory tract irritation
- there are signs of the dam filling inside the impoundment, i.e. partial covering of the sludge waste deposited in the facility

SLUDGE SF No. 2

- the company representatives determined it unnecessary to visit the site of sludge SF No. 2, referring to the fact that the facility is "closed", backfilled with soil and does not require maintenance
- according to satellite images: the sludge SF surface has not been smoothed, the territory has not been forested, there are white spots (stains), which may demonstrate incomplete facility closure and rehabilitation of the disturbed lands

25 Sludge storage facilities of Construction Phase I, II, and III, hereinafter in the Summary referred to as "sludge SF No. 1, No. 2, No. 3"

SLUDGE SF No. 3

- the impoundment filling level is close to critical[26]
- the areas of dry beaches were observed at the sludge SF, which can cause air pollution due to dusting of the solid waste fraction
- the dam is narrow in some places; there are obvious signs of its instability
- the diverting ditch, which has to perform the function of primary emergency waste capture, is in a neglected state – covered with vegetation; further, along the sludge SF perimeter on the side of the Dzerzhynska Processing Plant sludge SF, the diverting ditch is visually absent

Figure 14. Sludge SF No. 1 of the SMA Inkor & Co

After a visual inspection of the facilities, the toxic properties of the substances that comprise the waste were examined: **phenols, naphthalene, formaldehyde, pyridine, sulfuric acid**, etc.

These substances are characterized by a strong toxic effect: irritate and cause burns of the mucous membranes of the upper respiratory tract, can lead to respiratory dysfunction, burning in the eyes and overall body poisoning[27].

Figure 15. Google Earth image of the SMA Inkor & Co sludge SF No. 2 area, 2016

Analysis of the company's operating documentation demonstrated that in general the company pays sufficient attention to data documenting: the design and operational documents are available, the results of observations and control of the facilities' state are recorded, the documents are updated in a timely manner.

Application of the "Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety"[28] based on the analysis of visual observation data, staff interviews, and documentation, demonstrated that the relative safety level of sludge **SFs No. 1-3 is 58.2%, 58.1%, and 56.9% respectively** (*Table 3*).

Figure 16. Formation of dry beaches at sludge SF No. 3 of the SMA Inkor & Co

26 According to the company's documentation, the liquid level in the sludge SF impoundment in July 2018 was 154.73 m with a design level of 156.11 m

27 The information on the toxic effects of the waste substances is provided per chemical reference book "Harmful Substances in Industry. Handbook for Chemists, Engineers and Doctors". Ed. 7th, revised and enlarged. In three volumes. Volume I. Volume II. Organic substances. Ed. Honored Scientist, Prof. N.V. Lazareva and Dr. of Medicine E.N. Levina, L., "Chemistry", 1976

28 "Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety", the text in English is available on the German Environment Agency (UBA) web-page at the link

Figure 17. Sludge SF No. 3 of the SMA Inkor & Co. Photo: OSCE, 2019

Table 3. Results of categorical evaluation of SMA Inkor & Co sludge SFs operation
(values below 50% are highlighted)

№	Category	Results of safety criteria compliance, %			Category significance[29]
		Sludge SF No. 1	Sludge SF No. 2	Sludge SF No. 3	
I	Geological, climatic and local conditions	53.7	**38.9**	**42.1**	non-critical
II	SF location plan	89.7	88.9	89.7	non-critical
III	Substances (waste volume and toxicity)	**34.9**	73.3	58.3	critical
IV	Dam and screens	81.5	78.2	**45.6**	critical
V	Transport and infrastructure	62.5	88.9	59.3	critical
VI	Water flow management	**12.0**	**33.3**	**25.3**	critical
VII	Environmental impact assessment	**42.9**	**43.3**	**41.3**	critical
VIII	Emergency Response Plan	64.0	**11.4**	65.3	critical
IX	Monitoring	57.5	**26.7**	58.9	critical
X	Training and personnel	74.1	73.3	74.1	non-critical
XI	Verification and reporting	86.7	87.5	85.3	non-critical
XII	Closure and rehabilitation	**39.4**	53.3	**37.5**	critical
	Overall result	**58.2**	**58.1**	**56.9**	–

29 Critical categories are extremely important TSF safety categories, which relate mainly to facility technical aspects of operation and safety maintenance. Detection of non-compliance with the safety requirements in these categories requires urgent action. Non-critical categories relate to issues mostly concerned with documentation management and reporting and the facility personnel qualification level

The assessment demonstrates that the lowest rate on compliance of sludge SF operational safety with the requirements of the environmental safety standards is evaluated in the categories "Water flow management", "Environmental impact assessment", "Closure and rehabilitation" for the three sludge SFs, as well as "Substances (waste volume and toxicity)" for sludge SF No. 1, "Emergency Response Plan" and "Monitoring" for sludge SF No. 2, and "Dam and screens" for sludge SF No. 3.

The list of all the TSF operational non-compliances found during research and the measures on maintaining the facilities safety are provided in the Report on enterprise in the tabular form according to the scheme: "identified non-compliance" – "legislative criterion" – "corresponding recommendation". **Measures recommended for implementation by SMA Inkor & Co are provided below in Subsection 2.5. Issues related to the military actions are outlined in Section 5.**

2.3.

CONSIDERATION OF THE ANTHROPOGENIC PRESSURES FROM TSFs ON THE STATE OF WATER BODIES

The **SWB of the Zalizna river**[30], the Siverskyi Donets river sub-basin, is subject to the pressure from TSFs operation of SMA Inkor & Co (*Fig. 18*).

There is no direct discharge of polluted water from the sludge SFs into water bodies.

Due to the military actions, the company has not almost monitored the surface and groundwater in the area of the sludge SFs since 2014. Starting October 2018, the company has been periodically monitoring the quality of water from observation wells of sludge SF No. 1 and 3 after agreeing on safe access with several agencies: JCCC, OSCE SMM and State Emergency Service of Ukraine. For 2019, the monitoring results of groundwater quality are provided only by quantitative indicators of pH and phenols. Such a limited list of indicators does not allow to fully assess the current situation.

The monitoring results of surface water quality in 2004-2014 provided in the WDS Passports for sludge SFs No. 1-3, demonstrate higher levels of sulfate ions, alkalinity, chloride ions, pH, and dry residue in the waters of the Zalizna river downstream of the sludge SFs compared to the samples taken upstream of the facilities.

Groundwater samples from 2004 to 2009 recorded excessive values for almost all the indicators, especially sulfate ions and phenols; in particular, according to the sludge SF No. 3 WDS Passport in 2004, the concentration of phenols in the area exceeded the background 260 times.

Starting 2010, the company is unable to compare the results of the groundwater quality analysis with the indicators of the State Regional Geological Company "Donetskgeology" reference well, which was destroyed 9 years ago and had not been restored as of 2019.

30 SWB type code UA_R_16_S_1_CA, SWB individual number UA_M6.5.1_0291

Irregular sampling from the observation wells in the sludge SFs area since 2014 and lack of background values make it impossible to fully assess the current conditions occurring in water bodies due to TSFs operation.

The analytical scheme by the DPSIR indicators: Driver – Pressure – State – Impact – Response (provided in the Report on enterprise) is formed based on the results of a comprehensive study of SMA Inkor & Co LLC TSFs (review of natural conditions and their location, waste volume and toxicity, study of the facilities' current state, analysis of the available monitoring results, Sections 2.1-2.3) and their anthropogenic pressures on the water bodies.

According to an expert opinion, the SWB Zalizna river is at risk of failing to achieve the environmental objectives[31] due to the pressure and impact from TSFs operation of the SMA Inkor & Co. Measures recommended to the TSF operator (Subsection 2.5) and the competent authorities (Section 6) may be taken into account when developing the Don River Basin Management Plan for water body protection.

Figure 18. Location of SMA Inkor & Co sludge SFs in relation to the hydrographic network

31 The term, according to the Guidelines for Determining the Anthropogenic Pressures and Their Impacts on the State of Surface Waters, was approved by Protocol No. 2 at the Scientific and Technical Council meeting of the State Water Agency of Ukraine on 27 November 2018

2.4.

THREATS IDENTIFICATION UNDER THE PROBABLE ACCIDENT SCENARIOS AT TSFs

Due to the location of the SMA Inkor & Co industrial facilities near the contact line, they repeatedly came under fire and the industrial site areas were mined. Such external military hazard drivers caused disruptions in the enterprise operation and numerous emergencies, including: burning of resinous waste at sludge SF No. 1 (2014), partial damage of sludge SF No. 3 dam and pipeline (2016, 2018).

The research identified and mapped threats for probable accident scenarios at TSFs, taking into account the location of the facilities in the area of military actions.

The SMA Inkor & Co sludge SFs containing **toxic substances** in the waste and located in the armed conflict zone as a source of threat pose **hydrodynamic, fire, chemical, and environmental hazards with a domino effect, especially in the armed conflict area** (*Fig.19*).

These types of hazards can lead to accident scenarios at TSFs, the most probable of which are:

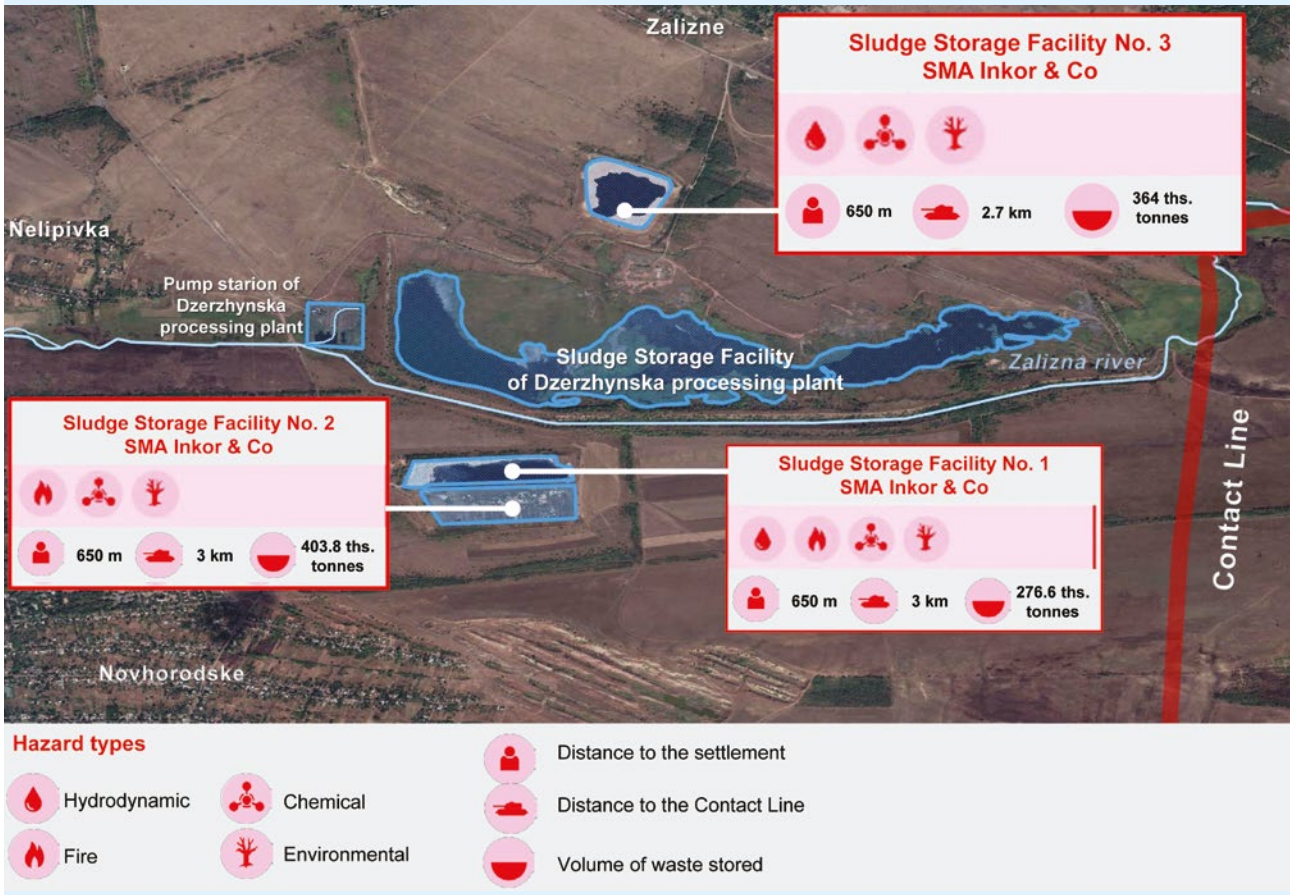

Figure 19. Types of hazards of SMA Inkor & Co LLC sludge SFs

SLUDGE SF No. 1

- fire
- sludge pipeline local failure on the route
- sludge pipeline failure on the dam crest
- dam local failure
- dam failure with a domino effect

SLUDGE SF No. 2

- fire

SLUDGE SF No. 3

- sludge pipeline or clarified water pipeline local failure on the route
- sludge pipeline failure on the dam crest
- dam local failure
- dam failure with a domino effect

Occurrence of the sludge SF No. 1 and No. 3 dam failure scenario can lead to a **domino effect** (*Fig. 20*): dam failure of the Dzerzhynska Processing Plant sludge SF with subsequent pollution of water bodies (the rivers Zalizna, Kryvyi Torets, Kazennyi Torets, Siverskyi Donets), Nature Reserve Fund site ("Krovetska Ravine"), damaged elements of transport communications (bridges, vehicle roads, railroads), destruction of residential and industrial buildings (township of Novhorodske, township of Nelipivka, village of Leonidivka, township of Petrivka, township of Shcherbynivka, village of Nelipivka, village of Ivanopillya), failures in the electrical grids (transformer substations, power transmission lines).

In the event of the above accidents, the spread of threats through groundwater and surface water, soil, and air will lead to poisoning of the environment components, flooding of territories, destruction of residential and industrial buildings of settlements and elements of the transport infrastructure. Experts of the Siverskyi Donets BWA calculated that **the pollutants flow time from the TSFs to the drinking water intake of the Communal Enterprise "Popasna District Water Services" will take 3 to 8.5 days**[32].

A review of the company's emergency preparedness at the TSFs showed that SMA Inkor & Co has developed **Accident Localization and Elimination Plans for sludge SFs No. 1 and No. 3 for 2017-2022** with a list of probable accident scenarios and measures to be taken in case of accidents. **The Plans, however, do not take into account all the existing types of threats from TSFs, including consideration of their location in the armed conflict area**. Specifically, this research identified additional probable accident scenarios – "fire" for sludge SFs No. 1 and No. 2, and "dam failure with a domino effect" for sludge SFs No. 1 and No. 3, which are recommended to be added to the Accident Localization and Elimination Plans.

It was not possible to perform the analysis and comparison with the Emergency Response Plans developed by the government authorities (at the region, district, and city level) in the framework of this research due to lack of access to the said documentation[33].

32 State of the Siverskyi Donets Basin and Related Risks under Military Operations. Technical Report (OSCE, 2018)

33 The requests to the executive authorities and local governments (Main Office of the State Emergency Service of Ukraine in the Donetsk Region, Donetsk Regional State Administration, Toretsk and Avdiivka Military-Civil Administrations, Yasynuvata District State Administration) did not result in receiving any Emergency Response Plans from any agency

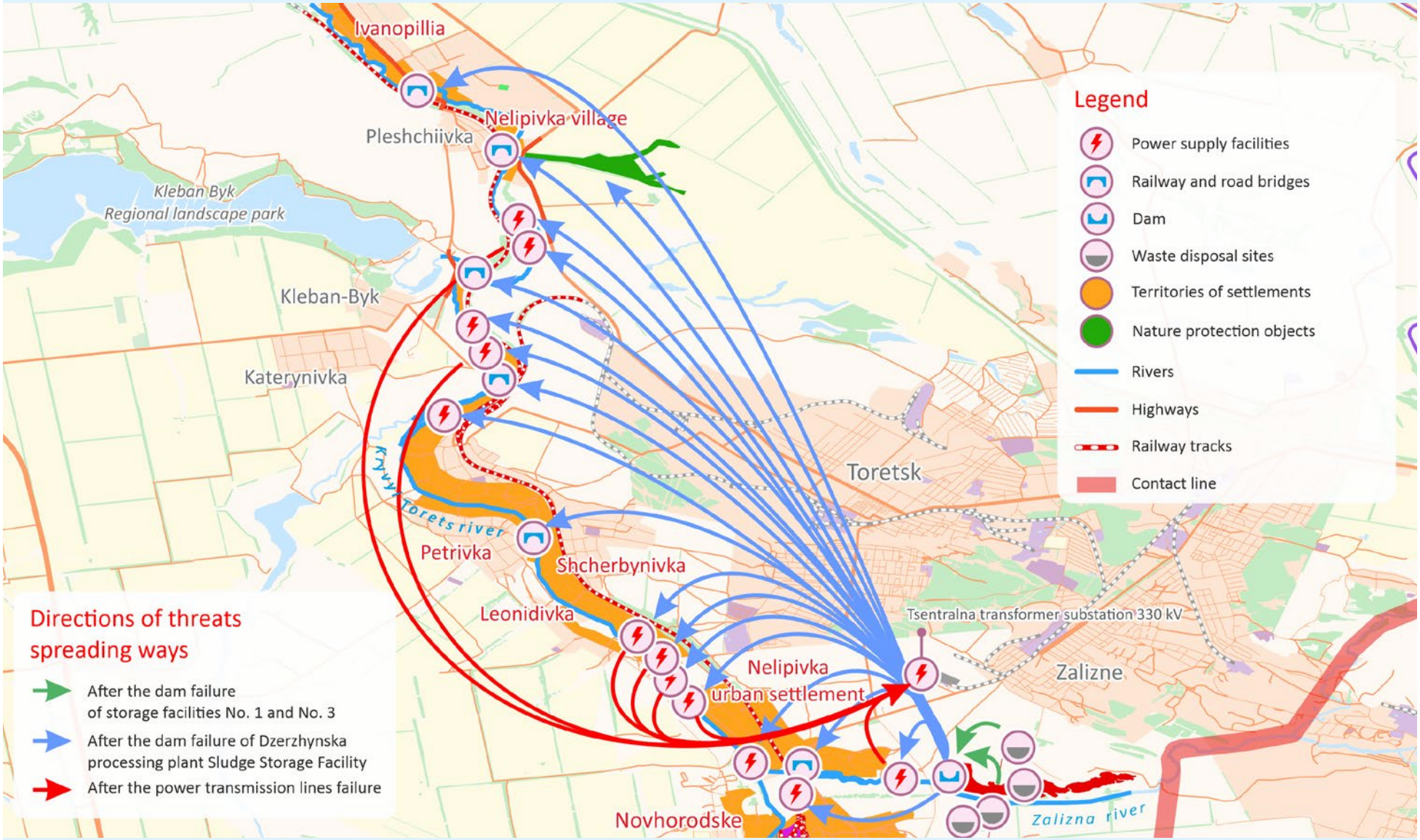

Figure 20. Domino effect under the dam failure of the SMA Inkor & Co sludge SFs No. 1 and No. 3

2.5.

MEASURES RECOMMENDED FOR IMPLEMENTATION BY SMA INKOR & Co

1. **Compliance with the operating conditions of sludge SF No. 1, whose waste contains hazardous gaseous emissions: phenol, naphthalene, formaldehyde:**

   1.1. Continuous monitoring of the air pollution level in the sludge SF No. 1 area – concentration of gaseous emissions of phenol, naphthalene, formaldehyde.

   1.2. Develop and take appropriate measures to prevent air pollution in the sludge SF area.

   1.3. Provide the staff with appropriate individual protection means.

2. **Proper operation of sludge SF No. 3**

   2.1. Monitor the uniform distribution of sludge and sufficient level of moisture in dry areas during facility operation.

   2.2. Avoid the critical level of filling the sludge SF No. 3 impoundment.

   2.3. Consider the possibility of using satellite monitoring of the dam stability to obtain field observation data on the facility state and to prevent and respond to emergencies in a timely manner.

3. **Install the appropriate warning signs in the sludge SFs area** ("danger zone", "passage and entry of unauthorized persons is prohibited").

4. **Ensure the preparedness of the enterprise for emergencies at the TSFs.**

   4.1. Revise and supplement the "Accident Localization and Response Plans" taking into account the results of threat identification under the probable accident scenarios provided in the Report on enterprise, including consideration of probable accident scenarios "fire" for sludge SFs No. 1 and No. 2, and "dam failure with a domino effect" for sludge SFs No. 1 and No. 3. Additionally, it is recommended to perform a flood risk assessment in case of emergency (modelling of the dam failure or overflow scenario).

5. **Perform the proper sludge SF No. 2 closure and rehabilitation of the disturbed lands.**

6. **Implement organizational, scientific, technical, and technological measures for maximum decontamination/disposal of the waste deposited in sludge SFs No. 1 and No. 3.**

3.

TAILINGS STORAGE FACILITIES RESEARCH

DZERZHYNSKA PROCESSING PLANT

3.1.

TSF OPERATOR LOCATION

The coal industry enterprise, Public Company "Dzerzhynska Processing Plant" (hereinafter "Dzerzhynska Processing Plant") is subordinated to the Ministry of Energy and Environmental Protection of Ukraine. The plant enriches coal for coking, produces coal concentrate for thermal power plants, and is located in Toretsk, Donetsk Region. The plant has two tailings storage facilities – sludge SF No. 1 and No. 2 located in the Siverskyi Donets river sub-basin area (*Fig. 21, 22*).

Sludge SF No. 1 is located in ≈ 40–50 m from residential buildings, which evidences a violation of the facility sanitary protection zone and a risk of air pollution in the residential housing area due to dusting from dehydrated areas of the sludge SF beaches.

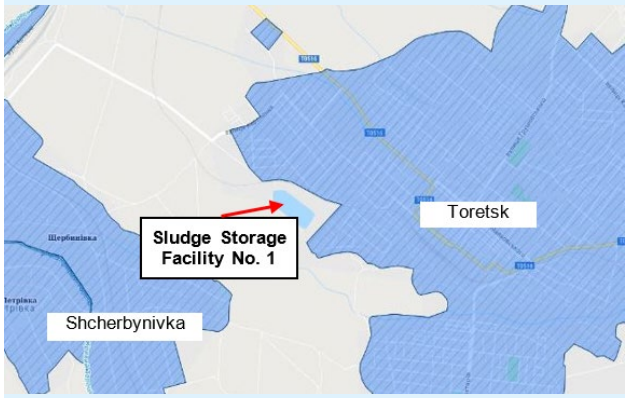

Figure 21. Sludge SF No. 1 location area

According to open data sources, in 2018, unknown persons carried out unauthorized excavation works on the territory of the facility and without providing the relevant permits[34], which poses a threat of facilities failure and loss of their stability with subsequent environment pollution.

Sludge SF No. 2 is located in the Yasynuvata District of the Donetsk region. Linear scheme of the hydrographic network: the Zalizna river – the Kryvyi Torets river – the Kazenyi Torets river – the Siverskyi Donets river – the Don river.

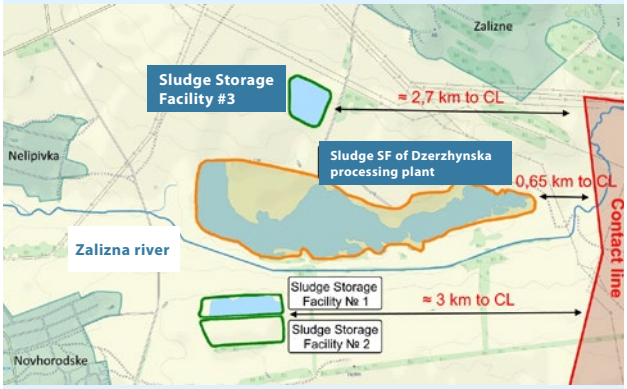

Figure 22. Location of sludge SF No. 2 relative to the contact line

Adverse climatic conditions and geological processes, typical for the territory of the TSF location, are:

- precipitation of rainstorm and local character, which can cause TSF overflow if the impoundment gets filled to a critical level
- seasonal storm winds which create an additional risk of environmental pollution due to small particles blown off the upper layer of "dry beaches" – areas with solid fractions of the TSF waste
- the groundwater belongs to the unprotected category, i.e. vulnerable to pollution
- excavation voids in the territory of sludge SF No. 2 location, which poses a threat of waste entering the voids during ground subsidence under the sludge SFs

34 According to the StopCor Information Portal, the publication dated 2 November 2018, posted at link

A peculiarity of sludge SF No. 2 location is availability of another enterprise's facilities at higher elevations – SMA Inkor & Co sludge SFs.

Other features of the facility area include proximity to the Zalizna river, residential housing area and transport communications of such settlements as town of Toretsk, township of Novhorodske, township of Nelipivka, town of Zalizne, and "Kleban Byk" regional landscape park and "Krovetska Ravine" national geological landmark.

Dzerzhynska Processing Plant sludge SF No. 2 is located in the Joint Forces Operation area, approximately 650 km from the contact line: because of the mined areas and active military actions, unimpeded safe access to the sludge SF is unavailable. **For 5 years since the beginning of the armed conflict, the enterprise has not been maintaining facility safety during its operation and has not been taking any measures to agree with the relevant agencies on safe access to the facility and to resume observations.** At the same time, SMA Inkor & Co, the operator of the closely located sludge SFs, periodically obtains approval for safe access to its facilities per procedures effective in the armed conflict area. Therefore, establishing communication with SMA Inkor & Co and the relevant agencies is an important step to ensure accident-free operation of sludge SF No. 2 under military actions.

3.2.

TSF CURRENT STATE

During the research, the company did not provide sufficient openness in cooperation with the Project experts, in particular:

- the site-visit to the enterprise was not agreed – the experts did not have the opportunity to inspect the entire infrastructure of sludge SF No. 2, the visual inspection of the facility was done at a distance while visiting the neighboring sludge SFs of SMA Inkor & Co
- the documentation was not provided in full
- interviewing of all the staff was not ensured – communication was carried out with one labor safety representative, without involvement of specialists from the operational and environmental services and civil protection specialists
- at the beginning of the project, the company did not report availability of sludge SF No. 1, this fact was found during the research of sludge SF No. 2. At the experts' request, a company representative informed that the facility was not in operation and that it was impossible to provide the documentation. **Therefore, the current state of sludge SF No. 1 was not researched.**

Over 47 years of operation[35] sludge SF No. 2 of Dzerzhynska Processing Plant accumulated 8.365 mln tons of coal processing waste (Waste Hazard Class IV), which is 52% of the facility design volume.

Toxic effects of the coal processing waste are manifested mainly in irritation of mucous membranes, chronic damage of the respiratory tract, and deposition of highly dispersed particles in the lungs[36].

35 Commissioned in 1972

36 The information on the toxic effects of the waste substances is provided per chemical reference books

At the same time, the chemical properties of the waste substances can change in an acid or alkaline environment: there are possible solubility reduction and changes in compounds toxicity in water. Thus, in case of an accident and waste penetration from the SMA Inkor & Co sludge SFs into Dzerzhynska Processing Plant sludge SF, chemical reactions between the constituent substances of "different environments" are possible: acid in the Inkor sludge SF No. 1, close to neutral in Dzerzhynska Processing Plant sludge SF No. 2, and alkaline in Inkor sludge SF No. 3 with formation of differently composed substances, which have to be investigated more thoroughly and taken into account for emergency planning.

Figure 23. Photo of Dzerzhynska Processing Plant sludge SF No. 2 from the dam of SMA Inkor & Co sludge SF No. 3

Partial TSF visual inspection in September 2019 allowed to determine the peculiarities of the facility location and visually examine its current state.

Main visual observations (*Fig. 23 – 25*):

- the facility is in a neglected state: the sludge SF flanks are not arranged, the drainage constructions are visually absent
- damage to the sludge SF pipeline was observed, which causes contaminated water to get discharged to the Zalizna river
- in the sludge SF No. 2 area there is a pump station, vehicle roads, and a power substation

Figure 24. Photo from Inkor sludge SF No. 1 dam. The light blue arrow is Dzerzhynska Processing Plant sludge SF, the blue one is Inkor sludge SF No. 3

Figure 25. **Sludge SF No. 2 and other facilities:** ❶ Inkor sludge SF No. 1, ❷ vehicle road, ❸ earthen reservoir, ❹ pump station, ❺ water intake tower. Photo: OSCE, 2019

Analysis of operational documentation management showed that the company has not developed the sludge SF operating instructions, waste passport, waste management plans, while the available documents – the Hydraulic Facilities Passport and the Waste Disposal Site Passport – need to be updated.

Application of the "Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety"[37] for Dzerzhynska Processing Plant TSF, which was limited by incompleteness of the data available[38], demonstrated that the relative safety level of sludge SF No. 2 is 30.7% (*Table 4*).

Table 4. Results of categorical evaluation of Dzerzhynska Processing Plant sludge SF No. 2 operation
(values below 50% are highlighted)

№	Category	Results of safety criteria compliance, %	Category significance (critical – extremely important)[38]
I	Geological, climatic and local conditions	**16.7**	non-critical
II	SF location plan	**28.6**	non-critical
III	Substances (waste volume and toxicity)	52.8	critical
IV	Dam and screens	**45.2**	critical
V	Transport and infrastructure	**29.6**	critical
VI	Water flow management	**46.7**	critical
VII	Environmental impact assessment	**0.0**	critical
VIII	Emergency Response Plan	**46.3**	critical
IX	Monitoring	**2.3**	critical
X	Training and personnel	**0.0**	non-critical
XI	Verification and reporting	50.6	non-critical
XII	Closure and rehabilitation	50.0	critical
	Overall result	**30.7**	–

The assessment shows a critically low "30.7%" overall rate on compliance of the sludge SF operational safety with the requirements of the environmental safety standards in all categories, which demonstrates systemic non-compliances in managing such facility in all the operation aspects. The value "0%" for the categories "Environmental Impact Assessment", "Training and Personnel" is due to lack of the data used to evaluate the category.

The value "2.3%" for the category "Monitoring" reflects lack of control and observation of the TSF safety and environmental monitoring (except for accounting and quality control of the return water from sludge SF No. 2 to the Zalizna river, see Section 3.3).

The company does not pay enough attention and resources to implement environmental safety measures for such a potentially hazardous facility in accordance with the environmental legislation of Ukraine.

The list of all the TSF operational non-compliances found during research and the measures on maintaining the facilities safety are provided in the Report on enterprise in the tabular form according to the scheme: "identified non-compliance" – "legislative criterion" – "corresponding recommendation". **Measures recommended for implementation by Dzerzhynska Processing Plant are provided below in Subsection 3.5. Issues related to the military actions are outlined in Section 5.**

37 "Methodology for Comprehensive Evaluation of Tailings Management Facilities Safety", the text in English is available on the German Environment Agency (UBA) web-page at the link

38 Visual inspection of the facility was performed at a distance, and the documentation was not provided in full. Insufficient data reduces the category assessment indicators

39 Critical categories are extremely important TSF safety categories, which relate mainly to technical aspects of facility operation and safety maintenance. Detection of non-compliance with the safety requirements in these categories requires urgent action. Non-critical categories relate to issues mostly concerned with documentation management and reporting and the facility personnel qualification level

3.3.

CONSIDERATION OF THE ANTHROPOGENIC PRESSURES FROM TSFS ON THE STATE OF WATER BODIES

The **SWB of the Zalizna river**[40], the Siverskyi Donets river sub-basin, is subject to the pressure from sludge SF No. 2 operation of Dzerzhynska Processing Plant (*Fig. 26*).

The company discharges the return water from sludge SF No. 2 into the Zalizna river, which flows into the Kryvyi Torets river. According to the company's documentation, the surface water quality is monitored at a station on the Kryvyi Torets river, and the Zalizna river surface water body is not considered an independent watercourse, thus, this surface water body is not monitored.

Due to the military actions, the company has not been monitoring groundwater and surface water since 2014; the unimpeded safe access to the sampling points on the water body and to the observation wells is unavailable.

According to WDS Passport of sludge SF No. 2, in 2000 it was recorded the exceeding of nitrite nitrogen (19.75 times), oil products (6 times), and phenols (2 times) in the surface waters of the Kryvyi Torets river.

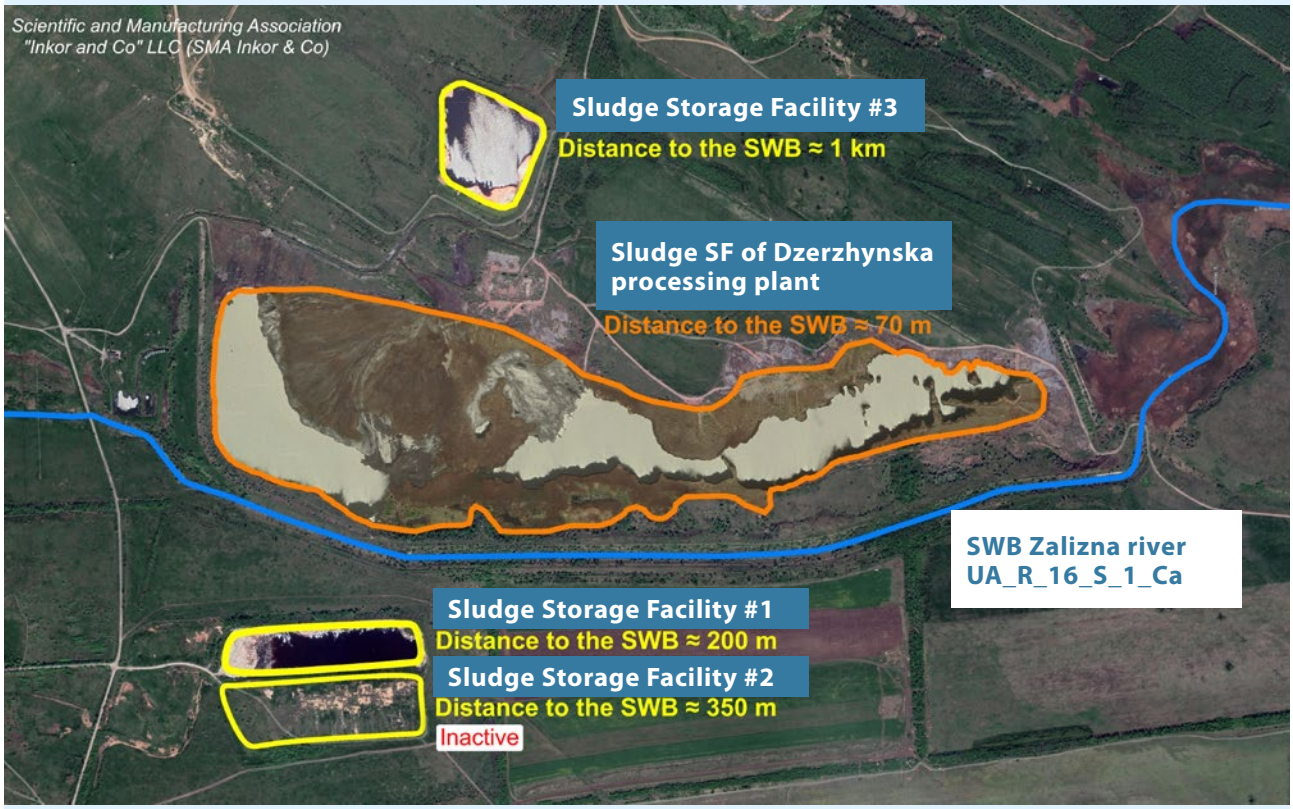

Figure 26. Location of Dzerzhynska Processing Plant sludge SF No. 2 in relation to the hydrographic network

40 SWB type code UA_R_16_S_1_CA, individual number UA_M6.5.1_0291

As of 2013, the norm was exceeded more than twice for the levels of mineralization, sulfates and chlorides. The data of the annual reports on water use based on the "2TP-vodhosp" template indicate the exceeding on the concentration of oil products and dry residue was exceeded in the return waters discharged from sludge SF No. 2 into the Zalizna river in 2016-2018.

The data of groundwater monitoring performed by the company are available only for 2000 – according to the WDS Passport, the norm of the following indicators was exceeded: ammonium nitrogen, iron, dry residue, phenols, chlorides, sulfates, bismuth, nitrite nitrogen. One-year only groundwater quality data do not reflect the current dynamics of pollutant concentrations in the groundwater in the sludge SF area.

At the same time, according to the state monitoring of the groundwater quality[41], in 2017 in the area of SMA Inkor & Co LLC sludge SFs, between which sludge SF No. 2 is located, MAC values were exceeded for the following indicators: ammonium (1.8 times), sulfates (1.8 times), nitrates (6.1 times), and dry residue (2.7 times).

Analysis quality state and determination of sludge SF No. 2 potential impact on the surface and groundwater is impossible due to lack of data – the information on the environmental pollution monitoring in the sludge SF No. 2 area performed by the company was provided only for two years with a long time interval between them (2000 and 2013).

The analytical scheme by the DPSIR indicators: Driver – Pressure – State – Impact – Response (provided in the Report on enterprise) is formed based on the results of a comprehensive study of Dzerzhynska Processing Plant sludge SF No. 2 (review of natural conditions and its location, waste volume and toxicity, study of the facilities' current state, analysis of the available monitoring results, Sections 3.1-3.3) and its anthropogenic pressure on the water bodies.

The review of the area's natural conditions, the specific character of the location, and the current state of the Dzerzhynska Processing Plant sludge SF allows to confirm the conclusion, formed under research of the SMA Inkor & Co sludge SFs (Section 2.3), about classifying the Zalizna river surface water body as at risk of failing to achieve the environmental objectives[42]. Measures recommended to the TSF operator (Subsection 3.5) and the competent authorities (Section 6) may be taken into account when developing the Don River Basin Management Plan for water body protection.

41 Data from the yearbook "State of Groundwater of Ukraine", DNVP "Geoinform of Ukraine", 2018

42 The term according to the Guidelines for Determining the Main Anthropogenic Pressures and Their Impacts on the State of Surface Waters, was approved by Protocol No. 2 at the Scientific and Technical Council meeting of the State Water Agency of Ukraine on 27 November 2018

3.4.

THREATS IDENTIFICATION UNDER THE PROBABLE ACCIDENT SCENARIOS AT TSFs

Due to the location of Dzerzhynska Processing Plant sludge SF No. 2 near the contact line, the facility is under threat of being hit with projectiles, and the industrial site area was mined. Such external military hazard drivers cause disruptions in the enterprise operation and emergency risks.

Among the past accidents at sludge SF No. 2 related to the military actions, the Questionnaire filled out by the company[43] stated destruction of the water intake tower and pipeline damage due to construction of fortifications, but detailed information on these accidents was not provided.

Dzerzhynska Processing Plant did not provide the project with sufficient information to identify threats. This Summary, however, provides an overview of possible accident scenarios for the SMA Inkor & Co sludge SFs located at a higher elevation in close proximity of Dzerzhynska Processing Plant sludge SF No. 2, which causes the formation of a domino effect area (see Section 2.4 above).

The review of the company's emergency preparedness at the TSFs shows that the Dzerzhynska Processing Plant has developed an Accident Elimination Plan, which contains accident scenarios for sludge SF No. 2. However, the Plan does not take into account all existing types of threats from the facility, including consideration of its location in the armed conflict area and between SMA Inkor & Co sludge SFs.

In particular, it is recommended that the Accident Response Plan be supplemented with accident consequences for sludge SF No. 2 from the determined scenarios with a domino effect at SMA Inkor & Co sludge SFs and vice versa – how the probable accident scenarios at sludge SF No. 2 will affect the SMA Inkor & Co facilities.

It was not possible to perform the analysis and comparison with the Emergency Response Plans developed by the government authorities (at the region, district, and city level) in the framework of this research due to lack of access to the said documentation[44].

43 Introductory Questionnaire on the operation of the Public Company "Dzerzhynska Processing Plant" TSFs, 2019

44 The requests to the executive authorities and local governments (Main Office of the State Emergency Service of Ukraine in the Donetsk Region, Donetsk Regional State Administration, Toretsk and Avdiivka Military-Civil Administrations, Yasynuvata District State Administration) did not result in receiving any Emergency Response Plans from any agency

3.5.

MEASURES RECOMMENDED FOR IMPLEMENTATION BY DZERZHYNSKA PROCESSING PLANT

1. **Establish interaction with the relevant agencies to obtain safe access to the entire infrastructure of the sludge SF, including observation wells, in accordance with the generally accepted procedures in the armed conflict area. If necessary, establish communication with the SMA Inkor & Co to jointly agree on access to the TSFs.**

2. **Perform regular control and observations of the sludge SF No. 2 safety state and environmental monitoring in the area of facility impact.**

3. **Proper operation of sludge SF No. 2.**

   3.1. Repair the damages in sludge SF No. 2 pipeline. Perform periodic observation of the pipeline state and timely repair.

   3.2. Consider the possibility of using satellite monitoring of the dam stability to obtain observation data on the facilities state and to prevent and respond to emergencies in a timely manner.

4. **Ensure the preparedness of the enterprise for emergencies at sludge SF No. 2.**

   4.1. Revise and supplement the "Accident Elimination Plan" considering the results of threat identification under the probable accident scenarios at SMA Inkor & Co sludge SFs which are provided in this Summary and which may lead to an accident at sludge SF No. 2 (domino effect). Additionally, it is recommended to perform a flood risk assessment in case of emergency (modelling of the dam failure or overflow scenario).

5. **Install the appropriate warning signs in the SF area ("danger zone", "passage and entry of unauthorized persons is prohibited").**

6. **Maintenance of operational documentation for sludge SFs.**

   6.1. Obtain a new permit for special water use in accordance with legislation.

   6.2. Ensure inclusion of the sludge SFs in the WDS register:

   - develop a WDS Passport for sludge SF No. 1 which is not operated
   - update the WDS Passport for sludge SF No. 2
   - submit the said WDS Passports to the Regional State Administration for approval
   - approval by the Regional State Administration of annual changes to the WDS Passport based on the company operation results

7. **Implement organizational, scientific, technical, and technological measures for maximum disposal of the waste deposited in the sludge SFs.**

OVERVIEW OF STATE POLICY ON EMERGENCY PREVENTION AND RESPONSE AT TAILINGS STORAGE FACILITIES UNDER THE MILITARY ACTIONS

4.

Accidents at TSFs can cause multi-million losses, and the cost of responding the consequences of accidents almost invariably exceeds the cost of ensuring proper facility safety and development of emergency protective and response measures.

A complex of special facilities and equipment for accumulation of large amounts of industrial waste, explosiveness and toxicity of the substances contained in this waste are internal hazard drivers, which, together with external hazard drivers, can lead to emergencies (*Fig. 27*).

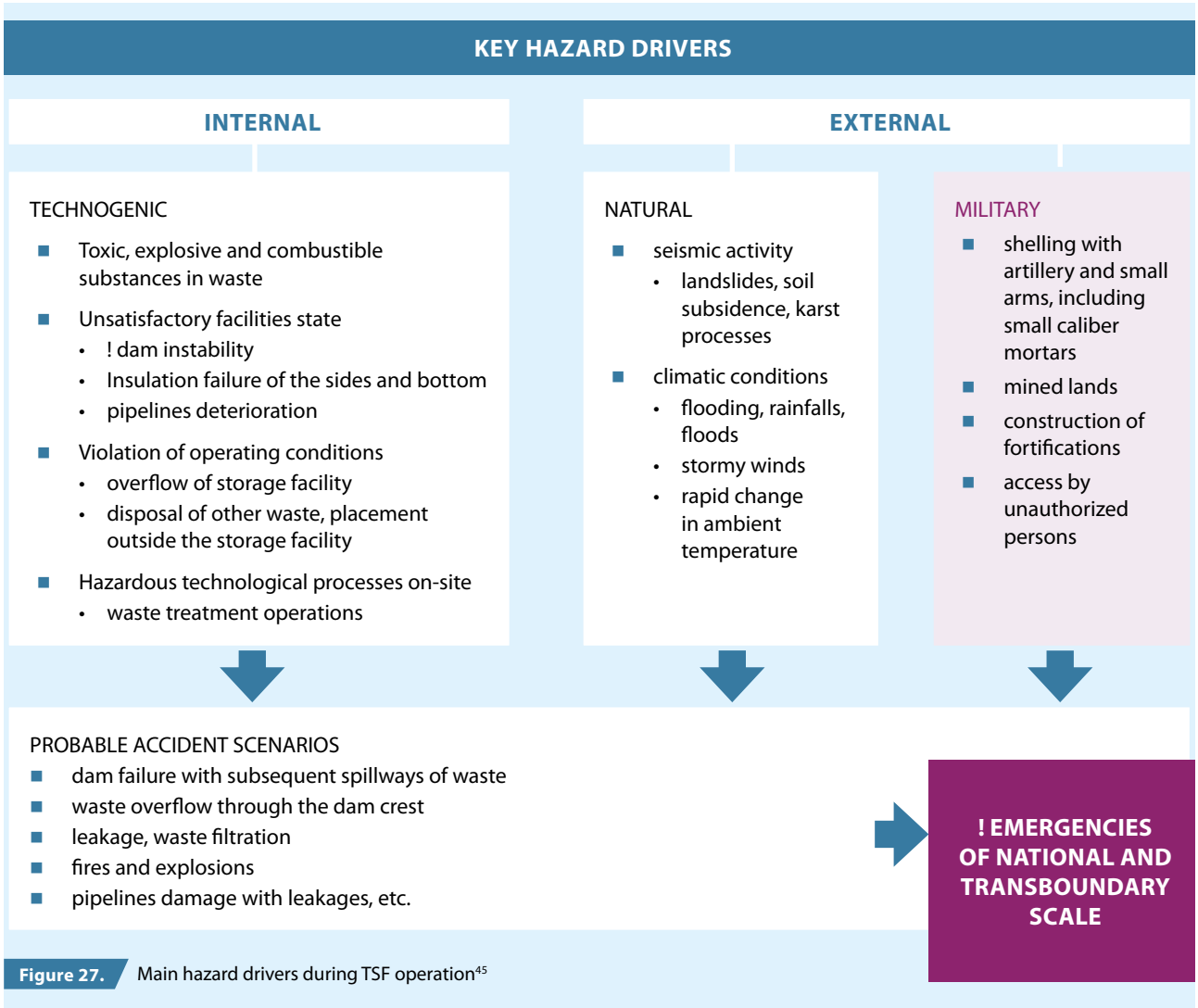

Figure 27. Main hazard drivers during TSF operation[45]

45 The scheme was formed using the terms indicated in the Methodology for Identification of Potentially Hazardous Facilities, approved by the Ministry of Emergency of Ukraine Order No. 98 dated 23.02.2006 and Regulation on Certification of Potentially Hazardous Facilities approved by the Ministry of Emergency of Ukraine Order No. 338 dated 18.12.2000

The location of the TSFs in the armed conflict area poses additional threats due to **external military hazard drivers**, which may trigger any accident scenario inherent in the action of technogenic or natural drivers.

The state policy on emergency prevention and response is implemented by the State Emergency Service of Ukraine, including organization of methodological support for emergency planning.

During the research, the Project parties discussed practical issues of developing Emergency Response Plans[46] at the level of the region, city, and district (Emergency Response Plans) and at the level of business entities – Accident Localization and Elimination of Accidents Consequences Plans at High-Hazard Facilities (ALEP) and Accident Elimination Plans (AEP). The review of the "Guidelines for Development of Civil Protection Plans" (Ukrainian Civil Protection Research Institute, 2015), analysis of the existing plans and discussions demonstrated shortcomings of the existing methodological approaches.

Development of the corresponding plans has gaps in the following aspects:

- consideration of all the probable accident scenarios, including:
  - military hazard drivers
  - flood risk assessment in case of an emergency (modelling of the dam failure or overflow scenario)
  - domino effect
- prevention of accidental transboundary water pollution

Industrial accidents at TSFs can lead to pollution of transboundary rivers, including the Siverskyi Donets river. Consideration of **the issues related to prevention of transboundary water pollution** is a necessary component in emergency response planning – in case of accidents at the TSFs of SMA Inkor & Co, PJSC Avdiivka Coke Plant and Dzerzhynska Processing Plant, the pollution area can reach water bodies on the territory controlled and uncontrolled by the Government of Ukraine, and that of the neighboring country – the Russian Federation. To date, the transboundary aspect is insufficiently reflected at the national legislative level[47].

In 2000, the Conference of the Parties to the Convention on the Transboundary Effects of Industrial Accidents introduced the UNECE Industrial Accident Notification System[48], through which countries, including Ukraine, can report such accidents and receive information from other countries, regularly publish updates, as well as request (mutual) assistance in case of any accidents (not only transboundary).

For the researched facilities, the experts identified the threats in case of probable accident scenarios at TSFs, which can be used to improve the Emergency Response Plans and the Accident Localization and Elimination of Accidents Consequences Plans at High-Hazard Facilities and Accident Elimination Plans (Sections 1.4, 2.4, 3.4 above).

46 Per Art. 130 of the Civil Protection Code of Ukraine and the Procedure for Development of Action Plans for the Unified State Civil Protection System approved by the Cabinet of Ministers Resolution No. 626 of 9 August 2017

47 According to the comparative analysis of the relevant national and European standards using the UNECE document "Checklist for Contingency Planning for Accidents Affecting Transboundary Waters (for competent authorities)", conducted under the Project. The analysis results are provided in the Reports on Enterprises

48 United Nations Industrial Accident Convention's Notification System website. The system is accessible to each communication point of the registered country. The system information and instructions are available at link

PROBLEMATIC ISSUES OF TSF SAFETY IN THE ARMED CONFLICT AREA WHICH REQUIRE STATE AND INTERNATIONAL TECHNICAL AND FINANCIAL SUPPORT

5.

Military actions in the area of TSF location cause obstacles to proper perform the works on facilities safety maintenance. As of September 2019, according to research results, the problematic issues of TSF safety in the armed conflict area are as follows.

1. MINED AREAS

DZERZHYNSKA PROCESSING PLANT

1.1. For 5 years since the beginning of the armed conflict, the company has not been maintaining the safety of sludge SF No. 2 which is operated for industrial waste disposal. No control and observation of its safety state is performed nor environmental monitoring.

PJSC AVDIIVKA COKE PLANT AND SMA INKOR & Co

1.2. Regular TSF safety control and observation:

- there is no periodic geodetic control over subsidence and displacement of facilities and their foundations, as well as the facilities' geometric parameters
- the position of the filtrated water level in the dams' body and the level of groundwater at the facilities' base are not measured
- the dam crest and downstream slopes are not cleared regularly from vegetation in order to perform visual observations of the facilities' state
- the hydraulic facilities of **PJSC Avdiivka Coke Plant** sludge SF are not inspected and certified regularly
- the proper state of the diverting ditch of **SMA Inkor & Co** sludge SF No. 3 is not ensured – it is not arranged from the side of **Dzerzhynska Processing Plant** sludge SF, no clearing is done to prevent overgrowth and siltation.

1.3. Environmental monitoring in the TSF area:

- there is no soils and groundwater quality control; the state of observation wells in the area of **PJSC Avdiivka Coke Plant** area is unknown
- surface water quality samples are not taken at the **PJSC Avdiivka Coke Plant** monitoring stations 500 m above and 500 m below the confluence of the Skotovata river (Kamianka) into the Ocheretova river, a tributary of the Kryvyi Torets river
- surface water quality in the Zalizna river area is not monitored; there is no quality control of soils in the area of **SMA Inkor & Co** sludge SF No. 1-3 and groundwater in the area of sludge SF No. 2.

1.4. It is difficult to find contractors for repair work, the problem is especially relevant in urgent need in case of emergency.

Ways to solve the issue:

Demining and continuous maintenance the safety of the company's industrial sites for regular control and observation of TSF safety state, environmental monitoring, and maintenance and repair during facilities operation

To SMA Inkor & Co, PJSC Avdiivka Coke Plant, and Dzerzhynska Processing Plant – prepare the materials on the demining territory and its area, which need to be submitted to the Ministry of Defense of Ukraine and agencies competent on these issues.

Parties relevant to the issue:

Ministry of Defense of Ukraine, State Emergency Service of Ukraine, international organizations SMA Inkor & Co, PJSC Avdiivka Coke Plant, Dzerzhynska Processing Plant.

2. ACTIVE MILITARY ACTIONS

SMA INKOR & Co

2.1 The company has to go through a lengthy procedure of obtaining approvals for safe access to the sludge SFs from several agencies and organizations: JCCC, OSCE SMM, and State Emergency Service of Ukraine, in order to inspect the facilities' state, take technical measures and perform environmental monitoring. Safe access is provided once a week. Moreover, the company has to begin the approval procedure 2 weeks before the access date and submit weekly notifications to the authorities on the visit results.

2.2 The company employees do not always have access to the observation wells in the downstream slopes of the dam.

2.3 The monitoring equipment (observation wells) is constantly been damaged by unauthorized persons, whereas it is impossible to take appropriate security measures under the armed conflict area conditions.

2.4 There is no emergency access to the facilities in case of accidents.

Ways to solve the issue:

Raise the issue on the special status of SMA Inkor & Co and Dzerzhynska Processing Plant TSFs as high-hazard facilities located in the armed conflict area

The issues of the maximum withdrawal of firing positions from objects and providing the permanent, unimpeded access to the objects are to be raised in negotiation processes. It is needed in order to perform the environmental monitoring, control and observation of facilities state, as well as for emergency access in case of accidents, that will probably affect the territories both controlled and uncontrolled by the Government of Ukraine, and the Russian Federation territory

Parties relevant to the issue:

Ministry of Defense of Ukraine, State Emergency Service of Ukraine, Ministry of Energy and Environmental Protection of Ukraine, Minsk Contact Group and international organizations (JCCC + OSCE SMM), SMA Inkor & Co, Dzerzhynska Processing Plant.

3. TSF DAMAGE IN RESULT OF MILITARY ACTIONS

SMA Inkor & Co

3.1 Emergency condition of the sludge SF No. 3 dam, which was partially damaged in result of military actions

- The dam is being banked up with loam, which does not provide proper stability of the facility. Clay, which is a more suitable material for reinforcement, is currently unavailable – the clay quarry is located on the territory uncontrolled by the Government of Ukraine
- In case of sludge SF No. 3 dam failure and waste leakage, the sludge discharge must be stopped immediately, the impoundment water level reduced as much as possible, and measures to be taken in accordance with the Accident Localization and Elimination Plan[49]. However, given the location of sludge SF No. 3 in the armed conflict area, the dam being in a critical condition, and a critical level of the impoundment filling, it is recommended to consider the technological possibility of arranging an emergency reservoir for waste capture.

Ways to solve the issue:

Ensure stability of the SMA Inkor & Co sludge SF No. 3 dam which was partially damaged in result of military actions

Parties relevant to the issue:

Ministry of Defense, State Emergency Service of Ukraine, international organizations (JCCC + OSCE SMM), SMA Inkor & Co.

4. DAMAGE TO INFRASTRUCTURE FACILITIES IN THE GRAY ZONE

PJSC Avdiivka Coke Plant

4.1 There is no supply of fresh service water to the plant due to two damaged water pipelines near the city of Horlivka. In this regard, the company has to repeatedly recycle the storage pond water which has become extremely mineralized (up to 5 g/dm^3), which in turn negatively affects the process equipment and, in case of failure of the storage pond facilities, creates a potential threat of flooding of the settlement and of environmental pollution.

Ways to solve the issue:

Resume fresh service water supply at PJSC Avdiivka Coke Plant – repair the water pipelines on the fifth rise near the city of Horlivka of the Donetsk Regional Production Office of Communal Enterprise "Donbas Water" located in the gray zone

Parties relevant to the issue:

Ministry of Defense, Donetsk Regional State Administration, Donetsk Regional Production Office of Communal Enterprise "Donbas Water" and international organizations, PJSC Avdiivka Coke Plant.

49 Per safety requirements for operation of TSF dams set forth in NPAOP 0.00-1.74-15. Labor Protection Rules during Operation of Tailings and Sludge Facilities of Ore Mining and Non-Metal Mining Enterprises

Mined territories and military actions hinder the companies' economic activities with proper compliance with the requirements of Ukrainian legislation in terms of technogenic and environmental safety (*Fig. 28*).

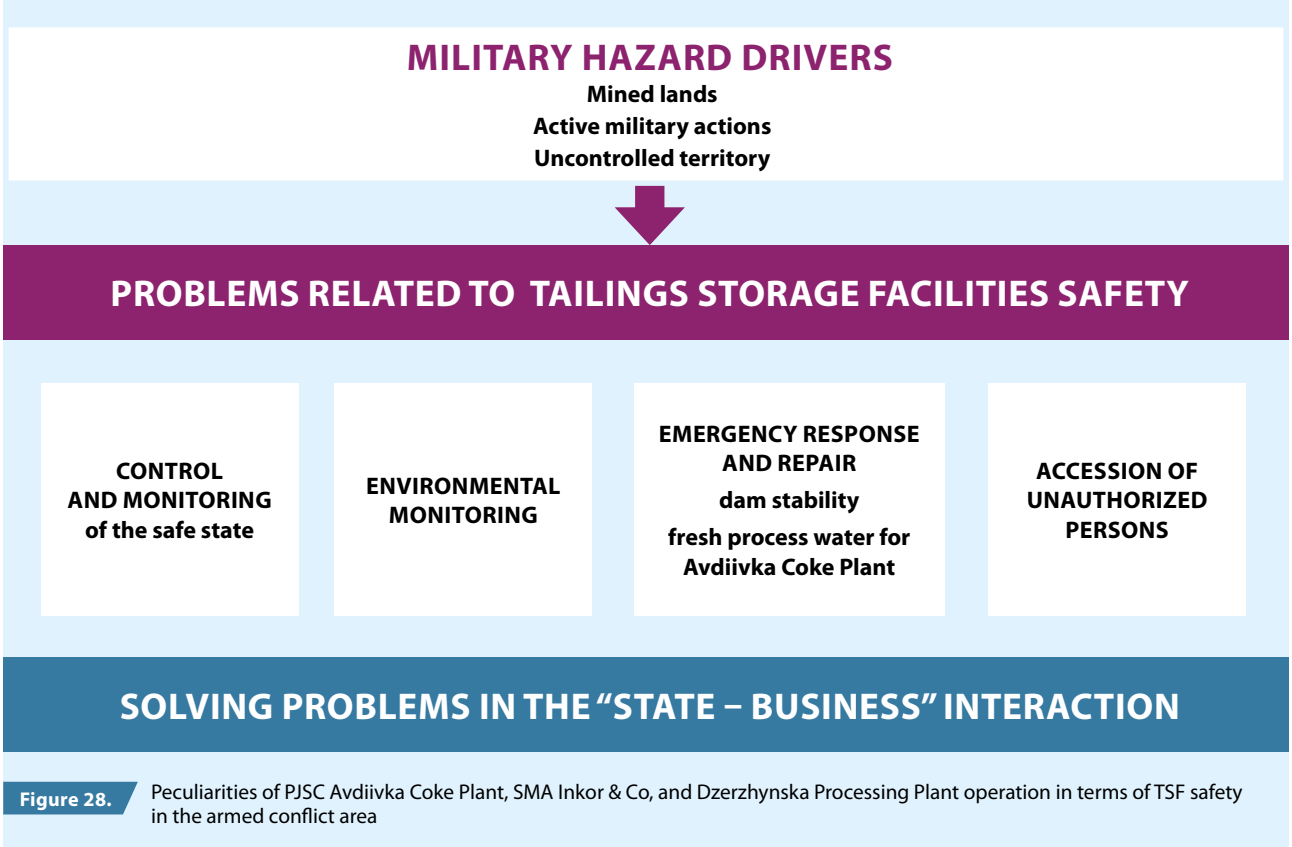

Figure 28. Peculiarities of PJSC Avdiivka Coke Plant, SMA Inkor & Co, and Dzerzhynska Processing Plant operation in terms of TSF safety in the armed conflict area

6. RECOMMENDATIONS TO COMPETENT AUTHORITIES

These recommendations are intended for the government authorities responsible for legislative regulation of such facilities as liquid industrial waste storage facilities (tailings storage facilities).

Such main central government authorities in Ukraine are:

- Ministry of Energy and Environmental Protection of Ukraine[50] which ensures formation and implementation of the state policy in the sphere of environmental safety, and
- State Emergency Service of Ukraine (SESU)[51] which implements the state policy in the sphere of technogenic safety

Regulation of TSF safety is also within the competence of such central and local government agencies as the State Agency of Water Resources of Ukraine, Siverskyi Donetsk Basin Water Administration, State Environmental Inspectorate of Ukraine, State Labor Service of Ukraine, Verkhovna Rada Committee on Environmental Policy and Nature Management, Regional State Administrations (Department of Ecology and Department of Civil Protection), and local governments (district, city, and village councils).

LIST OF RECOMMENDATIONS TO COMPETENT AUTHORITIES

Legislative and regulatory:

1. **Development of a TSF management system focused on their comprehensive safety maintenance should be ensured through development of legislation on industrial waste management and improvement of legislation on prevention of major accidents according to the European law: Directive EC – 2006/21/EC on the Management of Waste from Extractive Industries[52] and EU Directive 2012/18/EU on the Control of Major-Accident Hazards Involving Dangerous Substances (SEVESO III)[53], including development of appropriate methodologies.**

   It is also necessary to improve methodological support for planning the emergency response measures at TSFs in terms of consideration of all probable accident scenarios, including external military hazard drivers, flood risk assessment, and prevention of accidental transboundary water pollution (*Fig. 29*). Implementation of the Convention on Industrial Accidents is closely linked to implementation of the SEVESO III Directive. Adoption of the relevant Draft Law[54] will allow Ukraine to become a party to the Convention, which will help to improve the system of prevention, preparedness and response to transboundary industrial accidents, as well as exchange best practices in the sphere.

50 Ministry of Energy and Environmental Protection of Ukraine website

51 State Emergency Service of Ukraine website

52 Original title "Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries and amending Directive 2004/35/EC", the English version is available at the link

53 Original title "Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC", the English version is available at the link

54 Draft Law of Ukraine "On Ukraine's Accession to the Convention on the Transboundary Effects of Industrial Accidents" was published on 23 April 2019 on the SESU website in the Electronic Consultations with the Public section

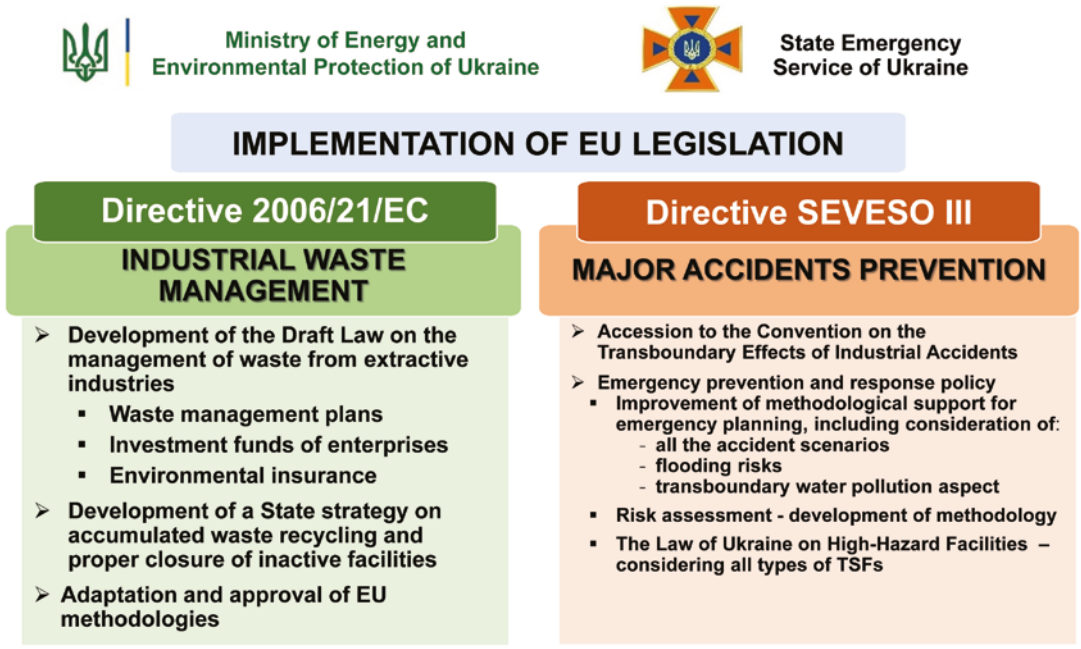

Figure 29. Recommendations for improving the legislative regulation of TSF operation

Organizational:

2. **Establishment of interaction and constructive dialog between the government authorities and TSF operators to implement the recommended measures on addressing the TSF operation non-compliances identified in the research.**

3. **Formation of an interagency working group to address operational issues of TSF safety in the armed conflict area with involvement of representatives of the central (Ministry of Energy and Environmental Protection of Ukraine, SESU) and local (Regional State Administration) authorities, TSF operators, and international organizations.**

4. **Improving interaction between the civil defense authorities and the enterprise as a business entity, considering the enterprise location in the armed conflict area:**

   4.1 Development, integration, and practice drills of emergency response plans (at the level of the region, city, district, and business entity) taking into account the issues of preventing transboundary accident water pollution.

5. **Improving the policy on major accident prevention in cooperation with TSF operators located in the armed conflict area[55]:**

   5.1 Introduction of dam stability satellite monitoring.

   5.2 Introduction of waste processing / decontamination technologies.

6. **Carrying out regular state supervision (control) measures of the enterprise compliance with the requirements of the current legislation concerning environmental protection and TSF safe operation.**

7. **Analysis of the surface and groundwater quality monitoring results in the TSF-affected area per enterprise reports and state water monitoring data with additional laboratory tests where necessary.**

55 Within the Project, experts reviewed companies with relevant experience, available technologies and facilities for processing industrial waste at the examined enterprises, as well as considered installation of dam stability monitoring systems with training of specialists for further independent use; a list of such companies is provided in the Report