Summary of Tailings Storage Facilities Research in the Dniester River Basin and in the Eastern Region of Ukraine

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Press conference, 2 March 2021

Introduction

Tailings Storage Facilities (TSFs) – storage of liquid industrial waste

Industries:

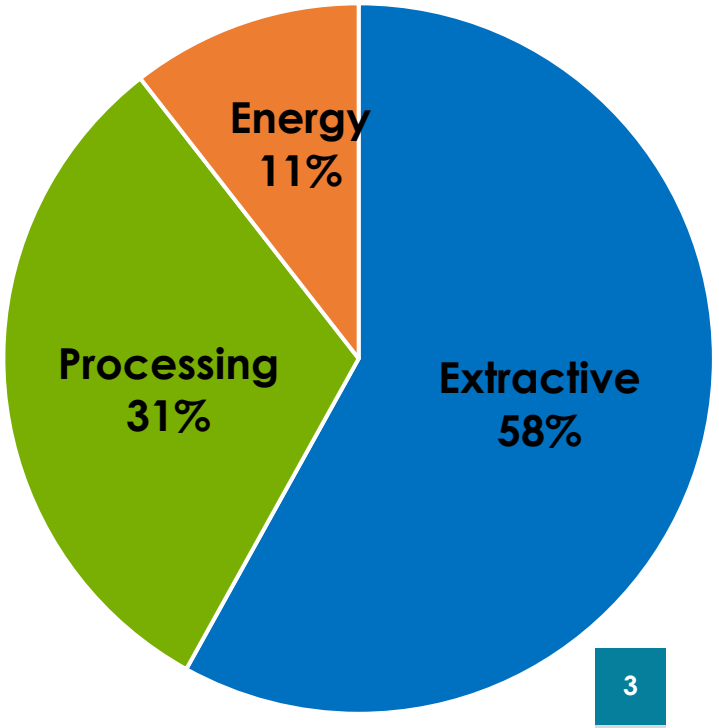
- **Extractive (270)**
- **Processing (146)**
  - Metallurgical (58)
  - Chemical (45)
  - Machine-building (15)
  - Oil refining (12)
  - Other (16)
- **Energy (49)**

Industrial waste other than waste from extractive industries
~ 2,5 billion tonnes

TSFs of Ukraine Database,2019
465 facilities - 6 billion tonnes

Commissioning year:
before 1980 (~60%)

Industries



TSFs HAZARD DRIVERS

INTERNAL

Facility operation

- Substances in waste
- **! structures' state** (dams, flanks, bottom insulation)
- Violation of operating conditions

EXTERNAL

Location

- Geological conditions and seismic intensity
- Hydrological conditions
- Climatic conditions

MILITARY

- Shelling
- Mining of territories
- Defensive constructions
- Unauthorized access

HAZARD TYPES

- fire
- chemical
- environmental
- hydrodynamic
- bacteriological

PROBABLE ACCIDENT SCENARIOS

- Dam failure with subsequent spillways of waste
- Waste overflow, leakage, filtration
- Fires and explosions
- pipelines failure, etc.

! EMERGENCIES of the national and transboundary scale

TSFs Inventory in the Dniester River Basin 2018-2020

Summary is published on the DNIESTER COMMISSION website

https://dniester-commission.com/en/news/large-scale-study-on-the-state-of-tailings-storage-facilities-in-the-dniester-basin/

TSFs IN THE DNIESTER RIVER BASIN

32 facilities

160 million tonnes of waste

Industries

EXTRACTIVE

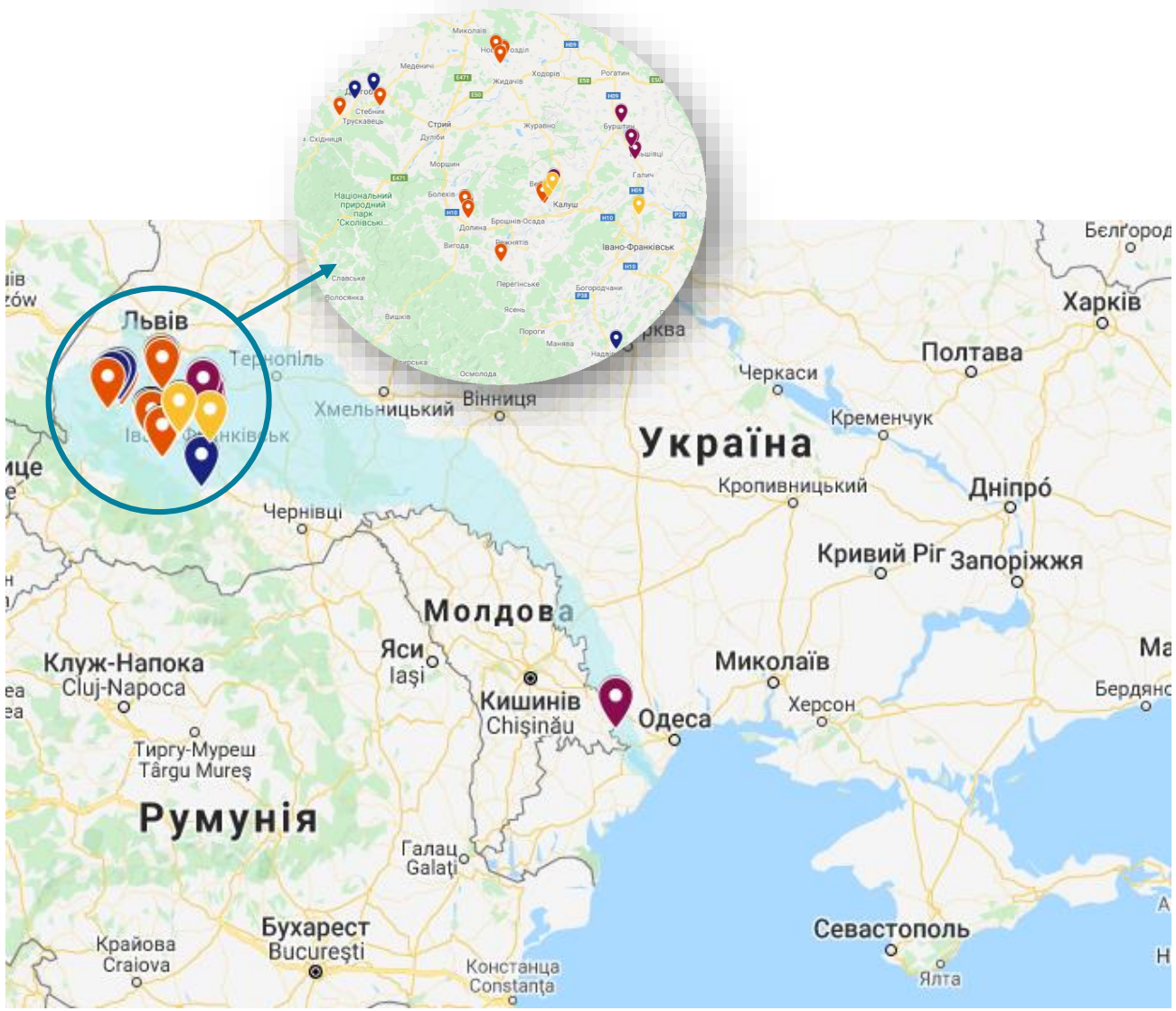
- **Oil and gas extraction**
  2 enterprises
- **Extraction of minerals for the chemical industry**
  3 enterprises

ENERGY

3 TPPs

PROCESSING

- **Oil refining**
  2 enterprises
- **Chemical**
  2 enterprises



PROCESSING INDUSTRY
Oil refining

EXTRACTIVE INDUSTRY
Oil and gas

WASTE

- **Oil sludge**
- **Gas emissions** – hydrocarbon vapors
- **Toxic impact of substances: significant** cardiovascular and endocrine systems impact, liver injury; ecosystem disruption

- **Critical filling level, overflow, waste infiltration**
- **Storage of waste on the ground**
- **Significant area of contaminated areas**
- **Improper closure of inactive objects**

Reuse, closure and rehabilitation is recommended

EXTRACTIVE INDUSTRY

Extraction of minerals for the chemical industry

Top 3 mining companies of the highest waste quantity in the Dniester river basin

POLYMINERAL (potash ores)

- **12.74 million m³** of waste -1 TSF
- karst processes
- non-operational project of mine No. 2 conservation using tailings from TSF

SIRKA (sulfur ores)

- **108.9 million** tonnes of waste- 3 TSFs
- **380 m to the Dniester river**
- sulfur storage, acid tars, municipal solid waste dump

ORIANA (potassium-magnesium ores)

- **26 million m³** of waste - 3 TSFs
- waste seeping
- overflow risk

PROBLEMATIC OF TSFs IN THE DNIESTER RIVER BASIN

- The proper technical condition is not ensured
- No environmental impact monitoring
- No proper closure of inactive facilities and land rehabilitation

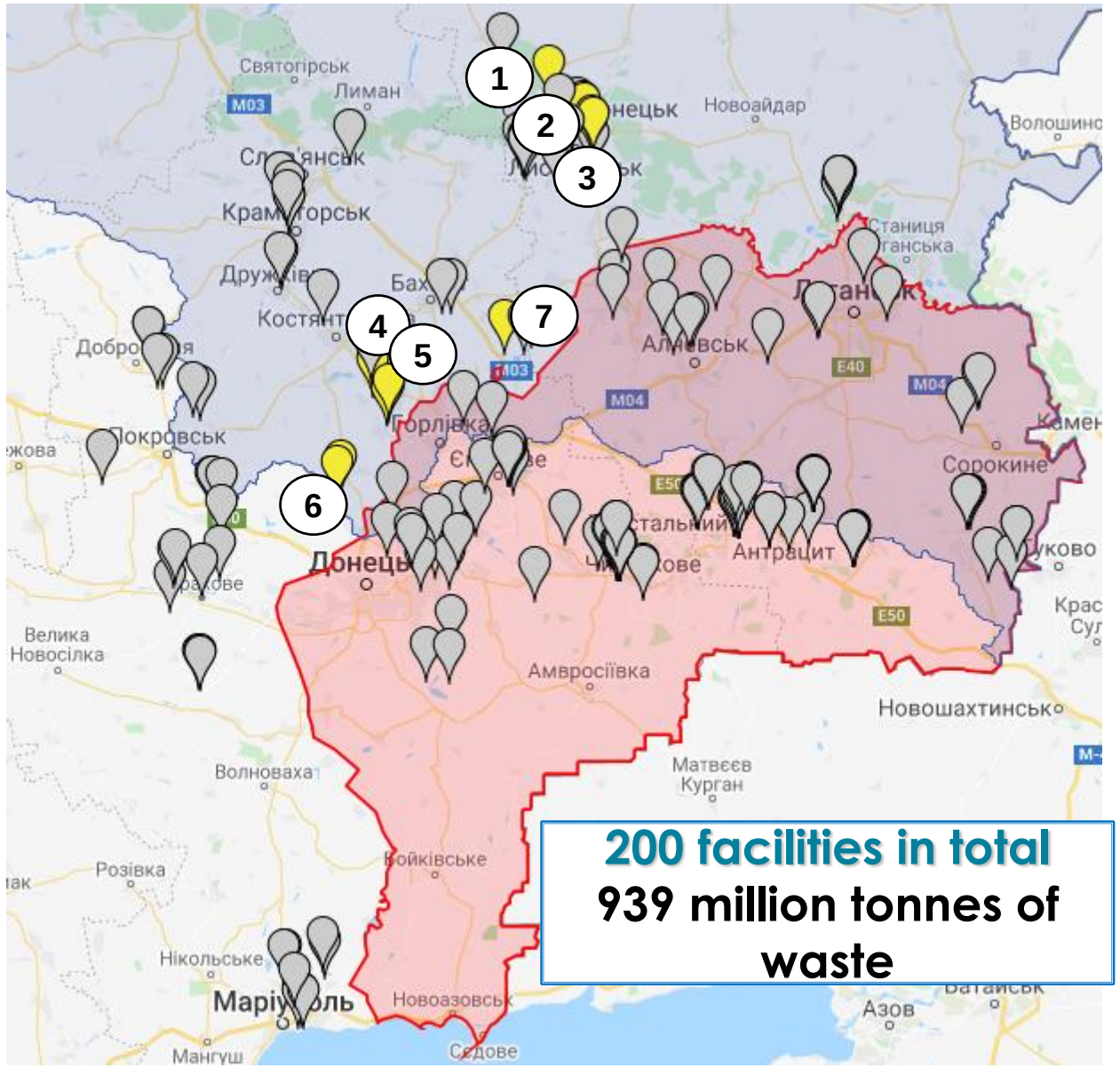
- **Excessive and unregulated industrial waste accumulation**
- **The low emergency preparedness level of TSF-operators**

THE SAFETY LEVEL DOES NOT MEET THE MINIMUM MODERN STANDARDS OF ENVIRONMENTAL AND TECHNOGENIC SAFETY

Research in the Eastern Region of Ukraine 2019, 2020

Summary is published on the OSCE Project Co-ordinator in Ukraine website
https://www.osce.org/uk/project-coordinator-in-ukraine/456847

Donbas TSFs Research



200 facilities in total
939 million tonnes of waste

17 facilities
28.8 million tonnes of waste

Luhansk region

1. Municipal Enterprise "Rubizhne Production Department of Water Supply and Sewerage" (TSF from "Rubizhne Krasytel" LLC)
2. PrJSC "Severodonetsk Azot Association"
3. Former enterprise "Lysychansk soda"

Donetsk region

4. SMA "Inkor and Co" LLC
5. Public Company "Dzerzhynska Processing Plant"
6. PrJSC "Avdiivka Coke Plant"
7. PrJSC "Bakhmut Agrarian Union" (BAU)

Luhansk region

- Rubizhanskyi TSF
- Soda TSFs

Rubizhanskyi TSF

TSF hazard drivers

Internal

- **unprofitable enterprise**
- no maintenance and monitoring
- structures deterioration
- evaporation and filtration of waste with toxic substances (- 33% over 10 years at section No. 5)
- unauthorized access: extraction of dam material, unknown technological works

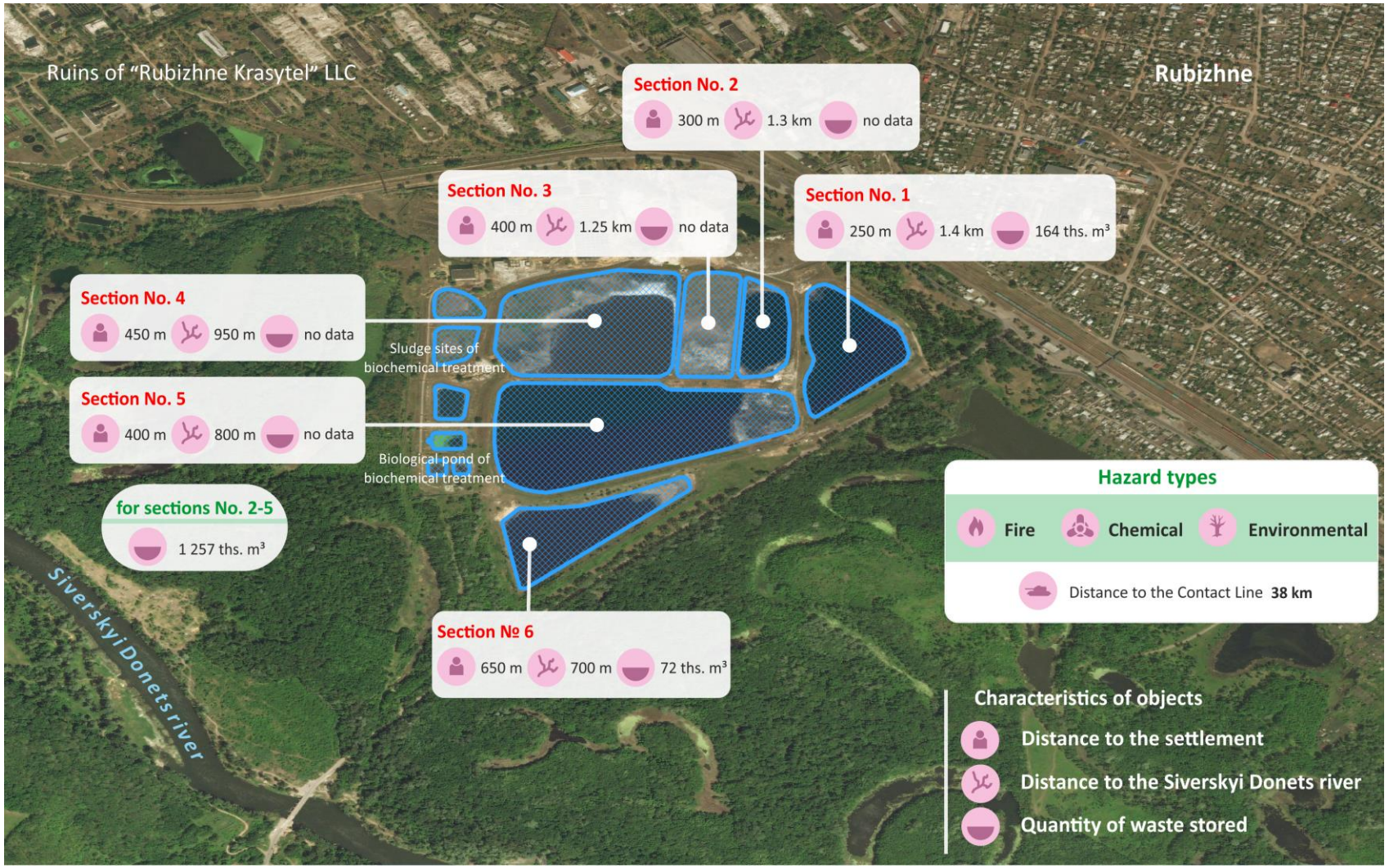
External

- seismically hazardous area
- **the Siverskyi Donets river - in ~1 km**
- **the groundwater level - 1.3-3.4 m**

On the balance sheet of the Water Supply and Sewerage company since **2009**
In operation up to 80 years (6 sections)
Waste

- 34 types of chemical production waste
- **1.7 million m³** (as of 2009)
- current quantity and composition of waste is unknown
- Gas emissions:
  nitric oxide (IV), hydrogen sulfide

Rubizhanskyi TSF
Threats identification



Probable accident scenarios

- Fire occurrence
- Dam local failure/ failure

Threats

- pollutants get into the air, soil, groundwater and the Siverskyi Donets River → **pollution of underground drinking water intakes**

Surface drinking water intake is upstream

Neutralization, closure and rehabilitation is recommended

Soda TSFs

TSFs hazard drivers

Internal

- **no balance holder**
- no maintenance and monitoring
- structures deterioration
- toxic substances in waste
- unauthorized access: waste removal from TSFs
- signs of TSF No. 1 instability

External

- seismically hazardous area
- **the Siverskyi Donets river - in ~ 0.06 km**

Military

- military trainings on TSFs site

The owner is unknown

4 inactive TSFs

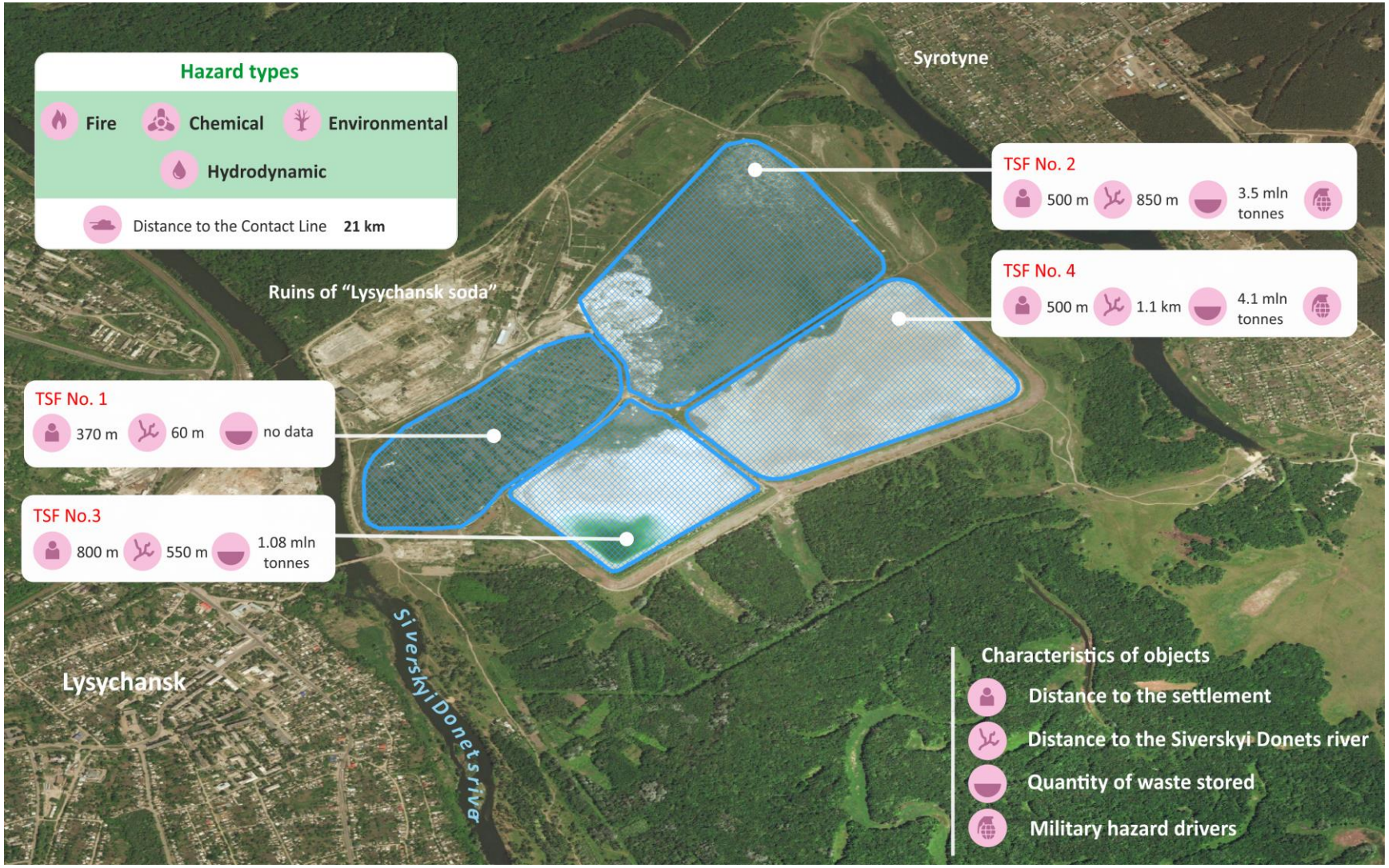
(2011 - the enterprise bankruptcy)

operational lifetime: ~40 years

Waste

- 8.7 million tonnes of soda production waste (TSF No.1 waste quantity is unknown)

Soda TSFs
Threats identification



Satellite monitoring of TSF No. 1 is recommended

Probable accident scenarios

- Fire occurrence
- Dams and slopes local failure/ failure

Threats

- The Siverskyi Donets riverbed blocking by the mudflow → Lysychansk town flooding, landslides

- pollutants get into the soil, groundwater and rivers

- destruction of infrastructure facilities

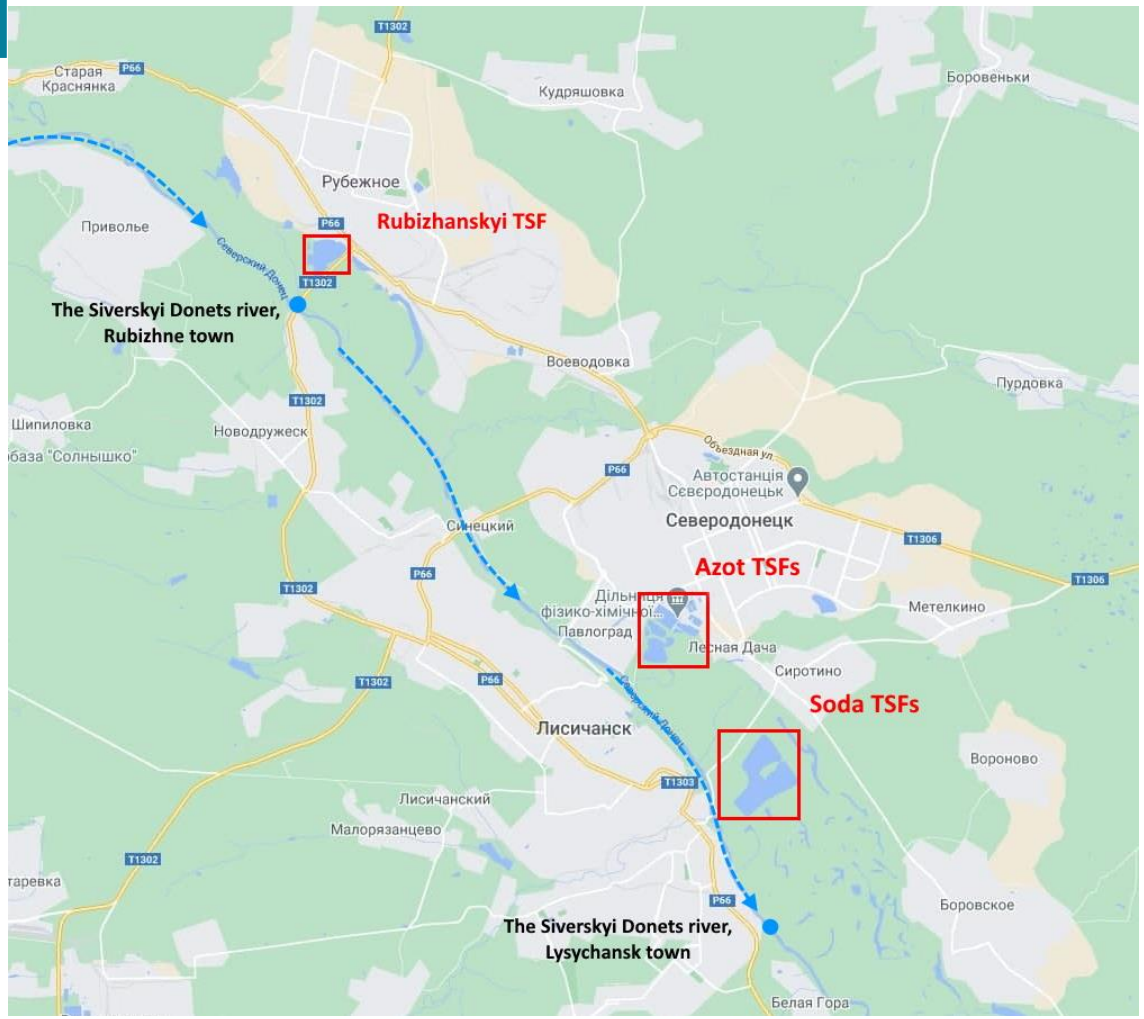
Anthropogenic pressure – qualitative status of water bodies

SURFACE WATER

- **SWB of the Siverskyi Donets river UA_M6.5.1_0007**
  - **"At risk"** by chemical and ecological status [the State Water Cadastre data]
- **The pressure on the Siverskyi Donets River increases downstream**
- The automated observation post is recommended

UNDERGROUND WATER

- **Underground water bodies UAM651Q101, UAM651K407, UAM651K409 and UAM651K410**
  - **"Bad"** quality status
- **Groundwater in the sites of TSFs is the most polluted in the Luhansk region**



Donetsk region

- SMA “Inkor and Co”
- Bakhmut Agrarian Union (BAU)

INKOR

TSFs hazard drivers

Internal

- toxic substances in waste
- TSF No. 3
  - Critical filling level
  - **narrow dam, signs of instability, damaged in result of the military actions**

External

- hydrological: the Zalizna river in ~ 200 m
- close location of Dzerzhynsk Processing Plant TSF in the lowlands

Military

- **on the contact line, active military actions**

shelling, mining of territories, unauthorized access

- No safe access for:

- regular control and monitoring
- dam repair works and emergency response

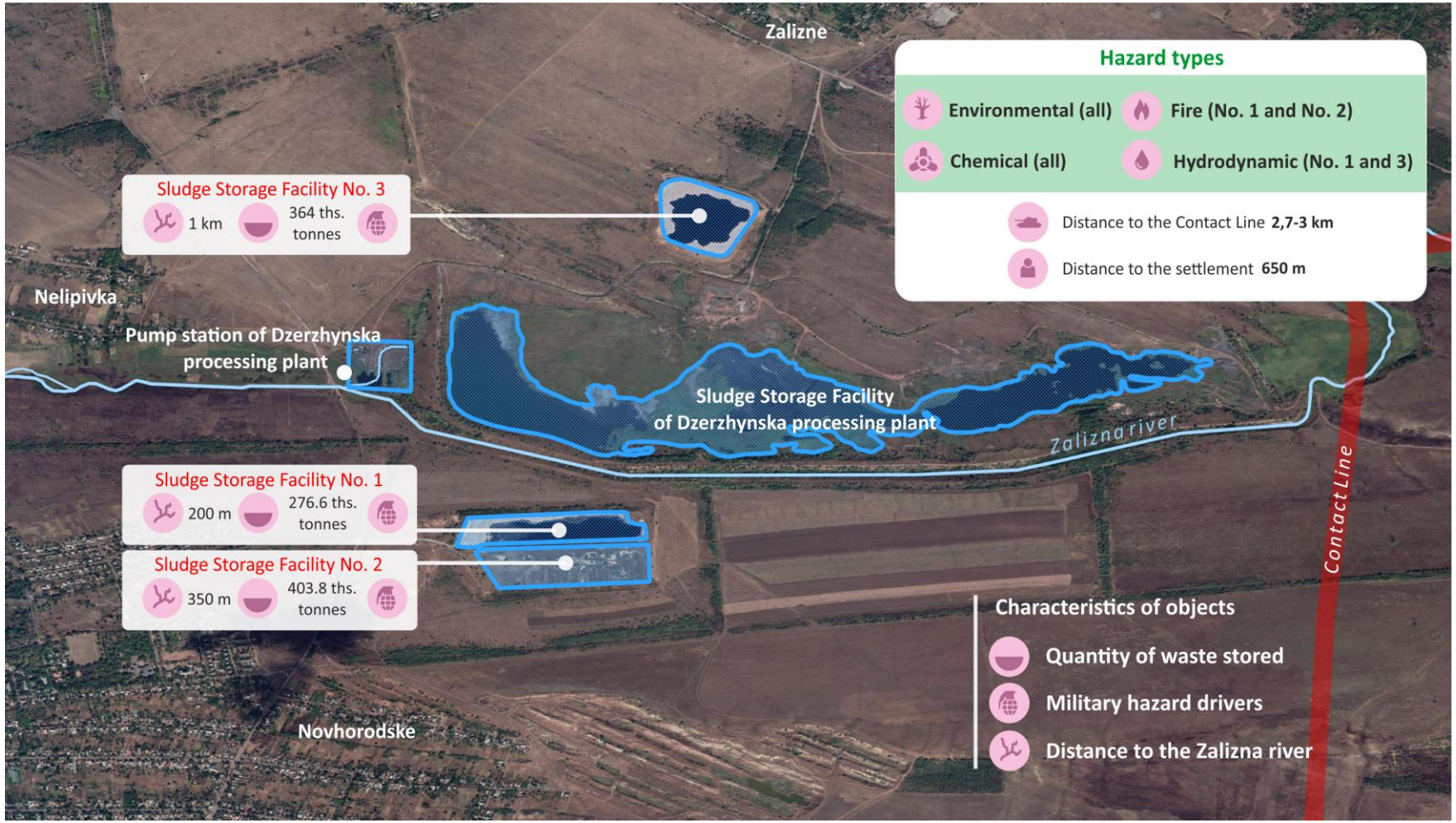
The processing of phenol- and naphthalene-containing raw materials enterprise

3 TSFs

Total 1.04 million tonnes of waste

- Gas emissions: phenol, naphthalene, formaldehyde

INKOR
Threats identification



Probable accident scenarios

- fire occurrence
- sludge pipeline failure
- TSF No. 3 dam local failure/ failure with a domino effect

Threats

- pollutants get into the soil and the Siverskyi Donets River
- destruction of infrastructure facilities

The pollutants flow time to the drinking water intake
[Siverskyi Donetsk Basin Water Administration]
from 3 to 8.5 days

Satellite monitoring of TSF No. 3 dam is recommended

BAU
TSFs hazard drivers

Internal
- toxic and pathogenic substances in waste
- outdated technologies and equipment (critical filling level)

External
- terrain features: slope from TSF towards water bodies

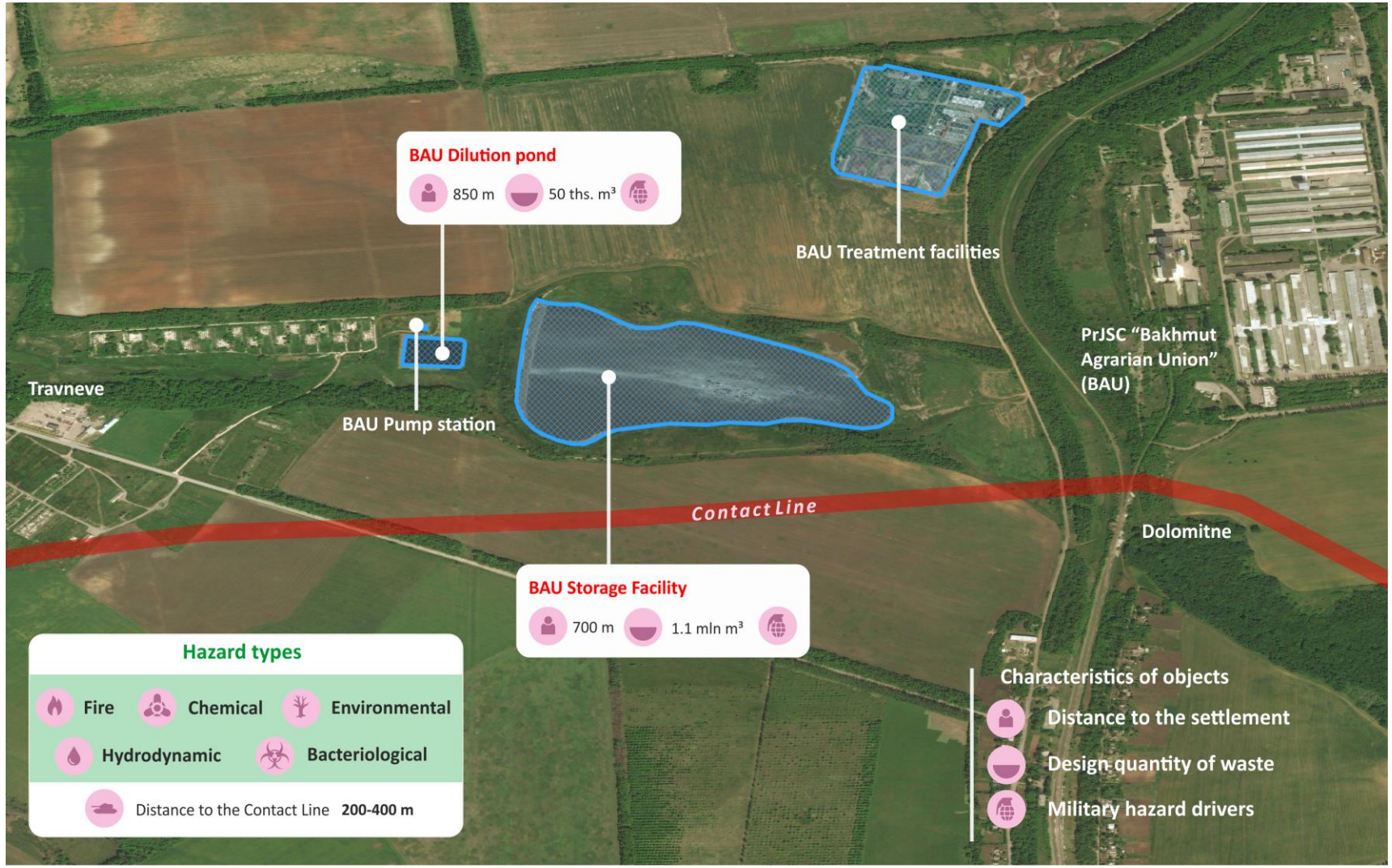
Military
- **on the contact line, active military actions,** shelling, mining of territories, unauthorized access
- No safe access for:

- regular control and monitoring
- damaged collector repair works and emergency response

Agricultural enterprise
1 TSF
- design capacity **1.1 million m³**

Waste
- animal by-products: purulent effluents
- Gas emissions: hydrogen sulfide, ammonia - pathogenic microorganisms

BAU
Threats identification



The joint search of the TSF located further from the contact line is recommended

Probable accident scenarios

- Fire occurrence
- Pipeline failure
- Dam local failure/ failure with a domino effect

Threats

- pollutants get into in the Bakhmutka river and the Siverskyi Donets river with mudflow

- destruction of infrastructure facilities

The pollutants flow time to the drinking water intake [Siverskyi Donetsk Basin Water Administration]
≈ 1- 3 days

Infectious-disease pathogens in purulent effluents -> epidemic outbreak

PROBLEMATIC OF TSFs OPERATED UNDER THE MILITARY ACTIONS

- Military activities
- Mined areas

No safe access for:

GROUNDWATER MONITORING	REPAIR WORKS	EMERGENCY RESPONSE	CONTROL of the facilities technical condition

✓ SOLVING PROBLEMS IN THE "STATE - BUSINESS" INTERACTION

Recommendations

Key recommendations for TSF-operators

EMERGENCY PREPAREDNESS

Technogenic safety

IMPROVING THE EMERGENCY PREPAREDNESS LEVEL ON TSFs

- Inclusion of TSFs in the list of Potential Hazard Objects, in the Risk Passports and in the Emergency Response Plans of the enterprises, regions, districts, with the consideration of probable accidents
- Practice drills (trainings) on emergency response interaction
- State classification of military emergencies

The moment of TSF's dam failure, Brazil, 2019.
© Source: The Guardian news

Preventing the drinking water sources pollution – groundwater and surface water of the transboundary the Dniester and the Siverskyi Donets rivers

Recommendations to the competent authorities

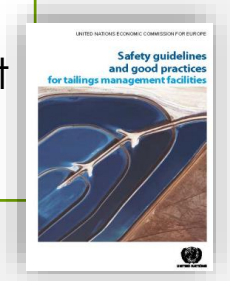
EUROPEAN STANDARDS ON TSFs SAFETY

Directive 2008/98/EC on waste

Directive 2006/21/EC on the management of waste from extractive industries

Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances

Safety Guidelines and Good Practices for Tailings Management Facilities, UNECE



ENVIRONMENTAL AND TECHNOGENIC SAFETY OF TSFs IN UKRAINE

DRAFT LAWS

INVENTORY - STATE ACCOUNTING

NATIONAL TSF SAFETY STANDARD

TSFs MANAGEMENT STRATEGY

! MANAGING TSFs OF ALL INDUSTRIES

Thank you for your attention!

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