Ecological aspect of the reintegration of the occupied territories of Donetsk and Lugansk regions

Donbas is one of the world’s largest coal mining technologically saturated regions, where the state of the environment has always caused serious concern among experts. Military aggression, economic crisis and ignoring of ecological risks by the “authorities” of the occupied territories in the near future can lead to catastrophic consequences.

The Ukrainian side for more than four years has no access to the territory seized by the militants, which does not allow to fully assess the damage done to the environment and take appropriate measures to respond to existing threats.

By the beginning of the military conflict, there were 4240 potentially dangerous objects (PDO) in Donbas, including 227 mines, 174 hydraulic facilities, 784 gas stations, 15 quarries, 13 railway stations, 128 bridges and overpasses, 18 main pipelines, 4 oil fields. 2160 objects were explosive, 24 - radiation, 1320 - fire, 176 - hydrodynamic, 34 - biologically and 334 chemically hazardous. Today, experts identified 176 PDOs, of which 99 are located on an uncontrolled territory.

Annex 1.

Statistics of accidents and violations of the operating mode at industrial enterprises during the military conflict in Donbas in 2014-2017
Among the many industrial enterprises that were damaged as a result of the combat, the following production proved to be the most environmentally dangerous: Yasinovsky, Avdeyevsky and Enakievo coke plants, Enakievo, Makeyevka and Donetsk metallurgical plants, Alchevsk metallurgical plant, Lisichansk oil refinery, Donetsk state chemical plant, Slavic, Luhansk, Uglegorskaya and Mironovskaya thermal power plants, chemical enterprises - the Severodonetsk plant ‘Azot’ and Gorlovsky ‘Stirol’.

The majority of industrial enterprises suffered during the period of active hostilities in 2014-2015. In 2016-2017, according to the National Security and Defense Council of Ukraine, the intensity of military operations has significantly decreased. During this period, the damage was caused to the Avdeevka Coke Plant, the Toretsky Phenolic Plant, the Donetsk State Chemical Plant, the Stakhanov Ferroalloy Plant and other enterprises located near the contact line.

Due to the lack of power supply and damage to the equipment, processes of flooding of mines in the area of Donetsk, Gorlovka, Yenakiyevo and Zolotoy
Наслідки військових дій:

- затоплення шахт та вихід шахтних вод на поверхню, проникнення у підземні води;
- руйнування очисних споруд;
- хімічне та радіаційне забруднення водних ресурсів;
- забруднення атмосферного повітря та ґрунтів;
- розриви снарядів та розсіювання хімічних речовин;
- руйнування міць зберігання небезпечних хімічних речовин, відходів, їх незаймання;
- знищення ландшафтів, рослинності;
- знищення значних площ лісів;
- ініціація масштабних пожеж;
Appendix 2
Pollution of surface and groundwater in the Donbas region

The data of the Center for Humanitarian Dialogue on the quality of groundwater confirmed the high level of pollution, but the lack of comparison of the results of measurements with background or historical values does not allow us to draw conclusions about the direct influence of the military conflict.

However, a comparison of the data of the Seversko-Donetsk IWRM on the content of metals in the bottom sediments of the Karlovsky and Kleban-Bitsky reservoirs with the situation before the outbreak of the conflict (in 2008) showed an increased (in 5 times) content of non-radioactive strontium, as well as a significant increase in barium concentration (in 13-15 thousand times). All these substances are used in industry, at the same time they are also known as standard components of modern ammunition.

The results of a study of the possible impact of the conflict in eastern Ukraine on the quality of surface waters and the dynamics of their changes also did not allow to clearly establish the consequences of such an impact.

Elevated concentrations of biogenic elements (mineral forms of nitrogen and phosphorus) in water as Seversky Donets River, and other rivers that were explored. A significant increase in the nitrogen concentration in the Kleban-Bik River, beginning in 2015, may be a consequence of the pollution of the river by sewage.

The increased content of nitric nitrogen in comparison with the Seversky Donets River was noted in the water of the Kazeny Torec and Krivoi Torec rivers: its
content fluctuated around 20 mg / dm³ since 2013, and this can also indicate the contamination of water with nitrogen compounds from sewage.

“Intercept” local emergency pollution is extremely difficult. When neutralizing the source of contamination (restoration of destroyed treatment facilities, etc.), and also due to the ability of natural waters to self-clean, the concentration of hydrochemical indicators will subsequently return to emergency levels. To identify short-term actions, which include fighting, more mobile means of operational monitoring are needed.

**Damage to water pipes and sewage treatment plants.**

Since the beginning of the armed conflict, the operation of water supply and water purification and sanitation facilities has been repeatedly disrupted and suspended, creating conditions for spontaneous accidental pollution. Cases of damage to communal sewage and water networks were recorded in most settlements along the line of contact.

In early January 2017, for damages in the Gorlovka-Toretskoye waterworks, water floods the Artyom and Yuzhnoye mines as a result of the shelling. Methane gas rises to the surface, which enters the cellars of residential and industrial buildings, which can lead to explosions and poisoning of people. Every day about 12 thousand m³ of water flows from the water pipeline. Because of this, almost 35 thousand inhabitants of the city receive water only two hours a day.

Especially threatening situation is in the summer, when the probability of an epidemic of infectious diseases increases.

According to available data, during the period 2014-2017, the violation of the work was also recorded at the most important objects of the water supply system of
the region - the Seversky Donets-Donbass, Mariupol, Enakievo, Gorlovka, Slavyanska, Western filter stations, the South Donbass, the Second Donetsk, Aidarskaya, Molodogvardeyska, Kondrashevsky water pipes and other objects.

11 June 2015, as a result of the powerful shelling of Gorlovka the only working pipeline Seversky Donets – Donbass was damaged. The missiles hit the territory of Gorlovka filtering station №2, as a result of which the station was completely de-energized - the transmission line and the switchgear were damaged. Without water, the towns of Gorlovka and Dzerzhinsk remained.

Fires were recorded at the water supply facilities where chlorine was stored - the Donetsk filtering station and the Verkhnokalmysky filter station.

11 August 2016, Dokuchaevske Department of Water and Sewerage because of shelling can not resume work, which can lead to an outbreak of infectious diseases and soil pollution. The territory of the sewage treatment plants of enterprises is located close to the demarcation line. Five settlements had no water because of the lack of permission to repair from the occupants.

In 2016, the wastewater from the Bahmut Agrarian Union overflowed due to the inability of their timely maintenance.

Annex 3.

Violation of mine terms of exploitation and their flooding
Before the conflict in the Eastern Ukraine, 150 coal mines were exploited or worked in a drainage regime.

In the Donetsk region, as a result of the conflict, interruptions in the operation of enterprises or pumping equipment were recorded in the Komsomolets Donbassa, Lidiivka, Vuglegirska, Chervonyi Profintern, Bulavinskaya, Olkhovatska, Trudovskaya, Chelyuskinsev and other

In Luhansk oblast, the Sukhodolskaya-Vostochnaya, Privolnyanska, Nikanor-Nova, Kyivska, Dovzhanska-Capitalna, Centrospilka, Kharkivska, Chervonyi Partizan, Samsonivska-Zakhidna, Pershotravneva, Proletarska, Bilorechenska, Frunze, Vakhrusheva, Cosmonavitiv, Dzerzhinskyi, Sverdlov and others like that.

The cases of infrastructure damage and the disconnection of coal-mining enterprises from electricity were repeatedly recorded, which led to the shutdown of mine water drainage systems, and in some cases to full flooding of the mines.

Today, the distillery does not work practically throughout the territory from the city of Gorlovka to the city of Enakievo, in the district of Pervomaysk, partially - in the cities of Donetsk, Makeyevka, Shahtorsk, Toretsk.

36 mines in the region are being flooded or already completely flooded and are not subject to further exploitation. Flooding of mines and adjoining territories is one of the main causes of potential pollution of underground and surface water by iron, chlorides, sulfates, other mineral salts and heavy metals.

A particular threat is the flooding of mines used as waste storage facilities - Olexandr-Zakhid, Vuglegirska and Kalinin in Gorlovka, Donetsk region.
Annex 4.

**Sedimentation of soils**

The inevitable consequence of large-scale flooding of mines is the flooding of surrounding areas and the sinking of the surface of the land decommissioning buildings, structures and communications, including underground gas pipelines, sewage and water supply systems and elements of the water supply system of Donbas.

Within the city of Donetsk, the area of flooded land is about 31% (5180 hectares) of the total area of the city, in Makiyivka 42% (1690 hectares).

According to satellite monitoring, the territory of Donetsk has already sown by 20-25 cm.

Significant sedimentation of soil is recorded:
not far from the mines in the Kyiv region (Donetsk) - 53 cm;
in Kalininsky district (Donetsk) - 69 cm;
in Petrovsky district (Donetsk) - up to 92 cm;
near the Shcheglovskaya mine (Makiyivka) - 52 cm;
Mining area (Makiyivka) - 63 cm,
and in other places.
Annex 5.

Chemical contamination of the territory of combat actions

Detailed field surveys of chemical pollution in the zone of conflict in the East of Ukraine were carried out by three organizations: "Ecology. Right. Human (ERH) in 2014 (Soil, Surface Water), Center for Humanitarian Dialogue (CHD) in 2016 (groundwaters, soils), Siversky-Donetsk water resources management (SDWRM) within the framework of the OSCE Project Co-ordinator's study in Ukraine (soils, bottom sediments).
According to the ERH data, the content of heavy metals in soil samples taken at combat sites (mostly in funnel for a short time after the cessation of hostilities) in most cases exceeded the background value by 1.2-12 times.

According to CHD, of the seven studied metals, only the content of cadmium (in 4.4 times) and lead (an average of 1.2 times) exceeded regional values.

On the basis of the results of analysis, performed by the Laboratory of the Siverskyi-Donetsk WRM in 2017, averaged as for 10 sites, which were affected by combat actions, the values of the indicators of chemical pollution in general were equal to the background value from adjacent territories with similar factors of influence, with the exception of the impact of hostilities.
Systematic excess in 1.1-1.3 times was observed in mercury, vanadium, cadmium, nonradioactive strontium and gamma-radiation.

The typical maximum excess for some indicators was 1.2-2 times from the background, and only in some cases reached 7-17 times for samples taken in Slavyansk. In some cases, background values were exceeded by more than 100 times.
Результати дослідження ґрунтів свідчають про значний вміст важких металів на місці розривів снарядів. Так, концентрація титану у пробі ґрунту на місці розриву снаряду на території степового заповідника «Крейдова флора» у 1500 разів перевищує фонові концентрації цього металу. Концентрація ванадію у цій пробі становить 100 мг/кг, для порівняння у чистій пробі ванадій відсутній. Виявлено також перевищення по сульфатах у 2,3 рази, рухомих формах важких металів: свинцю – 1,3 рази, кадмію – 1,5 рази.
Із графіків помітно, що концентрація діоксидів сірки та нітрогену в кілька разів перевищує гранично допустимі показники, що чітко корелює з обстрілами міста Щастя з кінця липня до кінця серпня. Зокрема, 13 серпня концентрація діоксиду сірки перевищила ГДК в 5 разів, а 14 серпня – у 8 разів.

Виявлено перевищення по стронцію на місці розривів снарядів у с. Закітне, концентрація якого становить 150 мг/кг, на місці утворення воронки площею 12 м2. У цій же пробі ґрунту перевищення по сульфатах сягає більш, як у 4 рази відносно фонових концентрацій, по кадмію – у 9 разів.

Annex 6.

Radiation pollution
In the occupied territories of Donbas there are dangerous objects that can cause the spread of radiation in the region.

In particular, in the case of violations of the current regime of drainage, non-exploited mines used to store hazardous and radioactive waste become hazardous, including "Olexandr-Zahid", "Vuglegirskaya", Kalinin mine and "Yunyi Communar"

On 16 June 2016, an explosion broke out in the Donetsk state plant of chemical products, near which the storage of radiation substances is located. This cemetery was built in 1958 and has been staying in an emergency state for many years.

In case of its depressurization, there is a threat of radioactive contamination of the environment and the Karliv Water Reserve, which supplies water to Donetsk.

**Radiation state of surface waters.**
Radiological studies were conducted in 18 sections, including:

- in the basin of the Siverskyi Donets - in 11 sections (4 along the route; 7 divisions in the sub-basins of the river: Kazennyi Torets, Bakhmutka, Krivoy Torets and Kleban-Bykske water storage);
- in the rivers of Azov basin in 3 sections;
- in the Samara river basin (Dnipro river basin) - in 4 sections.

In 2016, the average annual content of artificial strontium-90 and cesium-137 radionuclides in the rivers was:

- in the basin of the river Seversky Donets it fluctuated: by strontium-90 from 0.021 to 0.029 Bq / dm3 and by cesium-137 from 0.0305 to 0.0425 Bq/dm3, which is significantly lower than the established standards ‘Permissible levels of radionuclide content 137Cs and 90Sr in food and drinking water’(2.0 Bq/dm3);
in the basin of the Kalmius River fluctuated: by strontium-90 from 0.026 to 0.0275 Bq / dm³ and by cesium-137 from 0.0355 to 0.0363 Bq/dm³;
in the basin of the Samara River fluctuated: by strontium-90 from 0.0235 to 0.027 Bq / dm³ and by cesium-37 from 0.032 to 0.0395 Bq/dm³.

Annex 7.

Pollution of agricultural lands, the preservation of the natural reserve and the destruction of the forest area.
The greatest risks for forest plantations in the east of Ukraine are forest fires that arise from explosions of ammunition or deliberate arson associated with the tactics of warfare. As a result of fires caused by military actions, the plantations along the collision line suffered the most.

According to the representatives of the Donetsk and Lugansk regional forestry and hunting departments, fire statistics are now only available in safe remote areas, and therefore the only safe way to estimate the number of fires in the zone of a military conflict is the analysis of satellite data.

In general, in the Donetsk and Luhansk oblasts in 2014, MODIS recorded 12,518 plant fires, including 4,867 fires in the area of combat actions.
Притаманно збільшення кількості пожеж у зоні АТО є збіг кількох факторів:

- пасушилий сезон, що традиційно співпрацює з регіоном збільшення кількості загоряння сухої рослинності;
- неможливість гасіння пожеж (розвинена пожежна техніка, ліси й степи замішані, постійно тікати обстріли);
- велика кількість загорянь від вибухів;
- а також умисні підпалі в тактичних цілях.

За час АТО на сході України відбулось щонайменше 3000 пожеж*: у 15 разів більше, ніж у 2013 році.

*Дослідження виконане з використанням матеріалу дистанційного зондування землі MODIS (NASA) — terra.nasa.gov, (C) МБО «Екологія-Праця-Людина», 2014
Пожежі, викликані військовими діями, пошкодили 17% (2970 км²) площі рослинного покриву зони АТО*

*Дослідження виконано за законометричного матеріалу, отриманого дослідниками.

Щільність лісових пожеж в липні-серпні 2014 року
- Максимальна
- Мінімальна
Загалом на Донеччині і Луганщині створено 305 об’єктів природно-заповідного фонду. Більше половини таких об’єктів Луганщини, і близько третини заповідників Донецької області – знаходяться заряд або тимчасово знаходилось у зоні бойових дій АТО. Зокрема, це всі наявні в регіоні природні заповідники – Луганський та Український степовий, і всі національні природні парки – Святі гори і Меотида.
Військові дії на Сході України призвели до руйнування цілісних природних ландшафтів. Забруднення води, грунтів, атмосферного повітря, знищення біоресурсів є величезними і в часі реабілітації цих об’єктів довкілля триватиме доволі значний період. Відсутність можливостей надії контролю усієї території, фактичної відсутності контролюючих органів та постійна обстріль на дозволяють об’єктивно оцінити шкоду, нанесену довкіллю за період збройних нападів. З кожним наступним днем війни, масштаби екологічних наслідків стають усе більше, а їхне попередження чи ліквідація – усе важче уявити.

Важливим фактором пошкодження заповідних територій є обстріли та вибухи снарядів, що суттєво пошкоджують ландшафт, знищують рослинність і фауну.

Пошкодження територій обстрілами виявлено в НПП "Святі гори", відділеннях Українського степового заповідника "Кальміуське" та "Крейдяна флора", регіональних ландшафтних парках (РЛП) "Донецький крає" та "Слав'янський курорт", заказниках "Луганський", "Пристенське", "Крейдяне", "Білгородський", "Перевальський".

Під час будівництва бліндаців, траншей і критих окопів в нацпарку "Святі гори", було вирубано велику кількість лісу.
Annex 8.

Pollution of atmospheric air

Examples of indirect effects of combat actions include the changes in the quality of atmospheric air in the vicinity of the Luhansk thermal power plant (TPP). The estimation of air pollution data in 2014, obtained from two automated control posts located in the city of Shchastya of the Luhansk region, did not show a significant increase in concentrations of pollutants in the air of the city during the period of active combat operations.

On the other hand, according to DTEK’s energy holding, after the bridge’s blast in Nova Kondrashivka, coal supply at the TPP was stopped, and shortly thereafter, due to damage to the transmission lines, the Lugansk TPP was isolated from the grid of Ukraine.

As a result, the power plant, which provides electricity to more than 90% of consumers in the Luhansk region, was forced to independently adjust the frequency of the grid, using available high-sulfur and high-salt coal, which led to a sharp deterioration in the quality of atmospheric air.