



ENVIRONMENT – PEOPLE – LAW

Military Conflict in Eastern Ukraine – Civilization Challenges to Humanity





ENVIRONMENT – PEOPLE – LAW

**MILITARY CONFLICT
IN EASTERN UKRAINE – CIVILIZATION
CHALLENGES TO HUMANITY**

Lviv • 2015

Universal Decimal Classification 504.9
Bibliographic classification 20.1(4Укр)
В 63

AUTHORS:

Ol'ha Melen'-Zabramna, Sofia Shutiak — p. 1

(Ol'ha Melen'-Zabramna — subchapter 1.1, Sofia Shutiak — subchapter 1.2);

Alla Voytsikhovska, Kateryna Norenko, Oleksiy Vasyliuk — p. 2

(Alla Voytsikhovska — subchapters 2.1, 2.2, 2.4, 2.7, Kateryna Norenko — subchapter 2.3, Oleksiy Vasyliuk — subchapters 2.5, 2.6);

Kateryna Norenko, Alla Voytsikhovska, Oleksiy Vasyliuk, Oksana Nahorna — p. 3

(Kateryna Norenko — subchapters 3.1, 3.3.1, 3.3.2,
Alla Voytsikhovska — subchapter 3.2, Oleksiy Vasyliuk — subchapter 3.4,
Oksana Nahorna — subchapter. 3.5);

Kateryna Norenko, Alla Voytsikhovska — p. 4

(Kateryna Norenko — subchapter 4.1, Alla Voytsikhovska — subchapter 4.2).

Recommendations by *Alla Voytsikhovska, Olena Kravchenko*

Edited by Olena Kravchenko

Design: *Olena Zhinchyna*

В 63 Воєнні дії на сході України — цивілізаційні виклики людству. / Львів: ЕПЛ, 2015. — 124 с.

The manual offers studies by International Charitable Environmental Law Organization «Environment-People-Law» (EPL) on the impact of military operations on the environment in eastern Ukraine, evaluation of damage caused to the environment, provides key environmental features in Donetsk and Luhansk regions before the conflict, investigates factors about pollution and destruction of environmental objects caused by military actions, including air, soil and water pollution, forest fires, destruction of protected sites, provides the analysis of international studies of damage caused to the environment as a result of military conflict conducted by international organizations in post-conflict countries, lists key aspects of national and international environmental law during hostilities. The manual is designed for civil servants, representatives of civil society and for all who care about environment protection, health and life in eastern Ukraine for present and future generations.

Universal Decimal Classification 504.9
Bibliographic classification 20.1(4Укр)

© ICO «Environment-People-Law», 2015 «Military Conflict in Eastern Ukraine — Civilization Challenges to Humanity». All rights reserved. Widespread use of materials is encouraged. With any use of materials — «Military Conflict in Eastern Ukraine — Civilization Challenges to Humanity» — reference to the source is required. Materials in the manual cannot be used for commercial purposes in whole or in part in any form, in electronic or printed form, including photocopies.

CONTENTS

INTRODUCTION	7
 CHAPTER 1.	
LEGAL REGULATION of ENVIRONMENT PROTECTION during MILITARY CONFLICT	9
1.1. International Legal Regulation of Environment Protection during Military Conflict.	10
1.2 Key Aspects of National Legislation.	23
 CHAPTER 2.	
A BRIEF OUTLINE of the STATE of ENVIRONMENT in DONETSK and LUHANSK REGIONS before the BEGINNING of MILITARY ACTIONS in UKRAINE'S EAST...	47
2.1. Water Resources	48
2.2. Mineral Wealth	49
2.3. The Atmosphere	51
2.4. Land Resources	53
2.5. Biodiversity	54
2.6. Nature Reserve Fund	55
2.7. Waste.	56

CHAPTER 3.

THE EPL RESEARCH ON THE POLLUTION AND DESTRUCTION OF NATURAL ENVIRONMENTAL LOCATIONS AND FACILITIES IN UKRAINE'S EAST AS A RESULT OF MILITARY ACTIONS, AND DAMAGE EVALUATION	58
3.1. Changes in the Atmosphere According to the Results of Monitoring	59
3.2. Water and Soil Research and Waste Disposal	60
3.3. Fires	83
3.3.1. Environmental Impacts of Fires	83
3.3.2. Fires at Chemical Plants	94
3.4. The Impact of the Hostilities on the Nature Reserve Fund of Ukraine in Eastern Ukraine	99
3.5. Mineral Wealth and the Area of the Hostilities in Eastern Ukraine	101

CHAPTER 4.

ASSESSMENT METHODS OF DAMAGE CAUSED TO THE ENVIRONMENT AS A RESULT OF HOSTILITIES.	104
4.1. Post-conflict Environmental Assessment Based on International Practice	104
4.2. Methodology of Evaluation of Damage Caused to the Environmental Objects as a Result of the Hostilities in Eastern Ukraine	113
CONCLUSIONS	114
RECOMMENDATIONS OF EPL TO CEB (CENTRAL EXECUTIVE BODIES).	116

ABBREVIATIONS

ACS — Automated Control Systems
NASA — National Aeronautics and Space Administration
ATO — Anti-Terrorist Operation
WHO — World Health Organization
MIS — Military Industrial Sector
CPC — critical permissible concentration
SEI of Ukraine — State Environmental Inspectorate of Ukraine
SES — State Emergency Service of Ukraine
IRS — ionizing radiation source
ERS — Earth remote sensing
AF RF — Armed Forces of the Russian Federation
AFU — Armed Forces of Ukraine
CMU — Cabinet of Ministers of Ukraine
UNCLOS — UN Convention on the Law of the Sea
«LNR» — so-called «People's Republic of Luhansk»
MakNDI — Makiivka State Research Institute of Safety in the Mining Industry
EPL — International Charitable Organization «Environment-People-Law»
MHC of Ukraine — Ministry of Health Care of Ukraine
Ministry of Environment — Ministry of Environment and Natural Resources of Ukraine
ORP — Oil Refinery Plant
NNP — National Nature Park
UNO — United Nations Organization
POL — fuel and oil materials (petroleum, oil and lubricants)
NRF — Nature Reserve Fund
UNEP — the United Nations Environment Programme
UNDP — the United Nations Development Program
RLP — Regional Landscape Park
RF — the Russian Federation
SanPiN — Sanitary Regulations and Norms
SSU — Security Service of Ukraine
SDW — solid domestic waste
CHP — Combined heat and power plant

INTRODUCTION

Environmental protection, rational use of natural resources, environmental security is an essential condition for sustainable economic and social development of Ukraine. To achieve this aim, Ukraine carries out environmental policy aimed at nature conservation and environment protection, achievement of harmonious interaction between society and nature, conservation, rational use and renewal of natural resources.

When there is an armed conflict, people die and get heavily injured, it may seem for some people that it is not the best time to raise the issues related to the environmental damage. The urgent task is to save people. But it is only one, visible side of the hostilities. And there is another, invisible side of any armed conflict, which results in many years of gradual deterioration of human health and the environment. It happens due to the fact that dangerous substances, which have been accumulating for many years, penetrate into the human body through water, air and food and lead to fatal diseases and death, affect reproductive function, the ability of biological organisms to perform their function, have negative impact on the economic development of the region affected by hostilities.

Military actions in eastern Ukraine led to many additional social and humanitarian problems. One of the most pressing problems that require urgent solution is environmental one. Lack of control over the entire territory of Donetsk and Luhansk regions, real absence of regulatory bodies and constant shootings do not allow to objectively evaluate the damage caused to the environment by the armed confrontation. The risks related to damaged communications, enterprises and other facilities of high environmental hazard are of particular importance as lack of control and possibility to eliminate their negative effects potentially increase the scale of negative impact¹.

Nowadays there is considerable human pressure due to military operations in eastern Ukraine. In particular, artillery shelling caused fire at several environmentally hazardous productions of Avdiivka and Yasyniv Coke and Chemical Plants, Lysychansk Oil Refinery Plant and Kramatorsk Heavy Machine Tool Building Plant «Tochmash» and «Stirol»²; and due to emergency electricity cutoff significant amount of hazardous substances was emitted in the air; there is air and soil pollution by chemicals due to the use of different weapons and burning chemicals; large areas of land resources, fertile soil, vegetation, protected areas, including flora

¹ <http://epl.org.ua/ekologija/dovkillja-ta-viina/doslidzhennja-epl/viiskova-agresija-ruinuje-dovkillja/>

² <http://ua.interfax.com.ua/news/general/220110.html>

and fauna, are damaged; central farm of Luhansk steppe reserve is seized and destroyed by militants; mines are flooded; water treatment facilities are damaged and left without power, discharge of industrial and domestic water was carried out without any treatment; sewerage networks are damaged; highways and public service infrastructure on collection and removal of solid waste is destroyed.

Military actions in eastern Ukraine have caused damage to all areas without any exception. Nowadays there is not only lack of funding for restoration and rehabilitation of the environment or related infrastructure, but also for evaluation of damage caused to the environment due to military aggression³. In this difficult period it is extremely important for Ukraine to engage the world community into the process of solving environmental issues. First of all, it is necessary to conduct evaluation of damage caused to the environment as a result of military operations in eastern Ukraine.

For such evaluation it is necessary to identify risks and opportunities for natural resources, as well as existing national and local capacity to address these problems. Among the specific factors to be evaluated is the quality of institutions, legal and political framework, coordination mechanisms, financial and operational resources; technical knowledge and potential of civil society to participate in the decision-making process and to monitor compliance with relevant laws. Evaluation must also take into account vulnerability of the environment and natural resources during disasters and in the context of climate change. Evaluation should be aimed at early detection of environmental problems, attracting the attention of the executive authorities and the international community to their recovery. In many cases restoration of the environment can be a starting point for raising environmental awareness, increasing public support for environmental protection in the conflict area.

The list of objects and natural resources that have suffered damage due to military operations and caused negative impact on the environment requires detailed consideration. This issue today is in the focus of attention of International Charitable Organization «Environment–People–Law» (hereinafter — EPL). We believe that it is reasonable, especially nowadays, to carry out evaluation of the impact on the environment in the liberated from militants territories of Donetsk and Luhansk regions, which EPL is working on. The objective evaluation of damage caused to the environment will be one of the tools in decision-making process at the national and international levels and the driving force to attract the attention of the world community to restoration of peace for the sake of life in the context of conservation and environmental protection.

EPL Team

³ <http://epl.org.ua/ekologija/dovkillja-ta-viina/doslidzhennja-epl/epl-ta-elaw-zaklikajut-zupiniti-ruinuvannja-dovkillja-na-skhodi-ukrajini/>

CHAPTER 1.

LEGAL REGULATION OF ENVIRONMENT PROTECTION DURING MILITARY CONFLICT

Nowadays it is clear that military action is not only detrimental to the environment and natural resources within the national borders of one state but also to the environment in general, global objects and environmental balance. Impressive negative consequences of military clashes for the environment around the world became incentives to initiate regulation of impact of military operations on natural resources and the environment at the international level. However, the results of the efforts of diplomats, ecologists and militarymen are really minor ones, while adopted documents contain gaps and, consequently, are of limited use. Practice of monitoring the results of the environmental impact during and after military operations at the international level is not systematic and not institutionalized. Existing international bodies are also unable to ensure the prosecution of aggressor-states and to provide adequate compensation for damage to natural resources of all the states which are victims of war.

Legal regulation of environment protection during military operations in national legislation is fragmented and, unfortunately, does not explicitly prescribe the behavior of the Ministry of Defence and other central authorities regarding implementation of environmental monitoring and environmental safety during hostilities in wartime.

Human rights to a safe and healthy environment must be complied with regardless of the stage of hostilities settlement (planned military exercise, protection from military aggression).

In this section we will provide a brief analysis of international and national legislation that regulates the relationship of environmental safety during hostilities, make an attempt to answer the question how during the antiterrorist operation in Luhansk and Donetsk regions (and in fact — hostilities) it is possible to protect the human right to a safe and healthy environment and to compensation of damage caused by violation of this right, how to ensure the implementation of environmental monitoring, analysis of the collected information and its assessment regarding the requirements for compliance with environmental safety according to the current legislation of Ukraine. The authors will analyze the

powers of the central executive bodies in the field of environmental protection during hostilities; provide review of legal mechanisms to determine damage to natural resources, legal instruments to identify contaminated areas and to determine the legal regime of their use after the end of hostilities. The issue of access to information on military action in the context of protection of the right to a safe and healthy environment, the duties of the central executive bodies and local self-government bodies with respect to collection and dissemination of accurate information and the right of citizens to obtain relevant information will be covered separately.

1.1. INTERNATIONAL LEGAL REGULATION OF ENVIRONMENT PROTECTION DURING MILITARY CONFLICT

Certain provisions on limitation of the environmental impact during the hostilities can be found in a variety (in terms of their legal force) international instruments developed by international organizations and governments of different countries. To overview the current international legal norms in this area, it is necessary to refer to such branches of international law as humanitarian law, environmental protection law and human rights.

International Humanitarian Law. The norms of international humanitarian law, which were developed and used during military operations, for a long time did not include direct regulation of environmental issues in the wartime. On the other hand, limitation or prohibition of the use of weapons or methods of warfare to reduce the scale of the deadly influence or impact on the health of civilians also result in reducing the impact on the elements of the environment — air, water, biodiversity, etc. International legal regulation of warfare and protection of the civilians, civil and military facilities, tactics and methods of warfare in this or that way affects the conservation of environmental elements during the war.

In the 1970s of the previous century international community began to pay more attention to environmental issues as such, as well as to improvement of the legal regulation on the protection of the rights of armed conflicts victims. Shocking consequences of the Vietnam War for the civilian population and the environment, such as deforestation, pollution of land and incurable diseases of local residents due to the use of the toxic herbicide Agent Orange led to intensification of law-making processes at the international level. In 1976 and 1977 respectively, two international documents intended to prevent such effects of hostilities that took place in Vietnam were adopted. Thus, in 1976 the Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques

was adopted that was intended to limit methods of warfare, which may result in a change of natural processes, climate, etc.⁴

In 1977 was adopted Protocol Additional to the Geneva Conventions of 12 August 1949, which focused on the Protection of Victims of International Armed Conflicts (Protocol I).⁵ It was the first document containing standards, which were compulsory for the states-parties to this agreement regarding environmental issues during military aggression.

Article 35 regulates basic norms on methods and means of warfare indicating that the right of the parties to the conflict to choose methods or means of warfare is not unlimited. In particular, it is prohibited to employ weapons, projectiles and material and methods of warfare of a nature to cause superfluous injury or unnecessary suffering. Paragraph 3 of the article prohibits employment of the methods or means of warfare which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment.

Article 55 «Protection of the Natural Environment» guarantees the duty of protecting the natural environment against widespread, long-term and severe damage in warfare. This protection includes a prohibition of the use of methods or means of warfare, which are intended or may be expected to cause such damage to the natural environment and thereby to prejudice the health or survival of the population. Paragraph 2 of Article 55 prohibits attacks against the natural environment by way of reprisals.

The main common feature of these two articles is the prohibition of warfare which can cause widespread, long-term and severe damage to the natural environment. Such wording implies all — widespread and long-term and severe damage — that can pose difficulties in the application of this Article, and the threshold of acceptable environmental damage is quite extensive. In addition, the authors of the document have not provided any interpretation of the terms «widespread», «long-term» and «severe». Critics of these rules indicate that Articles 35 and 55 do not provide effective legal regulation of the environment protection, as achieving cumulative impact (damage) to the natural environment during normal hostilities using weapons which are not forbidden (eg. biological, nuclear) is almost impossible.⁶

⁴ Ukraine is a party to the Convention as successor of the USSR. http://zakon2.rada.gov.ua/laws/show/995_258 and the Russian Federation is a party to the Convention as successor of the USSR.

⁵ Ukraine and the Russian Federation are parties to Geneva Conventions and Additional Protocol: http://zakon4.rada.gov.ua/laws/show/995_c23

⁶ Bothe, M., Bruch, C., Diamond, J., and D. Jensen. (2010). «International law protecting the environment during armed conflict: gaps and opportunities.» *International Review of the Red Cross*. 92(879). P.576.

Another agreement that covers the issues of environment protection is Protocol III on Prohibitions or Restrictions on the Use of Incendiary Weapons⁷ to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects (1980). Paragraph 4 of Article 2 of the Protocol prohibits to make forests or other kinds of plant cover the object of attack by incendiary weapons except when such natural elements are used to cover, conceal or camouflage combatants or other military objectives, or are themselves military objectives.

Adequacy of legal regulation of the natural environment protection during military conflict by two afore-mentioned international agreements was questioned during Persian Gulf War in 1990–1991. Massive pollution caused by destruction of 600 oil wells in Kuwait by the Iraqi armed forces was estimated at 85 billion dollars and caused concern at the international level.⁸

Among other agreements in the field of humanitarian law, which indirectly may have the effect of preventing a negative impact on the environment during military operations, are the following documents: Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare (1925), Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction (1972)⁹, Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons (1980), Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (1993)¹⁰, Agreement on Comprehensive Test Ban Treaty (1996, not yet in force) and other agreements¹¹.

An important source of international humanitarian law are principles that can complement a variety of international instruments, be employed and interpreted in the decisions of international courts, etc. The peculiar feature of such principles is that they apply to all countries, in contrast to the international conventions and protocols that are binding only to the parties thereof. The following four principles are topical for the theme of this study: distinction, military necessity, proportionality and humanity.

The principle of distinction lies in the fact that during military operations it is necessary to distinguish between civilian and military objects, civilians and

⁷ Ukraine and the Russian Federation are parties to these agreements since as far back as 1982. http://zakon1.rada.gov.ua/laws/show/995_j48

⁸ Protecting the environment during armed conflict. An inventory and analysis of international law, UNEP, 2009. p. 8.

⁹ Ukraine ratified the Convention on 21.02.1975.

¹⁰ Ukraine ratified the Convention on 16.10.1998.

¹¹ Ukraine ratified the Agreement on 16.11.2000.

combatants¹², for civilian objects and civilian population remained outside the sphere of hostilities¹³. Definition of military objects is provided in Protocol I, which includes objects which by their nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage (paragraph 2 Article 52). Unfortunately, there may be cases when power stations or chemical plants will be considered military objects and their destruction can result in more than significant damage to the environment. In the same way a forest that is used by enemy forces as a hiding place can be recognized as military object and destroyed which will lead to the destruction of biodiversity, normal functioning of ecosystems, etc.

The principle of military necessity allows measures aimed at achieving military objectives which are not prohibited by international law, however, does not justify any other acts prohibited by international humanitarian law¹⁴. Of importance in this case is the ultimate goal and the result of hostilities that consequently may cause damage to the environment: were military objectives achieved or not? If these obvious goals have not been achieved, this principle is considered to be violated.

The principle of proportionality is that the parties who are fighting should not, in the course of combat, damage civilian objects and cause civilian casualties that would be regarded as excessive in relation to the anticipated military advantage gained over the enemy. The principle of proportionality cannot justify unlimited destruction or attacks on civilians and civilian objects¹⁵. In numerous cases of damage to the environment such damage must be considered disproportionate in relation to military objectives achieved.

The principle of humanity prohibits inflicting unnecessary suffering, injury and destruction¹⁶. To the inhumane means of warfare belongs damage or destruction of objects, caused by the aggressor, which are indispensable for the survival of

¹² Combatants (фр. combattant) — in international law — are people, who are part of the armed forces of the country in war, directly participating in military operations.. Thus combatancy is direct participation of soldiers in military operations. Source: Великий тлумачний словник української мови (з додатками і доповненнями) / Compiler and Chief Editor V. T. Busel, K.; Irpin: ВТФ «Perun» 2005. — 1728 p

¹³ Klymchuk Yu.V., The System of International Humanitarian Law Principles, Author's Abstract of the Dissertation for the Candidate Degree of Legal Sciences, Kharkiv — 2003. P.16.

¹⁴ Klymchuk Yu.V., The System of International Humanitarian Law Principles, Abstract of the Dissertation for the Candidate Degree of Legal Sciences, Kharkiv — 2003. P.15

¹⁵ Legal Work in the Armed Forces of Ukraine: Textbook / Under the General Editorship by V.I.Kyrylenko. — K.: PBI «Viyskovyi Instytut», 2010.p. 88.

¹⁶ Article 23 (e) of the Convention (IV) respecting the Laws and Customs of War on Land, concluded in 1907 (IV Hague Convention)

civilian population: poisoning of water wells, destruction of agricultural land or timber resources that contribute to the sustenance of the local population¹⁷.

Thus, nowadays the legal regime of international humanitarian law envisages certain protection to environmental objects in the form of various legal instruments; however, the effectiveness and adequacy of such protection is constantly debated by experts and scientists.

International Environmental Law

At present there is no unified international environmental instrument or agreement that would limit the impact of armed conflict on the natural environment or cover the issues of compensation for damage caused to the environment during armed aggression. Numerous international treaties and agreements in the field of environment protection and use of natural resources in the area of liability for environmental damage do not contain «war» articles. Moreover, they do not include provisions on the possibility or obligation for their application in hostilities. Theoretical debates and analysis of such agreements testify to the fact that the liability to apply such agreements in peace time does not preclude the necessity of their application in time of war. Provisions of several conventions confirm this conclusion. Only about 20 % of the conventions and treaties on the environment, analyzed by scientists under the auspices of the UN Environment Programme (UNEP) to study international law in the field of environment protection during hostilities, contained clear provisions on non-application of provisions thereof during armed conflict.¹⁸

In addition, the arsenal of international environmental law includes such sources of law as principles and «soft» instruments that are not binding, but play an important role in developing and applying the norms of this branch of international law. Presented below is a short overview of the key international agreements in the field of environmental protection that are relevant to the field of this study.

UN Convention on the Law of the Sea (UNCLOS) (1982)¹⁹

Preamble to the Convention includes a provision that it is an important contribution to the maintenance of peace, justice and progress for all peoples of the world. It includes provisions which are directly related to warships. It does not have any provisions regarding termination of its force during wartime, therefore, it can be

¹⁷ Protecting the environment during armed conflict. An inventory and analysis of international law, UNEP, 2009. c.13.

¹⁸ Protecting the environment during armed conflict. An inventory and analysis of international law, UNEP, 2009. c.34.

¹⁹ Ukraine and the Russian Federation are parties to this global agreement: the Convention is ratified by the Law of Ukraine N 728 dated from 03.06.99, the Russian Federation became a party on 12.03.1997.

presumed that its enforcement is not fully stopped during the wartime. Article 30 gives a right to the coastal State to request any warship to immediately leave its territorial sea if this warship does not comply with the laws and regulations of the coastal State, disregards any request for compliance therewith which is made to this ship. Article 31 implies international responsibility of the flag State for any loss or damage to the coastal State resulting from the non-compliance by a warship or other government ship operated for non-commercial purposes with the laws and regulations of the coastal State concerning passage through the territorial sea or with the provisions of this Convention or other rules of international law. In cases when the warships do not violate the afore-mentioned norms, they are given immunity. (Article 32 UNCLOS)

Article 192 commands the States to have the obligation to protect and preserve the marine environment. According to Article 194, the States are to take measures to prevent, reduce and control marine pollution from any source. Articles 207, 208 and 212 impose the same requirement with regard to pollution from land-based sources, from seabed activities, and through the atmosphere. However, positive effect of the provisions above is nivalated by the provisions of Article 236 excluding the necessity to apply the provisions of this Convention regarding the protection and preservation of the marine environment by any warship, naval auxiliary, other vessels or aircraft owned or operated by a State and used, for the time being, only on government non-commercial service. At the same time, the States have to take measures for such vessels or aircraft to operate in such a way, as far as is reasonable and practicable, that complies with this Convention (including provisions on marine environment protection).

Thus, nowadays it is not entirely clear to what extent UNCLOS offers protection during armed conflict, still its applicability to situations of marine environment pollution from land-based sources or oil facilities is open for consideration.²⁰

International Convention for the Prevention of Pollution from Ships (MARPOL) (1973)²¹

The Convention does not include provisions regarding its applicability during military operations, still it includes the rule on immunities of warships, naval auxiliary, other vessels or aircraft similar to that of UNCLOS — Article 3(3).

²⁰ Protecting the environment during armed conflict. An inventory and analysis of international law, UNEP, 2009. p. 36.

²¹ Ukraine joined the International Convention for the Prevention of Pollution from Ships (1973) on September 21, 1993, the Russian Federation joined the Convention in 1983.

The Convention on the Protection of the Black Sea Against Pollution (1992)²²

This Convention obliges the parties to take measures to reduce and prevent the following types of pollution in the Black Sea: pollution by hazardous substances or matter, the pollution from land-based sources, the pollution of the marine environment from vessels, the pollution resulting from emergency situations, the pollution by dumping, the pollution caused by or connected with activities on the continental shelf, the pollution from or through the atmosphere, the pollution from hazardous wastes in transboundary movement, as well as to protect the biodiversity and the marine living resources against pollution (Articles 6–14 of the Convention). Provisions of the Convention also include the norm of immunity of any warship, naval auxiliary or other vessels or aircraft owned or operated by a State and used, for the time being, only on government non-commercial service (Article 4). At the same time provisions on such immunity do not diminish the importance of Convention provisions on preventing marine pollution from other sources (not from vessels or aircraft). Similar to previous Conventions, absence of direct provision on applicability or non-applicability of the Convention in the wartime does not exclude the necessity to comply with the provisions of the Convention on the Protection of the Black Sea Against Pollution during armed conflict.

The Convention on Wetlands of International Importance especially as Waterfowl Habitat (1971)²³

The Convention provides for the duty of the states to designate suitable wetlands within its territory for inclusion in a List of Wetlands of International Importance (Article 2). The Parties should promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory (Article 3). The Convention gives the right to the states, because of their urgent national interests, to delete or restrict the boundaries of wetlands already included in the List (Article 2 (5) and Article 4). To such interests can belong interests of national security, wartime that can testify to the fact that the states are bound to apply provisions of this Convention in the armed conflict.

On the basis of provision of Article 3 on conservation of the wetlands included in the List it can be concluded that such obligation extends to conservation of the wetlands not only in the territory of this state but also in the territories of other states on condition that such wetlands are included in a List of Wetlands of International Importance.

²² The Convention is ratified by the Resolution of the Supreme Council N 3939 dated from 04.02.94, the Russian Federation ratified the Convention on August 12, 1993.

²³ Ukraine is recognized as a legal successor of the USSR with respect to participation in the Convention in accordance with the Law of Ukraine of 29.10.1996, the Russian Federation is a party since 1975, when the USSR joined the Convention.

Convention Concerning the Protection of the World Cultural and Natural Heritage (1972)²⁴

According to the provisions of the Convention, each state recognizes the duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage situated in its territory (Article 4). Key duties on conservation of such heritage, unfortunately, lie on the state only within the boundaries of its own territory. However, within the context of our topic of utmost importance is the norm of paragraph 3 Article 6 that obliges the State Parties to the Convention not to take any deliberate measures which might damage directly or indirectly the cultural and natural heritage situated on the territory of other States Parties.

The Convention mentions armed conflicts the threat of which is a ground to include existing objects to the List of World Heritage in Danger (Article 11(4)). Thus, one can conclude that this Convention becomes particularly important during the armed conflicts, therefore, the duty regarding protection of objects situated in the territory of other states should exist for the aggressor State Party to the Convention also during the wartime.

Convention on Long-range Transboundary Air Pollution (1979)²⁵

This Convention is an important international legal tool aimed at reduction of Transboundary Air Pollution in the European region. Due to its declarative character it is considered to be a Framework Convention: the parties to the Convention do not have any specific quantitative liabilities on reduction of their emissions, as the very Convention does not mention any specific pollutants whose emission should be reduced. Further this Convention was supplemented with 8 protocols; however, their ratification by Ukraine (and the Russian Federation) is very slow²⁶. Of great importance for this study is the Aarhus Protocol on Heavy Metals (1998) on reducing emission of heavy metals — cadmium, lead and mercury which is not ratified either by Ukraine or the Russian Federation²⁷. Unfortunately, the Convention does not include any provisions regarding its applicability during wartime.

²⁴ Ukraine ratified the Convention by the Decree of the the Presidium of the Supreme Council dated from 04.10.88. The Russian Federation ratified the Convention on 09.03.1988.

²⁵ Ukraine is a party to the Convention since 05.06.1980, the Russian Federation is a party since 22.05.1980.

²⁶ Ukraine is a party only to three (Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP), Protocol on Reduction of Sulphur Emissions or their Transboundary Fluxes by 30% and Protocol on Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes) from eight protocols to the Convention.

²⁷ http://www.unece.org/ar/env/lrtap/status/98hm_st.html

Convention on the Conservation of Migratory Species of Wild Animals (1979)²⁸

This Convention recognizes the duty of the parties to take action to prevent the threat of extinction of migratory species, in particular, by means of ensuring immediate conservation of migratory species included into Appendix (Article 2). Parties that are Range States of migratory species listed in Appendix 1 shall endeavour: a) to conserve and, where feasible and appropriate, restore those habitats of the species which are of importance in removing the species from danger of extinction; b) to prevent, remove, compensate for or minimize, as appropriate, the adverse effects of activities or obstacles that seriously impede or prevent the migration of the species; and c) to the extent feasible and appropriate, to prevent, reduce or control factors that are endangering or are likely to further endanger the species (Article 3). The Convention does not include the provision whether its applicability is terminated during military operations or armed conflicts.

Bern Convention on the Conservation of European Wildlife and Natural Habitats (1979 p.)²⁹

The Convention is aimed at conservation of wild flora and fauna and their natural habitats, especially those species and habitats whose conservation requires the co-operation of several States. Particular emphasis is given to endangered and vulnerable species, including endangered and vulnerable migratory species (Article 1). For certain species requiring special protection the Convention prohibits the deliberate damage to or destruction of breeding or resting sites; the deliberate disturbance of wild fauna, particularly during the period of breeding, rearing and hibernation, insofar as disturbance would be significant in relation to the objectives of this Convention.

The Convention does not include any mention of armed conflict, military action or wartime or extension of its applicability to such situations (periods), therefore, its significance for protection of wild flora and fauna during wartime is questionable.

To «silent» conventions also belong Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Convention on Biological Diversity, the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer, Convention on Environmental Impact Assessment in a Transboundary Context, United Nations Framework Convention on Climate Change, Convention on the

²⁸ Ukraine became a party to the Convention on 19.03.1999, the Russian Federation is not a party to this Convention.

²⁹ Ukraine became a party on 29.10.1996, the Russian Federation is not a party to this Convention.

Protection and Use of Transboundary Watercourses and International Lakes, European Landscape Convention, etc.

There is a number of conventions on liability in the field of nuclear energy that directly state that operator is not held liable for damage caused as a consequence of war, armed conflicts. For example, Convention on Third Party Liability in the Field of Nuclear Energy (1960), Vienna Convention on Civil Liability for Nuclear Damage (1963).

A special place as a source of international environmental law belongs to customs and principles of law that are included in international agreements, which are binding for the State-parties, and «soft» instruments, such as declarations, resolutions, court decisions, and so on. They can be applied in a much broader way to issues of legal regulation of prevention and control, damage to the environment as a result of both peaceful and military action as compared to the international agreements in the field of the environment.

To the most important principles belong the following ones: precautionary principle, principle of prevention, principle of liability of states for damage caused to the territory of other states and other important principles. A precautionary principle formulated in Rio de Janeiro Declaration on Environment and Development (1992) lies in the fact that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation (Principle 15)³⁰. Prevention principle states that it is necessary to endeavour prevent damage to the natural environment rather than later mitigate the consequences of such damage to the environment, as restoration of the polluted environment is often practically impossible and extremely costly and time-consuming process. The principle of liability of the state for damage inflicted to the natural environment and the territories of other countries states that the right of the state to exploit its natural resource is not absolute and shall be exercised considering rights and interests of other states and global community in the field of exploitation and conservation of natural resources³¹.

The most important documents of non-binding character in the field of environmental protection during the armed conflict is Stockholm Declaration on the Natural Environment³². (Principle 21, in particular, states that the states

³⁰ Rio de Janeiro Declaration on Environment and Development, adopted on 14 June 1992 at the UN Conference on Environment and Development. / http://zakon2.rada.gov.ua/laws/card/995_455

³¹ The Role of Special Principles of International Environmental Law in Provision of Implementation of its Norms / Medvedeva M.A. // International Law and International Relations: XXIth Century (to commemorate the 70-th anniversary of V.N. Honina) / under the editorship of Prof. A.V. Zadorozhnyy. K.: Feniks, 2013. p. 54-64

³² Adopted on 16.06.1972 at the UN Conference on Environment and Development.

have the sovereign right to exploit their own resources and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States. Principle 26. Man and his environment must be spared the effects of nuclear weapons and all other means of mass destruction)

World Charter for Nature³³ (principle 5: Nature shall be secured against degradation caused by warfare or other hostile activities. Principle 20: Military activities damaging to nature shall be avoided.)

Rio de Janeiro Declaration on Environment and Development in its Principle 23 states that the environment and natural resources of people under oppression, domination and occupation shall be protected. Principle 24 emphasizes: «Warfare is inherently destructive of sustainable development. States shall therefore respect international law providing protection for the environment in times of armed conflict and cooperate in its further development, as necessary.» And Principle 25 concludes: «Peace, development and environmental protection are interdependent and indivisible»³⁴.

Article 39.6 Agenda for the XXI century³⁵ states that it is necessary to consider measures that correspond to the norms of international law to address, in times of armed conflict, large-scale destruction of the environment that cannot be justified under international law. The UN General Assembly and its Sixth Committee are good forums to consider this issue. Special competence and role of the International Committee of the Red Cross should also be considered.

UN General Assembly Resolution on Protection of the Natural Environment in Armed Conflict³⁶ stressed violation of the provisions of the international law in the form of environmental damage and depletion of natural resources, including destruction of hundreds of oil wells and release of crude oil into the sea as well as destruction of the environment which is not justified by military necessity and happens without any reasons; called for the states to abide by the international law related to natural environment protection during armed conflicts and to take measures to include provisions of international environmental law into military textbooks and ensure their effective dissemination.

Unfortunately, nowadays international environmental law does not provide for the due environment protection during armed conflict. It is related to absence of the unified international regulatory acts that would regulate the issues how military activities affect the environment, and dubious interpretation regarding application of a number of international environmental agreements during

³³ Approved by the Resolution of the UN General Assembly 37/7 on 1.01.1982.

³⁴ http://zakon2.rada.gov.ua/laws/show/995_455

³⁵ Adopted at the UN International Conference on Environment and Development in Rio de Janeiro in June 1992.

³⁶ Resolution of the UN General Assembly A/RES/47/37 adopted on 25 November 1992.

armed conflicts. A number of important provisions include «soft» instruments of international law that have serious political weight in this respect and gained wide support of all the states. It is considered that the liability of the states to protect the environment and natural resources during the armed conflict, to compensate damage caused to the environment during military operations has become an international custom and is obvious to all the states.

International Human Rights Law

Human rights related to the environment are quite well protected at the international level by international treaties and declarations. These legal mechanisms can be applied to restrict the conduct of the states and bring them to responsibility for actions during armed conflict related to causing environmental damage and, consequently, violation of human rights (for instance, right to life or right to health). Decisions of international court institutions confirm the necessity to apply international human rights law in the field of human right in the situations during armed conflict.³⁷

The Universal Declaration of Human Rights (1948)³⁸ is not legally binding, still its provisions have been accepted already as customary law³⁹. Article 25 states that everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services. This article presumes that natural environment a person lives in should be of such quality that does not presuppose violation of this right. This quality of standard of living should also be guaranteed by the state during armed conflict.

European Convention for the Protection of Human Rights and Fundamental Freedoms (1950)⁴⁰ guarantees everyone's right to life (Article 2), the right to respect for his private and family life (Article 8) which are closely interrelated with the quality of the environment. The stand of the European Court of Human Rights confirms that the convention should be applied even during armed conflict, therefore, these provisions can ensure indirect protection to the natural environment during armed conflict. The practice of application of the Convention by the court demonstrates that the court and the Convention can be quite effective and accessible means of environment and human rights protection by the common citizens even during armed conflict.

³⁷ Protecting the environment during armed conflict. An inventory and analysis of international law, UNEP, 2009. p. 48.

³⁸ Adopted by the Resolution of the UN General Assembly 217 A (III) from 10 December 1948.

³⁹ Protecting the environment during armed conflict. An inventory and analysis of international law, UNEP, 2009. p. 48.

⁴⁰ Ukraine ratified the Convention by the Law № 475 dated from 17 July 1997, the Russian Federation ratified on 5 May 1998.

Limited experience of application of international law in armed conflict shows that nowadays there exist several response mechanisms to violation of the international norms by the states in the wartime and resolution of issues related to compensation of environmental damage.

The International Court of Justice is the principal judicial organ of the United Nations,⁴¹ which is responsible for peaceful resolution and settlement of the disputes between the states. The court renders judgments and provides advisory opinions on any legal issue. Court judgements are binding on the parties to the dispute (Article 94 of the UN Charter), while advisory opinions are not binding. Decisions and opinions of the International Court of Justice in environmental disputes are relevant for interpretation of the international treaties and also they fix the norms of customary law⁴².

International Criminal Tribunals are created ad hoc for international prosecution of persons for severe violations of the international humanitarian law on the basis of the decisions of UN Security Council. The decision of the International Criminal Tribunal for former Yugoslavia testifies to possibility of resolution by such tribunals of cases on prosecution for causing damage to the environment, albeit the tribunal also pinpointed the inadequacy of the current international law in this field⁴³.

The United Nations Compensation Commission was created in 1991 as a subsidiary organ of the UN Security Council with a mandate to process claims and pay compensation for losses and damage suffered as a direct result of Iraq's unlawful invasion and occupation of Kuwait. The jurisdiction of the Commission is fairly innovative for international law standards, both in terms of who can claim for damages (including individuals and corporations) as well as the types of damage covered (including environmental damages).⁴⁴ This decision was preceded by the UN Security Council Resolution 687 (1991), indicating in p. 16 that Iraq is liable under international law for any direct loss, damage, including environmental damage and the depletion of natural resources, as a result of Iraq's unlawful invasion and occupation of Kuwait. Paragraph 18 of the Resolution creates a fund to pay compensation for claims that fall within paragraph 16. The UN Security Council premised liability for environmental damage on Iraq's use of aggressive force (in violation of Article 2(4) of the UN Charter), and not specifically as a violation of international humanitarian or environmental law⁴⁵.

⁴¹ Article 92 of the UN Charter signed on 26 June 1945 at the United Nations Conference.

⁴² Protecting the environment during armed conflict. An inventory and analysis of international law, UNEP . 2009. p. 24.

⁴³ Protecting the environment during armed conflict. An inventory and analysis of international law, UNEP .2009. p. 27

⁴⁴ <http://www.uncc.ch/uncc-glance>

⁴⁵ Protecting the environment during armed conflict. An inventory and analysis of international law, UNEP .2009. p. 27

The claims relating to environmental damage and depletion of natural resources fell into two broad groups under Category F⁴⁶: Claims for environmental damage and the depletion of natural resources in the Persian Gulf region, including those resulting from oil-well fires and the discharge of oil into the sea; Claims for costs incurred by governments outside of the region in providing assistance to countries that were directly affected by the environmental damage⁴⁷.

Thus, analysis of the international legal regime in the field of environmental protection and armed conflict reveals a number of gaps that do not allow preventing damage and effectively protection of the environment during the war. Such gaps are present both in international humanitarian law and international environmental law. The scientists also stress the absence of proper procedural rules and mechanisms that would make it possible to detect, monitor and document such damage and hold the states or individual subjects liable for environmental damage according to the international law. Also, there is no unified institution that would consider claims related to environmental damage on a regular basis and provide adequate reparation to both states and ordinary citizens, as well as a mechanism for the implementation of international legal liability of states for damage caused to the environment of other states.

1.2 KEY ASPECTS OF NATIONAL LEGISLATION

State supervision over the observance of environmental safety requirements in regard to military and Defence objects, and military activity on the territory of Ukraine shall be exercised in accordance with the law and other legislative acts of Ukraine.

The Verkhovna Rada of Ukraine, proceeding from the provisions of the Constitution of Ukraine, the Declaration of State Sovereignty of Ukraine, and generally recognized international norms and rules, stating that the priorities of the national interests of Ukraine include, particularly, guarantees of constitutional rights and freedoms of human beings and citizens, protection of state sovereignty, territorial integrity and inviolability of state borders, inadmissibility of interference into domestic affairs of Ukraine, development of equal, mutually beneficial relations with other states of the world in the interests of Ukraine, and declaring that direct or indirect interference into domestic and foreign affairs of Ukraine under any pretext is unacceptable, realizing the need for immediate and efficient

⁴⁶ The United Nations Compensation Commission divided all the claims received into 6 categories. Claim category «F» was designed for governments and international organizations for losses of diplomatic property, evacuation costs, payments to the population, and environmental damages and depletion of natural resources.

⁴⁷ Protecting the environment during armed conflict. An inventory and analysis of international law, UNEP .2009. p. 27.

reaction to the existing and potential threats to the national interests and the national security of Ukraine, including hostile actions, armed assault of other countries or nonstate formations, infliction of harm to life and health of the population, taking hostages, expropriation of the public property and property of individuals and legal entities, causing material damages and creating obstacles for sustainable economic development, full-fledged exercise of their rights and freedoms by the citizens of Ukraine, adopted the Law of Ukraine «On the Sanctions», under which, to protect national interests, national security, sovereignty, and territorial integrity of Ukraine, to counteract terrorist activity, as well as to prevent violations, and to reinstate the violated rights, freedoms and legitimate interests of the citizens of Ukraine, the society, and the state, special economic and other restrictive measures (hereinafter — the sanctions) may be applied. The sanctions may be applied by Ukraine to a foreign state, a foreign legal entity, a legal entity that is controlled by a foreign legal entity or non-resident individual, foreigners, stateless persons, as well as agents of terrorist activity. Application of sanctions does not exclude other measures to protect national interests, national security, sovereignty, and territorial integrity of Ukraine, its economic independence, rights, freedoms, and legitimate interests of the citizens of Ukraine and the state. In particular, the sanctions may pertain to introduction of additional measures in the spheres of environmental, sanitary, phytosanitary, and veterinary control.

According to the Law of Ukraine «On the Basics of the National Security of Ukraine» of 19.06.2003 № 964-IV (as amended in accordance with the Laws № 3200-IV of 15.12.2005, GVR, 2006, № 14, p. 116 № 2411-VI of 01.07.2010, GVR, 2010, № 40, p. 527 № 4711-VI of 17.05.2012, GVR, 2013, № 14, p. 89 № 5286-VI 18.09.2012, GVR, 2013, № 38, p. 499 № 221-VII of 18.04.2013, GVR, 2014, № 10, p. 119 № 1170-VII of 27.03.2014, GVR, 2014, № 22, p. 816 № 35-VIII of 23.12.2014, GVR, 2015, № 4, p. 13 № 186-VIII of 12.02.2015, GVR, 2015, № 16, p. 110)⁴⁸, environmental safety is an inherent component of the national security. Agents of the environmental security provisions are the President of Ukraine, the Verkhovna Rada of Ukraine, the Cabinet of Ministers of Ukraine, the National Security and Defence Council of Ukraine, ministries and other executive bodies, the National Bank of Ukraine, general jurisdiction courts, Prosecution Service of Ukraine, local state administrations and local self-government bodies, Armed Forces of Ukraine, Security Service of Ukraine, the State Border Guard Service of Ukraine, and other military formations established according to the laws of Ukraine, citizens of Ukraine, and citizen associations (article 4 of the Law of Ukraine «On the Basics of the National Security of Ukraine»).

⁴⁸ Gazette of the Verkhovna Rada of Ukraine (GVR), 2003, № 39, p. 351

National security objects include:

- person and citizen — their constitutional rights and freedoms;
- society — its spiritual, moral and ethical, cultural, historical, intellectual and material values, informational and natural environments, and natural resources;
- state — its constitutional form of government, sovereignty, territorial integrity, and inviolability.

At times of military actions (armed conflict) fundamental rights of an individual and a citizen to environmental safety, and healthy environment, protection of which is determined by a number of regulatory acts of the national legislation, are violated.

National security of Ukraine is ensured by conducting a considerate state policy according to the duly adopted doctrines, concepts, strategies, and programs in political, economic, social, military, environmental, research and technological, informational, and other areas.

The priorities of national interests include ensuring environmentally and technology-related conditions of human and social life support, preservation of the natural environment, and rational use of natural resources.

Among the threats to the national interests and national security of Ukraine, inefficiency of the measures for prevention of negative effects of the military and other environmentally hazardous activities are the main real and potential threats to the national security of Ukraine, and stability in the society in the environmental sphere.

Main functions of the national security of Ukraine provision agents are continuous monitoring of the influence on the national security of the processes taking place in political, social, economic, environmental, research and technological, informational, military, and other spheres, religious environment, interethnic relations; forecasting changes that are taking place in them, and potential threats to the national security.

The Decree of the President «On the Strategy of the National Security of Ukraine» of 12.02.2007 № 105/2007⁴⁹ indicates among the present hazardous environmental and technology-related challenges and threats the absence of effective protection of critical infrastructure of the fuel and energy complex from environmental and technology-related influences and malicious acts.

The Law of Ukraine «On Defence of Ukraine» of 06.12.1991 № 1932-XII⁵⁰ endows the central and other bodies of power with a number of powers in the Defence sphere, however, they have auxiliary character in the process of Armed Forces of Ukraine formation. It would be relevant to endow them with powers of monitoring, gathering information, and environmental protection.

⁴⁹ <http://www.president.gov.ua/documents/5728.html>

⁵⁰ Gazette of the Verkhovna Rada of Ukraine (GVR), 1992, № 9, p. 106

Coalition agreement⁵¹, in chapter 1 *Reform of the National Security and Defence*, contains a number of planned measures to guarantee environmental safety during military actions. Among them, in particular, is a combination of international claims against the Russian Federation in the interests of the Ukrainian state, state-owned enterprises and enterprises of other ownership forms, and citizens of Ukraine, who suffered from the occupation of Crimea and military actions on the territory of the Donetsk and Luhansk regions; monitoring of the environmental situation in the East of Ukraine in the area of military actions, including use of modern means of earth remote sensing that are available in Ukraine; and utilization of the Governmental information and analytical emergency system.⁵²

A lot of attention is paid in the national legislation of Ukraine to operation of the environmental policy in the military sphere and conversion of the military-industrial complex (hereinafter — the MIC) through environmentalization of the military and technical policy of the state; formation of the military perspectives and environmental legal consciousness of the military leadership, military personnel of the Armed Forces of Ukraine, employees and officers of the MIC enterprises; conducting research and development activities to assess, improve, and stabilize environmental situation in the regions where military units and objects, including foreign ones, are located; introduction of the environmental passportization of objects in the Armed Forces of Ukraine, arrangement of the environmental monitoring systems for permanent posts and MIC enterprises, their inclusion into the system of state environmental monitoring; mandatory higher legal responsibility for violation of the environmental legislation on the part of the servicemen, including those of foreign armies, who are temporarily deployed on the territory of Ukraine, as well as the personnel of the Defence enterprises; development and implementation of a complex program for ensuring environmental safety of the Armed Forces of Ukraine activity in the long term.

The right of people to environmental safety is ensured during military actions by active work of state agencies, local self-government bodies, and the citizens of Ukraine individually.

According to Article 3 of the Constitution of Ukraine and the Law of Ukraine «On Environmental Protection»⁵³ of 25 June 1991 № 1264-XII, environmental protection, rational use of natural resources, and ensuring environmental life-sustaining activities of people are an inseparable condition of sustainable economic and social development of Ukraine.

⁵¹ http://samopomich.ua/wp-content/uploads/2014/11/Koalicyjna_uhoda_parafovana_20.11.pdf

⁵² V.Ya.Shevchuk et al. *Ecologization of energetics*. — K.: Geoprint, 2002.

⁵³ *Gazette of the Verkhovna Rada of Ukraine (GVR)*, 1991, № 41, p. 546

To achieve this aim, Ukraine operates on its territory an environmental policy aimed at preservation of safe existence of animated and inanimate nature, protection of life and health of the population against negative influences caused by pollution of the environment, achievement of harmonious interaction of the society and nature, protection, rational use, and replication of natural resources.

According to Article 16 of the Constitution of Ukraine, it is the responsibility of the state to ensure environmental security and maintenance of environmental balance on the territory of Ukraine, to mitigate the aftermath of the Chornobyl catastrophe, a catastrophe of planetary scale, and protection of the genepool of the Ukrainian nation.

Environmental security is the state of the environment that prevents deterioration of the environmental circumstances and appearance of threats to human health. Environmental security is guaranteed to the citizens of Ukraine by taking a wide range of interconnected political, economic, technical, organizational, and other measures.

According to the Law of Ukraine «On the Main Principles (Strategy) of the State Environmental Policy of Ukraine by 2020» of 21.12.2010 № 2818-VI⁵⁴, goal 4 envisages integration of the environmental policy and improvement of the system of integrated environmental management in the military and Defence industry by elaborating by 2015 the stimuli for liquidation of the results of environmental harm inflicted by military activities, particularly, compensation of damages to the state caused by temporary deployment of foreign armies on the territory of Ukraine. The Resolution of the Verkhovna Rada of Ukraine «On Main Lines of the State Policy of Ukraine in Environment Protection, Use of Resources, and Provision of Environmental Security» of 05.03.1998 № 188/98-BP⁵⁵ indicates in Chapter 7 «Military Activity and Conversion of the Military-Industrial Complex» that everyday military activity usually has very negative impact on the environment polluting its main components: soils, surface and ground waters, and atmospheric air.

To strengthen institutional capacity for reaching stable and guaranteed environmental security during military actions, it is necessary to streamline the main efforts through establishment of mutual trust and interaction between the Ministry of Environmental Security of Ukraine and the heads of the Armed Forces of Ukraine in regard to the environmental condition and effectiveness of environment protecting activity in the Defence sphere; liquidation of the effects of environmental harm inflicted by military and Defence activity, and, in particular, compensation of damages caused by the temporary deployment of foreign armies on the territory of Ukraine; extension of publicity and raising objectiveness in highlighting environmental problems of the Defence activity in Ukrainian mass media.

⁵⁴ Gazette of the Verkhovna Rada of Ukraine (GVR), 2011, № 26, p. 218

⁵⁵ Gazette of the Verkhovna Rada of Ukraine (GVR), 1998, № 38-39, p. 248

For immediate regulation of the relations in regard to environmental security in the course of activity of the Armed Forces of Ukraine, the decrees of the Minister of Defence of Ukraine are of special importance.

According to the decree of the Minister of Defence of Ukraine of 4 July 1995 «On Measures of Organization of Environmental Support of the Armed Forces of Ukraine» № 171, radiological, chemical and biological Defence forces of the Armed Forces of Ukraine are responsible for planning the environmental support measures, organization and supervision over their implementation by the Armed Forces of Ukraine (hereinafter — the AFU) both in times of peace and war.

The decree of 9 September 1999 № 455 «On the Drawbacks in Organization of Environmental Support of the Armed Forces of Ukraine» indicates that environmental security as a component of the national security of the country urges to more active participation of the AFU in solving the environment protection tasks.

According to the Provision on the Organization of the Environmental Support of the AFU, approved by the decree of the Minister of Defence of Ukraine № 171 of 4/07/1995, taking into account continuous factors of military activity that have negative influence on the natural environment, health of the staff and civilians, heightened attention of international organizations, bodies of state power, and community to the issues of environmental security of military objects and military and industrial production, participation of the AFU in programs for liquidation of nuclear and conventional weapons, the necessity to take into account the influence of environmental factors on the activity of the armed forces at times of peace and war caused the necessity to create such environmental provision at the AFU and establish the respective bodies to organize it⁵⁶.

Environmental support of the AFU is a complex of organizational, research and technical, regulatory and legal, economic, social, and educational measures taken by the AFU and aimed at protection, rational use and restoration of the natural environment in the process of forces activity, as well as at carrying out the tasks according to their designation in conditions of environmentally unfavorable technology-related and natural factors⁵⁷. It is important to indicate that the aim of the environmental provision of the AFU is, among other things, protection of the environment in places of forces and other military objects deployment.

The main tasks of environmental support of the AFU include environmental support of everyday activity of the forces, interaction with state and official bodies for protection of the environment and international cooperation on environmental support of military activity. Environmental support of everyday life of the forces presupposes preparation of proposals to the Plan of Ensuring

⁵⁶ http://vyhovna-roboty.blogspot.com/2011/03/blog-post_9107.html

⁵⁷ Ibidem.

Radiological Chemical and Biological Protection of the Forces in the Course of Military Actions and assessment of environmental harm inflicted by the activities of the forces, and taking measures to restore the natural environment.

To our best knowledge, during military activities toxic substances that accompany such activity uncontrollably get into the environment in the amounts that increase the critical permissible concentration of such chemical substances by thousands of times. To take measures to monitor such influence on the environment is the obligation of the state on its way to guaranteeing human rights to environmental security. Attention should be paid to the procedure of the AFU state environmental monitoring, which lies in elaboration of an automated subsystem of environmental monitoring of the AFU on the basis of the existing and developed automated management systems (AMS), computing centers (points), and measurement complexes and systems; development and publication of directives and regulatory technical documents regulating the functioning of the subsystem for environmental monitoring of the AFU; development and implementation of special mathematic, program, and material and technical support for automated subsystem of environmental monitoring of the AFU; ensuring functioning of the automated subsystem of environmental monitoring and information combination with its state system and institutional subsystems; control, analysis, and forecasting the environmental condition in the AFU and presentation of information to the interested state bodies⁵⁸.

Interaction with state and official bodies of environment protection and international cooperation on environmental support of the military activity includes organization of the interaction between the environmental security bodies of the AFU and the state and local bodies of power, the Ministry of Environment and Natural Resources of Ukraine, and other bodies in the sphere of environment protection; coordination of the research and development and design works at the Ministry of Defence of Ukraine with similar works at other ministries and institutions of Ukraine to achieve the most effective use of scientific and technical potential of the state for solution of environmental problems; International cooperation in the sphere of environment protection; study, generalization, and implementation of the international experience concerning performance by other states of their obligations stipulated by international agreements in the sphere of natural environment protection; interaction with military institutions of other states in regard to issues of environmental support of the forces.

Thus, the Armed Forces of Ukraine and the Ministry of Defence of Ukraine have all the necessary powers to conduct environmental monitoring of military actions, and to elaborate the proposals to the Plan of Ensuring Radiological Chemical and Biological Protection of the Forces in the Course of Military Actions

⁵⁸ http://vyhovna-robota.blogspot.com/2011/03/blog-post_9107.html

and Assessment of Environmental Harm Caused by the Activity of Forces, and taking measures to restore the natural environment.

Military actions are the kinds of activities that constitute increased environmental hazards even at times of peace. This is indicated in clause 10 of the Resolution of the Cabinet of Ministers of Ukraine of 28 August 2013 № 808 «On Approval of the List of Types of Activity and Object that Constitute Increased Environmental Hazard»⁵⁹. The objects of increased hazard include production, preservation, disposal, and destruction of ammunition of all types, explosives, rocket fuel, and other toxic substances.

According to Article 58 of the Law of Ukraine «On Environmental Protection» of 25.06.1991 № 1264-XII⁶⁰, the requirements of environmental security relate to a certain extent to military and Defence objects, as well as to objects of the internal affairs bodies, and state security bodies. These requirements should be also observed during deployment of military units, holding military training exercises, maneuvering, and relocation of the forces and military equipment⁶¹.

Civil population, its property and environment are protected during military actions. According to the Law of Ukraine «On the Armed Forces of Ukraine» of 06.12.1991 № 1934-XII⁶², no extreme circumstances, orders or instructions of commanders can be the reason for any illegal actions that violate people's right to the environment that is safe for their life and health.

The Law of Ukraine «On High-Risk Facilities» of 18.01.2001 № 2245-III⁶³ contains the definition of a high-risk facility as an object where one or several hazardous substances or categories of substances are used, produced, processed, stored, or transported in the amount that equals or exceeds the normative mass threshold limit levels, as well as other objects that, according to the law constitute a real threat of a technology-related or natural emergency, which includes, among other things shell bursts.

The Resolution of the Cabinet of Ministers of Ukraine of 11 July 2002 № 956 «On Identification and Declaration of Safety of High-Risk Facilities»⁶⁴ as amended according to the Resolutions of the Cabinet of Ministers № 313 (313 — 2004-П) of 11.03.2004, № 990 (990 — 2011-П) of 21.09.2011, № 380 (380 — 2013-П) of 29.05.2013, № 748 (748 — 2013-П) of 07.08.2013, offers a more detailed definition of high-risk facilities and indicates that they include

⁵⁹ <http://zakon0.rada.gov.ua/laws/show/808-2013-%D0%BF/conv/print1429780786844183>

⁶⁰ Gazette of the Verkhovna Rada of Ukraine (GVR), 1991, № 41, p. 546

⁶¹ P. Getman, M. V. Shulha, Environmental Law of Ukraine: Textbook. — Kharkiv: Pravo, 2005 http://www.ebk.net.ua/Book/law/getman_ekopu/part7/701.htm

⁶² Gazette of the Verkhovna Rada of Ukraine (GVR), 1992, № 9, p. 108

⁶³ Gazette of the Verkhovna Rada of Ukraine (GVR), 2001, № 15, p. 73

⁶⁴ <http://zakon4.rada.gov.ua/laws/card/956-2002-%D0%BF>

explosives — solid and liquid substances or mixtures that under the influence of external factors can quickly change their chemical composition, and this process can self-distribute with release of a large amount of heat and gaseous products (class 1 according to GOST 19433–88), including substances of mixtures that burning in detonation regime produce an explosion wave in the air; substances or mixtures, whose energy-releasing reactions in the regime of detonation, deflagration or thermal explosion in a case (apparatus, tank, pipeline or in a special product) cause destruction of this case and an explosion wave in the air, and scattering of debris.

Explosive substances can be divided into initiating (primer) explosives, disruptive (secondary) explosives, and pyrotechnic explosives.

Initiating (primer) explosives are the substances, which under the influence of heat or external mechanical factors can undergo quick chemical transformation generating heat and gaseous products. Pyrotechnic mixtures are compounds on the basis of an oxidizer and combustible matters with different functional admixtures that can under the influence of initiating explosives or under considerable influence of external factors undergo energy-releasing reactions with light, heat, sound, reactive or smoke (particularly tear) effect. The state register of high-risk facilities of military designation is maintained by the Ministry of Defence.

Thus, military actions result in release of hazardous substances into the air, water and soil, and are an environmentally dangerous activity. The AFU is responsible for environmental monitoring, as the AFU have full information concerning their emissions, and can collect the information about the actual state of the elements of the environment on site. This idea runs through the Defence legislation of Ukraine, but is not reflected in the general norms on the procedure of environmental monitoring of Ukraine. It would be relevant to spell out the powers of ecomonitoring of the Ministry of Defence at the level of the law and a resolution of the Cabinet of Ministers of Ukraine.

To protect national interests of Ukraine, reinforce and strengthen constitutional principles of democratic law-based state in the sphere of civil-military relations, enforcement of rights and freedoms of human beings according to the international obligations undertaken by Ukraine, recognized legal principles of organizing and carrying out democratic civilian control over the AFU and other military formations established according to the laws of Ukraine, as well as over law-enforcement bodies, the Law of Ukraine «On Democratic Civilian Control over the Military Organization and Law-Enforcement Bodies of the State» of 19. 06. 2013 № 975-IV was adopted (as amended according to the Laws № 4652-VI (4652–17) of 13.04.2012, GVR, 2013, № 21, p. 208 № 5286-VI (5286–17) of 18.09.2012, GVR, 2013, № 38, p. 499, № 245-VII (245–18) of 16.05.2013, GVR, 2014, № 12, p. 178, № 1697-VII (1697–18) of 14.10.2014, GVR, 2015, № 2–3,

p. 12⁶⁵. According to this law, the subject of civilian control in the sphere of Defence and security, and law-enforcement activity of the state is the reasonability of the decision of state bodies on military issues and issues of law-enforcement from the perspective of their correspondence to the principles of internal and external policy, international obligations of Ukraine under the concluded agreements, the agreement to mandatory nature of which was granted by the Verkhovna Rada of Ukraine. A progressive norm of this law is Article 7, according to which the subjects of civil control shall exercise their powers in the sphere of control observing the access mode to the information that belongs to state secrets determined by the Ukrainian legislation, as well as limitations determined by the law for protection of strategic interests of the state, including imposition of the state of emergency or martial law.

Operations and mobilization plans of the Armed Forces of Ukraine, other military formations, and law enforcement bodies, operations and disposal arrangements of their officials are not subject to control on the part of the citizens and civil organizations. Control over the activity of the Security Service of Ukraine, intelligence and counter-intelligence agencies of Ukraine, operational subdivisions in charge of operational search, as well as pre-trial investigation agencies shall be done observing the requirements of the Laws of Ukraine «On the Security Service of Ukraine» of 25.03.1992 № 2229-XII⁶⁶, «On Intelligence Agencies of Ukraine» of 22.03.2001 № 2331-III⁶⁷, «On Counter-Intelligence» of 26.12.2002 № 374-IV⁶⁸, «On Operational Search» of 18.02.1992 № 2135-XII⁶⁹, «On Military Law and Order Service in the Armed Forces of Ukraine» of 07.03.2002 № 3099-III⁷⁰, other laws, and the Code of Criminal Procedure of Ukraine of 13.04.2012 № 4651-VI.⁷¹

The Cabinet of Ministers of Ukraine, executing constitutional powers in regard to the domestic and foreign policy of the state, guarantee of its sovereignty, Defence capacity, and national security, public order, and combating crime, according to the Constitution and the laws of Ukraine, and the Acts of the President of Ukraine does the following:

- elaborates and submits for consideration by the Verkhovna Rada of Ukraine the bills on national security and Defence, and law enforcement activity that require legislative regulation, and takes the respective decisions within its competence;

⁶⁵ Gazette of the Verkhovna Rada of Ukraine (GVR), 2003, № 46, p. 366

⁶⁶ Gazette of the Verkhovna Rada of Ukraine (GVR), 1992, № 27, p. 382

⁶⁷ Gazette of the Verkhovna Rada of Ukraine (GVR), 2001, № 19, p. 94

⁶⁸ Gazette of the Verkhovna Rada of Ukraine (GVR), 2003, № 12, p. 89

⁶⁹ Gazette of the Verkhovna Rada of Ukraine (GVR), 1992, № 22, p. 303

⁷⁰ Gazette of the Verkhovna Rada of Ukraine (GVR), 2002, № 32, p. 225

⁷¹ Gazette of the Verkhovna Rada of Ukraine (GVR), 2013, № 9-10, № 11-12, № 13, p. 88

- following the legislation, determines the needs in expenditures for the national security and Defence, law-enforcement, fight on organized crime and terrorism, protection of the state border, security activity, and execution of punishments. Draft Defence budget, as a component of the State Budget of Ukraine, is first considered by the National Security and Defence Council of Ukraine;
- ensures fulfillment of the State Budget of Ukraine approved by the Verkhovna Rada of Ukraine, including allocation of budgetary appropriations for the needs of the national security and Defence, and law enforcement;
- accounts of and reports to the Verkhovna Rada of Ukraine on fulfillment of the State Budget of Ukraine in the sphere of national security and defence, and law enforcement;
- elaborates and submits for approval by the Verkhovna Rada of Ukraine nationwide programs in the sphere of the national security and defence, the programs of military, military and political, and military and technical cooperation of Ukraine with other states and inter-state alliances;
- organizes development and approves state order for production of military products, supervises its implementation, as well as creation, preservation, and development of mobilization capacity, creation, maintenance, and timely update of material values of the mobilization reserve, controls preservation and maintenance of transport and other means that in case of imposition of martial law or the state of emergency, according to the Ukrainian legislation, shall be transferred to the Armed Forces of Ukraine, other military formations, and law enforcement agencies;
- organizes development and submits for approval to the President of Ukraine draft Mobilization Plan of Ukraine for a special period;
- controls export of weapons and military equipment, strategic materials, technologies, and double-purpose products;
- controls observance of land, tax, economic, labor, housing, and environmental legislation by the Armed Forces of Ukraine, other military formations, and law enforcement agencies;
- submits proposals on improvement of the organizational structure of the Military Organization and law enforcement agencies of the state for consideration by the President of Ukraine.

Local self-government bodies and local state administrations, within the powers determined by the Constitution and the laws of Ukraine do the following:

- control the observance of the land, tax, economic, labor, housing, and environmental legislation by military units, bodies and institutions of the Armed Forces of Ukraine, other military formations, and law enforcement agencies located on the territory of the region;

- coordinate — from the perspective of citizen security — the plans concerning military training exercises and other events connected with participation of a large number of people on the territory of the region;
- develop operational plans and ensure interaction of the local self-government bodies, local state administration, and respective structures of military management in the course of performing the tasks of territorial Defence;
- receive from the commanders of the military units and divisions of the Armed Forces of Ukraine, and other military formations located on the territory of the region the necessary information about the threat or the extent of contamination of the environment by radioactive, poisonous, and other hazardous substances resulting from emergencies on military objects or with military equipment, as well as in regard to availability and capabilities of powers, means, and resources on the subordinated territory to organize coordinated actions in cases of emergency;
- inform the public, including through mass media, about their activity in solving the tasks connected with national security and defence, and combating crime.

To accomplish these tasks, local governments can establish deputy commissions for democratic civil control, and local state administrations can establish respective subdivisions.

To achieve the state of national security, legal regime of emergency and environmental emergency may be imposed. According to the Law of Ukraine «On Legal Regime of Emergency» of 16.03.2000 № 1550-III⁷², the state of emergency is a special legal regime that can be temporarily imposed in Ukraine or in its separate areas in cases of technology-related or natural emergencies of not lower than the national level, which lead or may lead to human and material losses, pose a threat to life and health of people, or in cases of attempted turnovers or changes of the constitutional order in Ukraine by violence, in which case the respective bodies of state power, military commanders, and local self-government bodies, in accordance with this Law, are endowed with the powers necessary to avert the threat and ensure security and health of the citizens, regular functioning of the national economy, bodies of state power and local self-government bodies, protection of the constitutional order, as well as are allowed to resort to temporary, caused by the threat, limitation in exercise of constitutional rights and freedoms of a person and a citizen, and rights and legitimate interests of legal entities with indication of the period of such limitations. The state of emergency is imposed only in case of a real threat to security of citizens or the constitutional order, and if this threat cannot be eliminated in other ways.

The state of emergency may be imposed in the following cases:

1. occurrence of especially extreme emergencies of technology-related and natural character (natural disasters, catastrophes, especially large fires, application

⁷² Gazette of the Verkhovna Rada of Ukraine (GVR), 2000, № 23, p. 176

- of destruction means, pandemics, zoonoses etc) that pose a threat to life and health of a significant number of people;
2. carrying out of mass terrorist acts that lead to losses of life or destruction of vital infrastructure;
 3. onset of inter-ethnic and inter-religious conflicts, blocking or seizure of vital objects or areas which poses a threat to citizen security and violates regular course of work of the bodies of state power and local self-government bodies;
 4. onset of mass disturbances that are accompanied with violent treatment of citizens, and limitation of their rights and freedoms;
 5. ways of takeover or change of the constitutional order in Ukraine by means of violence;
 6. mass crossing of the state border from the territory of the neighboring states;
 7. the necessity to restore constitutional public order and operation of the state bodies of power.

The Law of Ukraine «On the Environmental Disaster Area» of 13.07.2000 № 1908–III⁷³ regulates the relations concerning the environmental disaster area, which may be declared on a separate territory of Ukraine, where such environmental disaster happened. Environmental emergency is an emergency in case of which negative changes in the natural environment requiring emergency measures on the part of the state occurred on a certain territory.

Negative changes in the natural environment include loss, exhaustion or destruction of separate ecosystems and resources as a result of excessive pollution of the environment, destructive influence of the elemental forces and other factors limiting or excluding the possibility of human living and economic activity in these conditions. The reasons for declaring a separate area an environmental disaster area are as follows:

- considerable increase of the permissible levels of indicators of the natural environment quality, determined by the legislation;
- emergence of a real threat to life and health of a large number of people, or great material damages to legal entities, individuals, or the natural environment as a result of natural environment pollution, destructive influence of elemental forces or other factors;
- negative changes that occurred in the natural environment on a large territory and which cannot be eliminated without application of emergency measures on the part of the state;
- negative changes that occurred in the natural environment, and which substantially limit the possibilities of living and engaging into economic activity on the respective territory;
- a substantial increase in the morbidity rate among the population resulting from negative changes in the natural environment.

⁷³ Gazette of the Verkhovna Rada of Ukraine (GVR), 2000, № 42, p. 348

Legal regime of the environmental disaster area is a special legal regime that can be temporarily imposed in separate areas in cases of environmental emergencies and is aimed at prevention of human and material losses, avoidance of the threat to human life and health, and elimination of the negative effects of the environmental emergency.

Introduction of the respective legal regime of the environmental disaster area envisages allocation by the state and/or local self-government bodies of additional financial and other material resources sufficient for normalization of the environmental condition and compensation of damages, introduction of a special regime for delivering products for state purposes, and implementation of the state target programs of community service.

In case of availability of sufficient grounds, a legal regime of emergency can be imposed within the area of the environmental emergency in accordance with the procedure determined by the Law of Ukraine «On the Legal Regime of Emergency» of 16.03.2000 № 1550-III⁷⁴.

Introduction of legal regime of environmental emergency area stipulates mandatory allocation of funds from state and local budgets, the reserve fund of the Cabinet of Ministers of Ukraine, and other sources allowed by the law. In view of lack of funds, the Cabinet of Ministers of Ukraine shall refer a bill on amendments to the State Budget of Ukraine to the President of Ukraine, which shall be referred to the Verkhovna Rada of Ukraine for extraordinary consideration as an urgent one.

As part of expenditures stipulated by local budgets for specific purposes, bodies of local self-government allocate financial and other material resources, and, if necessary, additional funds in compliance with requirements set by article 67 of the Law of Ukraine «On Local Self-Government» of 21/05/1997 № 280/97-BP⁷⁵.

To ensure collection, processing, storage and analysis of information on adverse changes in the environment that occurred within the environmental emergency zone, special environmental monitoring is carried out with a view to:

- determine the impact of hazards that resulted in and caused environmental emergency;
- ensure short and long-term prognosis of negative environmental changes within the environmental emergency zone and the adjacent areas.

Under the Resolution of the Cabinet of Ministers of Ukraine of January 26, 2015 № 18 «On State Commission on Technogenic and Environmental Safety and Emergency Situations», the State Commission on Technogenic and Environmental Safety and Emergency Situations (hereinafter — State Emergency Commission) is a permanent body that coordinates activities of central and local executive bodies.

⁷⁴ Gazette of the Verkhovna Rada of Ukraine (GVR), 2000, № 23, p. 176

⁷⁵ Gazette of the Verkhovna Rada of Ukraine(GVR), 1997, № 24, p. 170

Its duties include ensuring technogenic and environmental safety, protecting population and territories against emergencies, taking organizational measures to counter terrorism and military threats, as well as preventing emergencies and responding to them.

The Law of Ukraine «On Military and Civil Administrations» of 03/02/2015 № 141-VIII⁷⁶ determines authorities and order of activity of military and civil administrations with a view to ensure safety and normalize vital activity of population in the region of anti-terrorist operation. Military and civil administrations are temporary state bodies operating on the territory of Donetsk and Luhansk regions as part of Anti-terrorist Center at the Security Service of Ukraine, and are aimed to secure operation of the Constitution and the laws of Ukraine, to ensure security, normalize vital activity of population, administer the law, ensure counteraction to manifestations of sabotage and terrorist acts, and are aimed to prevent humanitarian crisis in the region of anti-terrorist operation.

Civil Protection Code of Ukraine of 02/10/2012 № 5403-VI⁷⁷ governs relations connected with protection of population, territories and property against emergency situations and responding to them; operation of the single state civil protection system; and determines powers of state bodies, Council of Ministers of the Autonomous Republic of Crimea, bodies of local self-government, rights and duties of the citizens of Ukraine, foreign citizens and stateless citizens, as well as enterprises, institutions and organizations, regardless of their type of ownership. The system of central body of executive power that secures formation and implements state policy in the sphere of civil protection, includes civil protection forces, educational establishments, scientific institutions, and healthcare facilities (medical units) (hereinafter — bodies and units of civil protection) that are part of its management.

Central body of executive power that secures formation and implements state policy in the sphere of civil protection:

- ensures implementation of measures on mitigation and disaster recovery connected with technological terrorist manifestations and other kinds of terrorist activity in the course of anti-terrorist operations; conducts outreach and practical training activities with a view to prepare population on how to act in the event of a terrorist attack;
- conducts fireworks activities connected with explosive ordnance disposal that remained on the territory of Ukraine after the wars, as well as modern ammunition and explosive means (apart from explosive devices used for the purposes of terrorism) apart from the territories provided for deployment and permanent activity of military units, institutions and military educational

⁷⁶ Gazette of the Verkhovna Rada of Ukraine(GVR), 2015, № 13, p. 87

⁷⁷ Gazette of the Verkhovna Rada of Ukraine(GVR), 2013, № 34-35, p. 458

establishments, as well as enterprises and organizations of the Armed Forces of Ukraine and other military formations; and approves order of organization of such activities and order of cooperation in the course of their implementation.

Main tasks of civil protection forces include: 5 fireworks activities connected with explosive ordnance disposal that remained on the territory of Ukraine after the wars, as well as modern ammunition and explosive means (apart from explosive devices used for the purposes of terrorism) apart from the territories provided for deployment and permanent activity of military units, institutions and military educational establishments, as well as enterprises and organizations of the Armed Forces of Ukraine and other military formations.

Sources of technogenic emergencies:

1. potentially dangerous objects and high-risk facilities;
2. buildings and facilities operating conditions of which have been violated;
3. economic entities with critical state of production facilities and violated operating conditions;
4. nuclear facilities operating conditions of which have been violated;
5. effects of terrorist activity;
6. hydraulic structures;
7. uncontrolled import, storage and use of technogenically dangerous technologies, substances and materials on the territory of Ukraine;
8. overaccumulation or disordered accumulation of domestic or industrial waste, and products unsuitable for plant protection;
9. consequences of military and other environmentally dangerous activity;
10. business entities whose objects are used for production, storage and disposal of explosive ordnance;
11. public infrastructure, operating conditions of which has been violated;
12. other objects that create a threat of accident.

Under the Decree of the Ministry of Internal Affairs of Ukraine and Ministry of Infrastructure of Ukraine of 16/02/2015 № 162/61 «On the approval of Instruction for the order of information exchange in the sphere of preventing emergency situations and responding to them in the event of emergencies between the State Emergency Service of Ukraine and the State Agency of Automobile Roads of Ukraine»⁷⁸ and in line with the Civil Protection Code of Ukraine, Decree of the President of Ukraine of May 15, 2013 № 265 «On the decision of the National Security and Defence Council of Ukraine of March 29, 2013 «The issue of counteracting threats and emergency recovery», as well as resolutions of the Cabinet of Ministers of Ukraine of October 9, 2013 № 738 «On approval of the Order of recording emergency situations»⁷⁹ and of January 9, 2014 № 11 «On

⁷⁸ <http://zakon2.rada.gov.ua/laws/show/z0286-15>

⁷⁹ <http://zakon4.rada.gov.ua/laws/show/11-2014-%D0%BF>

approval of the Provision on the single state civil protection system»⁸⁰, with a view to implement state policy in the sphere of protecting population and territories against consequences of emergency situations, improving interaction between the State Emergency Service of Ukraine and the State Agency of Automobile Roads of Ukraine in the course of emergency recovery.

Under the resolution of the Cabinet of Ministers of Ukraine of January 21, 2015 № 32 «On approval of the Provision on the Ministry of Environment and Natural Resources of Ukraine»⁸¹ and within powers stipulated by the law, Ministry of Environment and Natural Resources of Ukraine shall participate in planning and taking measures for preventing emergency situations of technogenic and natural character and responding to them.

In line with article 103–5 of the Budget Code of Ukraine of 08/07/2010 № 2456-VI⁸², fulfillment of state and local budgets in the populated areas of Donetsk and Luhansk regions, which are located on the territory of anti-terrorist operation and the list of which is approved by the Cabinet of Ministers of Ukraine, shall be gained with consideration of the following peculiarities:

1. expenditures from the state budget, including in the part of transfers from the state budget to local budgets, shall be undertaken after the territories are brought back under state control;
2. transfers to local budgets that are stipulated by the law on the State Budget of Ukraine, shall be made in the order approved by the Cabinet of Ministers of Ukraine;
3. a special order of activity of parties to the budget process on the respective territory and/or discontinuation or resuming of their activity, or their shifting, reorganization or liquidation, is possible by the decision of the President of Ukraine, the respective bodies of state power or their public servants.

In case of termination of bodies of local self-government of Donetsk and Luhansk regions their functions in the part of budget authorities shall be exercised by local state administrations and executive bodies of city councils by a separate decision of the Cabinet of Ministers of Ukraine that is taken on the basis of address of the respective regional state administration.”

Monitoring of sites of generation, storage and disposal of waste is part of a single system of state environmental monitoring.

According to Methods for estimation of damage caused by pollution and contamination of land resources through violation of environmental legislation,⁸³ lands are deemed to be polluted if negative quantitative or qualitative changes that

⁸⁰ <http://zakon2.rada.gov.ua/laws/show/11-2014-%D0%BF>

⁸¹ <http://zakon4.rada.gov.ua/laws/show/32-2015-%D0%BF>

⁸² Gazette of the Verkhovna Rada of Ukraine(GVR), 2010, № 50-51, p. 572

⁸³ <http://zakon0.rada.gov.ua/laws/show/z0285-98/conv/page2>

occurred as a result of economic activity or impact of other factors, were revealed. Herein, the changes might be caused not only by the emerge of new noxious substances in aeration zone, but also by the increased substance content which exceeds their maximum allowable concentration, typical of uncontaminated soil, or in comparison with agrochemical passport data (for agricultural land plots).

Lands are deemed to be polluted if foreign items, materials and garbage is found on the open land without the respective licences, which has caused or may cause environmental pollution.

Standard monetary value of a land plot that has been polluted is taken as a basis for calculating the size of damage as a result of land pollution. Dimensional unit for calculating the size of damage shall be earth stratum equal to 0.2 m (volume of soil material amounting to 2000 cubic metres per one hectare of earth surface).

Expenditures on measures for reducing or eliminating land pollution shall increase depending on depth of pollutant infiltration in the ratio 10:3 (i.e. if depth is increased 10 times relative to earth stratum which is 0.2 m, expenditures on pollution elimination shall increase by three times).

Contaminants that caused pollution of a land plot are divided into four groups of danger, and the amount of critical permissible concentration (CMC) and approxible permissible concentration (APC) of chemical substances in the soil is taken as a basis to determine the degree of danger.

Under the Order of the Cabinet of Ministers of Ukraine of October 22, 2014 № 1024-p «On approval of the Concept of fighting land degradation and desertification»⁸⁴, ways to improve the state system of environmental monitoring, including that of lands (including large-scale ground inspection and agrochemical certification), forests and waters, envisage improving operation of state land, forest and water cadastres; ensuring land planning in the part of elaboration of respective documentation in the sphere of land protection and implementation of measures stipulated by the respective documents, as well as forest management.

In line with the Decree of the Ministry of Agrarian Policy and Food Products of April 26, 2013 № 283 «On Approval of Land Conservation Procedure» and articles 171–172 of the Land Code of Ukraine, the Procedure determines organizational principles for conservation of degraded and low-yielding land, practical use of which is environmentally dangerous and cost-inefficient, as well as technogenically polluted land plots that are not suitable for environmentally clean production, and presence of people on these land plots is dangerous for their health.

This Procedure is applied to bodies of executive power and bodies of local self-government who transfer land plots of state or communal ownership to ownership or use in line with their powers (hereinafter — authorized bodies),

⁸⁴ <http://zakon2.rada.gov.ua/laws/show/1024-2014-%D1%80>

as well as to owners of land plots and land users. This Procedure is mandatory for fulfillment by bodies of executive power, owners of land plots and land users, and is of advisory nature for bodies of local self-government.

Land conservation shall be applied to eroded lands; to waterlogged lands with high degree of salinity and acidity of soil; to soil polluted with chemical substances and other kinds of pollution that are dangerous for human health; to radiological and radioactive contaminated land or land polluted with heavy metals and chemical elements outlined in Table 1 Benchmarks that characterize soil properties and determine the need for land conservation by natural agricultural zones.

In case lands outlined in clause 2 of this Procedure have been detected, territorial bodies of State Agriculture Inspectorate of Ukraine and/or territorial bodies of State Environmental Inspection of Ukraine shall issue an instruction (order) for the owner of a land plot or a land user that ceases practical use of land.

In case there is no registered ownership or right of use in regard to the land plots that are subject to conservation, territorial bodies of State Agriculture Inspectorate of Ukraine and/or State Environmental Inspection of Ukraine shall submit a petition to the authorized body at the location of a land plot for initiation of land conservation work by authorized bodies.

After the petition or instruction (order) has been received, authorized bodies — owners of land plots or land users — are obliged to initiate the work on land conservation within 30 days.

With a view of undertaking land conservation, a land plot owner or a land user shall hand in a written application to the authorized body at the location of a land plot, providing reasons for land conservation outlined in clause 2 of this Procedure. A copy of the document attesting a land title, agrochemical passport of a field or a land plot (in case of agricultural land plot conservation), as well as materials of your own observations shall be attached to the application.

On the ground of application of a land plot owner or a land user; a petition of territorial bodies of State Agriculture Inspectorate of Ukraine and/or State Environmental Inspection of Ukraine; or at their own initiative (if there is no registered ownership or right of use in regard to land plots that are subject to conservation), the authorized body shall within one month issue an order (decision) to set up a commission on land inspection at the site and prepare conclusions on conservation expediency.

A land plot owner; a land user; representatives of authorized bodies, including territorial bodies of State Agency for Land Resources of Ukraine, State Agriculture Inspectorate of Ukraine and/or State Environmental Inspection of Ukraine that submitted a petition for initiation of land conservation work; as well as representatives of Crimean Republican or Regional State Institution «Soils Protection Institute of Ukraine» are involved to be members of the commission.

After inspection of a land at the site, the Commission shall prepare conclusions on expediency of conservation, and shall refer them to the authorized body. Within a month, the authorized body shall consider the materials referred as well as the conclusions and shall issue an order (decision) on land conservation.

In line with the issued decree (decision), a land conservation management plan shall be elaborated (hereinafter — land conservation plan). It shall determine types and kinds of land conservation, conservation deadlines and directions of land use. Bodies of executive power, Council of Ministers of the Autonomous Republic of Crimea, bodies of local self-government, land owners and land users may be land conservation customers (hereinafter — customer).

Land conservation plan shall be elaborated by an economic entity who is a land planning contractor in line with the Law of Ukraine «On Land Planning» of 22/05/2003 № 858-IV⁸⁵ (hereinafter — contractor) and under the agreement on elaboration of land conservation plan, concluded between the customer and the contractor. Land conservation plan shall be elaborated according to the task on elaboration of land conservation plan approved by the customer. Land conservation plan is not subject to mandatory state expert examination of land planning documentation. Land conservation plan shall be approved by the customer. A contractor shall refer land conservation plan to the territorial body of State Agency for Land Resources of Ukraine with a view to store it in the local land planning documentation fund.

When implementing a land conservation plan, in cases stipulated by the legislation, land plot lines shall be established (restored) in the order set by the decree of the State Land Resources Committee of Ukraine of May 18, 2010 № 376 «On approving Instruction on establishing (restoring) land plot lines at the site and fixing boundaries with the use of land marks», which was registered at the Ministry of Justice of Ukraine on June 16, 2010, № 391/17686. The State Land Cadastre shall be updated in line with the Law of Ukraine «On the State Land Cadastre»⁸⁶ of 07/07/2011 № 3613-VI and the resolution of the Cabinet of Ministers of Ukraine of October 7, 2012 № 1051 «On approval of the Order of keeping records of state land cadastre»⁸⁷.

After the end of land conservation term, determined by land conservation plan, and on the ground of application of a land owner or a land user, or on its own initiative, the authorized body shall within a month establish a commission on inspecting the freed land at the site. A land plot owner; a land user;

⁸⁵ Gazette of the Verkhovna Rada of Ukraine(GVR), 2003, № 36, p. 282

⁸⁶ <http://zemres.com/2-rizne/2-postanova-kmu-vid-17-zhovtnia-2012-r-1051-pro-zatverdzhennia-poriadku-vedennia-derzhavnoho-zemelnoho-kadastru>

⁸⁷ <http://zemres.com/2-rizne/2-postanova-kmu-vid-17-zhovtnia-2012-r-1051-pro-zatverdzhennia-poriadku-vedennia-derzhavnoho-zemelnoho-kadastru>

representatives of authorized bodies, including territorial bodies of State Agency for Land Resources of Ukraine, State Agriculture Inspectorate of Ukraine and/or State Environmental Inspection of Ukraine that submitted a petition for initiation of land conservation work; as well as representatives of Crimean republican or regional State Institution «Soils Protection Institute of Ukraine» are involved to be members of the commission. The Commission shall inspect freezed lands at the site and shall propose authorized bodies to return them to the previous land-use, continue conservation, or shall make any other proposals aimed at rational and environmentally safe use of land plots.

Owner of a land plot has the right to address an authorized body with a petition to be allocated an equal land plot instead of lands that became environmentally dangerous, cost-inefficient or technogenically polluted through no fault of his.

The designated purpose of a land plot, as well as any activity, apart from the one stipulated by land conservation plans, shall be prohibited for the period of land conservation.

Table 1

Benchmarks that characterize soil properties and determine the need for land conservation by natural agricultural zones

Properties and features of soils	Unit of measurement	Indicators of soil properties (with consideration of zonal location)
Erodibility (denudation and deflation)	Soil erodibility level	Eroded, heavily and medium eroded, heavily and medium deflated
Skeletal soil	Content of rock debris 3 mm in size, %	> 26 % of soil volume (in 30 cm soil layer)
Light grain size composition	Content of physical clay (particles less than 0.01 mm in diameter), %	a) Polissia zone – up to 3; b) Forest steppe zone – up to 7; c) Steppe zone and Dry steppe – up to 10
Heavy grain size composition of surface-water gley	Content of physical clay (particles less than 0.01 mm in diameter), %	More than 50
Humus content	Humus content, % of soil weight	a) at Polissia – less than 0.5; b) at forest steppe, at northern and southern steppe – less than 1.0; c) at dry steppe – 1.0
Soil solution reaction	Water pH	In all zones: a) less than 4.0; b) more than 8.5
Content of mobile aluminium	mg-eq per 100 g of soil	More than 3.0
Content of absorbed sodium	% of total absorbed bases	More than 10

Properties and features of soils	Unit of measurement	Indicators of soil properties (with consideration of zonal location)
Salination	% of soil weight, in equivalent to toxic salts	a) sodium – more than 0.1; b) chloride-sulfate – more than 0.2; c) sulfate – more than 1.0
Physical degradation	Unit weight, g/cc	a) more than 1.5 – for loamy and clayey soils; b) more than 1.7 – for sandy loam and sandy soils
Exhaustion of organic soils (peaty)	Capacity of organic layer, cm	Less than 30
Secondary underflooding (bogginess)	Ground water level, m	Less than 1,0
Chemical pollution	Maximum admissible concentration (HDK)	Exceedance of maximum admissible concentration of slip forms (ammonium acetate extraction)
Radiation pollution	Ground contamination density with cesium - 137, strontium - 90, Ci/ sq. km	Cs – 137 – more than 15; Sr – 90 – more than 3

Legislative definition of the current situation in the East of Ukraine was enshrined by the Presidential Decree of April 14, 2014 № 405/2014 on implementation of the decision of the National Security and Defence Council of Ukraine of April 13, 2014 «On urgent measures to address the terrorist threat and to preserve territorial integrity of Ukraine»⁸⁸.

Hereafter, the Law of Ukraine «On temporary measures for the period of anti-terrorist operation» of 04/03/2015 № 1669-VII⁸⁹ was adopted. The law determined temporary measures for supporting economic entities who perform their activity on the territory of anti-terrorist operation, as well as persons living in the anti-terrorist zone, or those who moved away for the period of operation. The law regulates issues of lease, mortgage and loan repayment, however, unfortunately neglects issues of environmental safety, environmental monitoring and public health.

In line with the law, period of anti-terrorist operation is time between the date of enactment of the Decree of the President of Ukraine «On the decision of the National Security and Defence Council of Ukraine of April 13, 2014 «On urgent measures to address the terrorist threat and to preserve territorial integrity of Ukraine» of April 14, 2014 № 405/2014 and the date of enactment of the Decree of the President of Ukraine on completion of anti-terrorist operation or military actions on the territory of Ukraine.

⁸⁸ <http://zakon1.rada.gov.ua/laws/show/405/2014v>

⁸⁹ Gazette of the Verkhovna Rada of Ukraine(GVR), 2014, № 44, article 2040

Territory of anti-terrorist operation embraces the territory of Ukraine that includes populated areas determined in the list approved by the Cabinet of Ministers of Ukraine, where the anti-terrorist operation has been conducted, and that was launched according to the Decree of the President of Ukraine «On the decision of the National Security and Defence Council of Ukraine of April 13, 2014 «On urgent measures to address the terrorist threat and to preserve territorial integrity of Ukraine» of April 14, 2014 № 405/2014.

The citizens of Ukraine may participate in exercising civil control over military organization of the state and law-enforcement bodies simultaneously with the help of NGOs, they belong to, deputies of representative state bodies, or personally by addressing either the Human Rights Commissioner of the Verkhovna Rada of Ukraine and their representative on the issue of protecting rights of military men, or other state body in the order determined by the Constitution of Ukraine and the Law of Ukraine «On Citizens' Appeals» of 02/10/1996 № 393/96-BP (with consideration of amendments made in line with the Laws № 653-XIV of 13/05/99, GVR, 1999, № 26, article 219 № 1294-IV of 20/11/2003, GVR, 2004, № 13, article 181, № 2384-IV of 20/01/2005, GVR, 2005, № 11, article 200 № 1254-VI of 14/04/2009, GVR, 2009, № 36–37, article 511, № 4054-VI of 17/11/2011, GVR, 2012, № 27, article 276, № 4452-VI of 23/02/2012, GVR, 2012, № 50, article 564, № 5477-VI of 06/11/2012, GVR, 2013, № 50, article 693, № 245-VII of 16/05/2013, GVR, 2014, № 12, article 178, № 1261-VII of 13/05/2014, GVR, 2014, № 28, article 937, № 1697-VII of 14/10/2014, GVR, 2015, № 2–3, article 12)⁹⁰.

In line with the Constitution of Ukraine, this Law and statutory provisions, NGOs, registered in the established order, are guaranteed the opportunity of:

- requesting for and obtaining information that does not include a state secret pertaining to the activity of the Armed Forces of Ukraine, or other military formations, or the law-enforcement activity in the established order on the part of state authorities, including military authorities, as well as other organizations, enterprises and institutions pertaining to State military establishment; as well as law-enforcement and other bodies;
- carrying out research on problems of military construction, defence organization, ensuring country's safety, and crime combating; public discussion of their results; and in view of this, establishing public funds, centers and groups of experts, etc.;
- conducting public hearings of the draft laws, decisions, and programmes; presenting their conclusions and proposals to the respective state bodies to have them considered in the course of reforming the Armed Forces of Ukraine, as well as other parts of State military establishment and law-enforcement bodies of the state;

⁹⁰ Gazette of the Verkhovna Rada of Ukraine(GVR), 1996, № 47, p. 256

- participating in public discussions and open parliamentary hearings on matters of reforming and activity of the Armed Forces of Ukraine and other parts of Military establishment and law-enforcement bodies of the state;
- familiarizing with conditions of service and way of life of military men;
- with the help of subjects with the right of legislative initiative, advancing legislative initiatives in the sphere of military construction, law-enforcement activity and social protection of military men, pensioners and members of their families.

With consideration of all abovementioned, it could be concluded that national legislation of Ukraine quite properly regulates the issue of protection of human rights to safe environment in the course of military actions.

Several central bodies of executive power are granted the powers that allow them properly monitor the state of environment during military actions; assess the level of damage; and decide on the measures for mitigating negative consequences.

Legal settlement of active cooperation between the Armed Forces of Ukraine and Ministry of Environment and Natural Resources of Ukraine regarding environmental monitoring needs to be specified. It would be expedient to grant environmental staff of the Armed Forces of Ukraine the right to conduct environmental monitoring not only in peace-time but also during military actions (military conflicts). Particularly, water, soil and air sampling for a qualitative analysis of the existing background of the territory during military actions. The obtained information is necessary for making an efficient plan with a view to protect people against negative impact of repugnant substances and take measures to prevent negative consequences. Information on the state of environment in the zone of military operations should be updated in the single modern system of environmental monitoring of Ukraine at least once a week (which, by the way, still has to be established), since pollution that takes place during military actions goes far beyond the conflict zone.

Ukrainian legislation provides for the right of the citizens of Ukraine to precise information on the state of environment in the zone of military operations. The citizens should be aware of this and actively use this right.

Apart from this, it should be kept in mind that legal terrain includes efficient mechanisms for protecting territories that suffered from negative consequences of military operations. Particularly, imposition of the state of emergency, announcing a territory environmental disaster area, or conservation of degraded and low-yielding land, etc. The citizens should be aware of these mechanisms and efficiently use them to protect their rights, as well as monitor, restore and preserve environment that would be suitable for safe living.

CHAPTER 2.

A BRIEF OUTLINE OF THE STATE OF ENVIRONMENT IN DONETSK AND LUHANSK REGIONS BEFORE THE BEGINNING OF MILITARY ACTIONS IN UKRAINE'S EAST

The environmental situation in eastern Ukraine before the beginning of military actions may be characterized as crisis, which was formed during a long period of using natural resources and a direct negative effect on all environmental locations.

A low level of environmental awareness, the absence of sufficient waste and discharge purification, the absence of civilized waste disposal, especially the most dangerous one, the absence of the complex approach to solving environment conservation issues, led to considerable degradation of the environment of eastern Ukraine, overpollution of surface and subterranean waters, air, and land resources.

The situation with intensive air pollution was formed during decades in the process of establishment and development of industry in eastern Ukraine. The environmental aspect was neglected during industrial construction. The biggest contaminators of air were collieries, ironworks, chemical industry, heating enterprises. Namely, the biggest amount of methane was released into the air in cities and districts, where coal producers are situated, and it amounts to approximately 70 % of the general amount of emissions.

The major contaminators of water bodies were enterprises of iron and steel industry (smelters of Mariupol, Yenakiieve, Makiivka, Avdiivka), coal industry and power industry. In a number of cities, waste treatment facilities were morally and physically outdated. Water resources of Donetsk and Luhansk regions are characterized by high salt content. The reason for this is dumping highly-mineralized shaft waters, with which over 1 million tons of different salt end up in water resources in a year. According to the observations of Donetsk region center of hydrometeorology, the most polluted rivers are the following: the Kalmius, the Krynka, the Bakhmut and the Kalchyk.

Also, industrial waste had considerable anthropogenic environmental effect. Within 200 years of developing coal deposits of Donetsk and Luhansk regions around 1260 terricones were formed. For example, around 20–30 % of hazardous waste of the general amount of national waste is formed in Donetsk region. Due

to the absence of modern emplacement areas and enterprises for decontamination and recycling of dangerous waste, dangerous waste is stored on the territory of enterprises, which does not always correspond to the environmental requirements⁹¹.

Taking into account the fact that before military aggression, there was considerable anthropogenic load on the environment on the territory of eastern regions of Ukraine as a result of mining coal, ore and other underground resources, metallurgical production, a large amount of waste, presence of hazardous chemicals, which are used in industry, the damage, done nowadays to the environment, multiplies, is enormous and can hardly be compensated in the near future.

In this chapter we provide a brief description of environmental locations of Donetsk and Luhansk regions and the main factors of anthropogenic impact before the beginning of military actions.

2.1. WATER RESOURCES

Donetsk region is situated in south-eastern part of Ukraine. On its territory there is watershed divide of the rivers of the Black and Azov sea area. The characteristic feature of the region's geological structure is the presence of large deposits of coal system in the central and eastern parts of the region.

Rivers constitute the main part of surface waters of Donetsk region. There are 247 rivers in the region, but only 8 are longer than 40 km. All rivers are fed by precipitation, snow meltwater, springs and industrial effluents. The main waterway of the territory is the river Siverskyi Donets, which flows on its territory for 95 km. The overall length of the river is 1053 km, the basin area is 100 thousand km². The Siverskyi Donets belongs to the basin of the river Don.

According to records, sewage water disposal is done in Donetsk region by over 270 water consumer enterprises in the amount of over 1400 million m³. The main contaminators of water bodies are enterprises of metallurgical industry PJSC «Mariupolskyi Metalurhiynyi Kombinat Imeni Illicha» (Mariupol Illich Steel Mill) and PJSC «MMK «Azovstal» («Azovsteel»), PJSC «Yenakiievskyi Metalurhiynyi Zavod» («Yenakiive Metallurgy Plant»), branch «Metallurgy Complex» PJSC «Donetskstal» — Metallurgy Plant», PJSC «Makiivkoks» («Makiivcoke») and PJSC «Avdiivskkyi koksokhimichni zavod» («Avdiivka Coke and Chemical Plant»), enterprises of metallurgical industry, waste treatment plants of industrial and domestic effluents of residential places⁹².

Monitoring of natural water resources state is done by Siverskyi Donets Water Basin Committee (SDWBC), Donetsk Regional Center of Hydrometeorology,

⁹¹ <http://www.menr.gov.ua/index.php/dopovidi/infooglyad>

⁹² <http://www.menr.gov.ua/docs/activity-dopovidi/districtalni/rehionalni-dopovidi-u-2012-rotsi/donetska%202012.pdf>

Sanitary and Epidemiological Service, the corresponding services of public utility «Kompaniya «Voda Donbasu» («Company «Water of Donbas») and other.

Estimating the environmental condition of the Azov sea area, there is a high level of pollution of its coastland in comparison with offshore monitoring spots. The ecosystem of the Azov sea is prone to considerable impact of industry, which leads to the deterioration of its environmental state.

Luhansk region is situated in south-eastern part of Ukraine in the basin of the midstream of the Siverskyi Donets from Donbas to Russia. The region's territory is 26,7 thousand km² (4,4% of the territory of Ukraine). The length from south to north is more than 250 km and from west to east — more than 190 km. The Siverskyi Donets divides it into two parts: the smaller — right bank and the bigger — left bank.

The present state of surface water bodies in the region is characterized by anthropogenic pressure of farm management subjects. The main surface water source on the territory of the region are the rivers Mius and Siverskyi Donets. Over 100,0 million m³ of insufficiently purified sewage is dumped into them every year. The reason for the unsatisfactory work of waste treatment plants is their physical and moral obsolescence, undue current and capital repair works. The general number of waste treatment plants in the region is 175, including 148 which deal with sewage before dumping it into surface water bodies, 78 of them provide effective purification, while 70 work inefficiently and do not provide standard purification of return water.

The main contaminators of water bodies are enterprises of metallurgical industry — metallurgy plants of Mariupol, Yenakiieve, Makiivka, Avdiivka, coal industry and power industry. In a number of cities, waste treatment facilities were morally and physically outdated. Water resources of Donetsk and Luhansk regions are characterized by high salt content. The reason for this is dumping highly-mineralized shaft waters, with which over 1 million tons of different salt end up in water resources in a year. According to the observations of Donetsk region center of hydrometeorology, the most polluted rivers are the following: the Kalmius, the Krynka, the Bakhmut and the Kalchyk⁹³.

2.2. MINERAL WEALTH

Mineral wealth of Donetsk region is particularly rich in raw materials; it provided not only the region with many kinds of mineral raw materials, but also the whole Ukraine. On the territory of Donetsk region there were 1027 deposits of different raw materials (including deposits which are explored), among which there are 399 deposits of fuel and energy sector of the region, which consist of coal. In

⁹³ http://www.menr.gov.ua/docs/activity-dopovidi/districtalni/rehionalni-dopovidi-u-2012-rotsi/luganska_2012.pdf

the region, 52 mines with industrial capacity of 25,5 mln.t/year fully or partially process coking coal; 89 mines of the region with the capacity of 9,4 mln.t/year exploit anthracites. On working mines, the reserves of coking coal are 2620,8 mln.t (53,6 % of the general reserves of the mines); the reserves of anthracites are 741,8 mln.t (15,2 % of the general reserves of the mines). The depth of coal bed exploitation in the region ranges from 20 to 1420 m, the average depth is 740 m. In 2012 59,4 % of the overall output of the region was extracted at the depth of over 700 m, including 21 mines of the region which worked at the depth of over 1000 m. In 2012 their output was 5,9 mln.t, or 22,6 % of the overall output.

Taking into consideration the fact that Donetsk region is highly affected by hazardous exogenous processes (slides, carse, abrasion, underflooding etc.), the whole territory of the region is defined as first category territory. In Donetsk region 189 slides were registered, with the total area of 9,04 km², the region's affectedness is 0,034 %. On the territory of Donetsk region slides are usually characteristic of two regions: on the coast of the Azov sea (Novoazovsk and Pershotraven districts) and in the basin of the river Siverskyi Donets⁹⁴.

Luhansk region is one of the mining regions of Ukraine. Long-term intensive exploitation of the region's subsoil resources led to the considerable changes in the geological environment. Among the main factors contributing to the negative impact are: an extremely high concentration of mining enterprises, a high level of depletion of most deposits, insufficient funding of work, aimed at decreasing negative environmental impact during the whole period of mining. After adopting and implementing a decision concerning the liquidation of unprofitable mines, environmental problems in the region became serious and new environmental and geological situation started to appear under the influence of hydrogeological, engineering-geological and hydrogeochemical factors. Hydrogeological factors are connected with partial or full rise of underground water as a result of stopping mine drainage in the process of wet conservation. On the one hand, it leads to smaller volumes of drainage flow, but on the other hand, it leads to subflooding of land, residential and industrial buildings. The general environmental situation in Luhansk region, despite certain precautions, remains unsatisfactory. Exogenous geological processes are activated, large territories suffer from subflooding, sources of water supply are polluted. Measures of the corresponding state programs are not fulfilled to the full.

Underground waters are the main source of utility and drinking water supply in Luhansk region. Around 87 % of underground water from the general quantity of the necessary amount of water is used for water supply of population. The main reserves of fresh groundwater are in fissure-karst zone of cretaceous-marly strata of upper cretaceous. The most favourable circumstances for the formation

⁹⁴ <http://www.menr.gov.ua/docs/activity-dopovidi/districtalni/rehionalni-dopovidi-u-2012-rotsi/donetska%202012.pdf>

of the reserves of underground water are in the basin of the river Siverskyi Donets and its confluents (the rivers Luhan, Aidar, Borova, Derkul, Luhanchyk). The problem of keeping underground water from pollution is its unprotectedness from penetration of contaminants from the earth's surface. The main sources of underground water pollution are industrial and building agglomerations, where the main sources of pollution were formed due to the discharge from industrial sewerage, the absence of reliable waterproofing of discharge channels and accumulating mechanisms of enterprises, withdrawal of underground water by intakes, dumping contaminated industrial and utility fluids into the surface water bodies. In Luhansk region the most polluted are underground waters within Rubizhano–Lysychansk industrial region, the cities of Alchevsk, Stakhanov and Luhansk. Contaminating components here are salts, phenols, heavy metals, formaldehydes, nitrogen compounds, oil products. Norm exceedance of different components is 10–50 times, in some cases 100 times and more⁹⁵.

2.3. THE ATMOSPHERE

Before the beginning of military actions of 2014, Ukraine's east was a powerful technosphere, which included 1100 industrial enterprises in Donetsk region and 562 enterprises in Luhansk region. The enterprises belong to mining, metallurgical, chemical and oil refining industries, power industry, heavy engineering and construction materials, among which there are environmentally hazardous plants of nationwide significance. For example, in Donetsk region 78% of industrial production belongs to environmentally hazardous production of metallurgical and mining spheres, electricity production and coke industry. Enterprises of these particular spheres have the most negative impact on the environment. Coal mines and burning refuse dump have a major impact on the state of the air basin. High concentration of industrial and agricultural production, transport facilities combined with a high density of population created a huge load on the biosphere the biggest in Ukraine and Europe.

The reasons for the high level of air pollution are the following:

- considerable relative density of power, metallurgical, coal mining and chemical industry enterprises in the industrial structure;
- outdated equipment and technology which is still used in industry;
- the absence of modern filters and other air purification systems from harmful substances, systems of dust trapping;
- insufficient funding and stimulation of the measures connected with decreasing emissions;

⁹⁵ http://www.menr.gov.ua/docs/activity-dopovidi/districtalni/rehionalni-dopovidi-u-2012-rotsi/luganska_2012.pdf

- increasing number of the means of transport and worsening conditions of road surface.

According to the data of statistics department, as of 2012 the emissions of contaminants in Donetsk region amounted to 1514,8 thousand tons, the average value was 1644,8 tons per one enterprise. As of 2012, in Luhansk region industrial enterprises released 10,3 % from the general emissions into the atmosphere in Ukraine, while together with industrial enterprises and means of transport, 529,5 thousand tons of contaminants were released. A part of contaminants from coal and metallurgical industries and power stations in Donetsk region is 93,5 % of all emissions. That is why the biggest pollution of the atmosphere was registered in the places where the abovementioned enterprises are situated.

All Combined heat and power stations of Donetsk region (Zuivska CHP, Starobesheve CHP, Slovyansk CHP, Vuhlehirsk CHP, Kurakhiv CHP) have outdated vacuum cleaning constructions, which were launched as far back as 60–70-ies, and also they use raw solid and liquid fuel (with high concentration of sulfur). At all combined heat and power stations of Donetsk region there is no equipment for stack gas cleaning from sulfur and nitrogen oxides⁹⁶.

There are 6 facilities on the territory of Luhansk region which are the biggest environmental contaminants in Ukraine (in the context of the biggest impact on the air basin of cities): «Luhanska Teplova Electrychna Stantsiya» (Luhansk Combined Heat and Power Station) of LLC «DTEK Skhidenergo», PJSC «Alchevskiyi Metalurhiynyi Kombinat» («Alchevsk Metallurgy Plant»), PJSC «Severodonetsk obyednannia Azot», PJSC «Alchevskkoks», PJSC «LYNIK», OJSC «Lysychanska soda». On the territory of Donetsk region the main contaminants of the atmosphere, except power stations, are PJSC «Metalurhiynyi kombinat «Azovstal» («Steel Mill «Azovstal»), PJSC «MMK Imeni Illicha», PJSC «Donetskstal-MZ» (Donetsksteel-M3), PJSC «Donetskyi Elektrometalurhiynyi Zavod» («Donetsk Electric and Metallurgy Plant»), PJSC «Yenakiivskiyi Elektrometalurhiynyi Zavod» («Yenakiieve Electric and Metallurgy Plant»), PJSC «Yenakiivskiyi Koksokhimprom», PJSC «Donetskkoks», PJSC «Avdiivskiyi Koksokhimichnyi Zavod» («Avdiivka Coke and Chemical plant»), and also PJSC «Yasynivskiyi Koksokhimichnyi Zavod» («Yasyniv Coke and Chemical plant»)⁹⁷.

The issues of reducing emissions of blast furnaces, namely, emissions of cast houses as well as interbell spaces remain serious and topical. At coke and chemical enterprises, the topical tasks are the tasks of closing the cycle of final refrigeration of coke gas, developing dust-free coke discharge and reconstruction of biological chemical purification plants.

⁹⁶ <http://www.menr.gov.ua/docs/activity-dopovidi/districtalni/rehionalni-dopovidi-u-2012-rotsi/donetska%202012.pdf>

⁹⁷ http://www.menr.gov.ua/docs/activity-dopovidi/districtalni/rehionalni-dopovidi-u-2012-rotsi/luganska_2012.pdf

As of 2012, the most polluted air in Donetsk region is in Mariupol (21,8 % of region amount of emissions), Debaltseve (11,4 %), Khartsyzsk (7,3 %), Yenakieve (5,1 %), Donetsk (4,7 %), Kirovske (3,4 %). In Luhansk region the cities with the biggest air pollution are Luhansk (29,2 % of region amount of emissions), Alchevsk (23,7 %), and Krasnodon district (19,5 %).

2.4. LAND RESOURCES

Land fund of Donetsk region is more than 2650 thousand ha — this is 4,4 % of the territory of Ukraine. Agricultural land occupies approximately 2040 thousand ha, of which cultivated land occupies 1652,4 thousand ha.

A topical and serious problem for Donetsk region remains the negative environmental impact of multi-year intensive coal mining and quick closing of dozens of deep unprofitable mines, the activity of which led to irreversible changes in the geological environment on a large territory.

Among all regions of Ukraine, Donetsk region is characterized by the highest erodibility of soil. Here 66,2 % of washed-off agricultural lands are situated, from them 66,5 % of washed-off cultivated land (of the general area of these lands). Deflationary hazardous agricultural lands occupy 85,8 %, while cultivated land — around 90 % of their area in the region. In the region, lands are influenced by water and wind erosion most frequently. Of all region lands around 205,4 thousand ha are inefficient and degraded agricultural lands.

One of the factors of anthropogenic influence on the land resources of Luhansk region is soil pollution, namely radioactive nuclides, heavy metals and other substances, as well as coal mining. In the process of coal mining there is soil disturbance on large territories, which leads to degradation.

On the territory of the region the area of land under open development, quarry and working mines is 7,2 thousand ha; depleted developments and pits, closed mines, burrows, terricones which are no longer in use, occupy 4,1 thousand ha. Land subsidence, pollution by coal mining waste and land surface damage are one of the negative factors of influence on land condition.

Coal industry introduces considerable changes to natural landscapes. Land subsidence, pollution by coal mining waste and land surface damage are one of the negative factors of influence on land condition. Open extraction of minerals intensifies anthropogenic influence on the environment, which is accompanied by using land on large areas with the removal of soil surface. Such activity leads to land degradation and other negative environmental consequences, since recultivation of damaged land is done in undue time or on the insufficient level. The changes introduced by coal industry cannot be restored by nature alone. Therefore, at the location of natural and territorial complexes damaged

by the industry, it is necessary to create new productive and stable natural and commercial formations, which satisfy human needs (forestation, artificial reservoirs, places of recreation). Land subflooding and flooding is a widespread and dangerous process. Location of residential places in low spots, climate and geological conditions, unsatisfactory condition of water supply and sewerage networks, a high level of industrial development etc. are the main reasons for and factors of land subflooding⁹⁸.

2.5. Biodiversity

According to the scientists of Donetsk Botanical Garden of the National Academy of Sciences of Ukraine, modern flora of Donetsk region consists of 1930 species of vascular plants, which belong to 653 genera, 136 families. 369 species of vascular plants belong to rare fraction of flora, that is around 19 % of the general number. The general area of forests of Donetsk region is 204 thousand ha.

Fauna species composition of Donetsk region consists of over 25 thousand animal species of various systematic groups, more than 24 thousand of which are represented by invertebrates (shellfish, insects, myriapods, arachnids, crustaceans, worms etc.). 134 animal species, which are on the territory of the region, are included in the Red Data Book of Ukraine. 25 species of fauna are included in Appendices to Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); 60 species of fauna are included in Appendices to Convention on the Conservation of the European Wildlife and Natural Habitats (Berne Convention); 41 species are included in Appendices to Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, CMS); 17 species are protected by the African-Eurasian Migratory Waterbird Agreement (AEWA); 5 species are protected by the Agreement on the Conservation of Populations of European Bats (EUROBATS)⁹⁹.

Flora of Luhansk region comprises 1838 species of vascular plants that belong to 629 genera and 141 families, which is 36 % of the general number of vascular plants growing in Ukraine.

Under the Law of Ukraine «On the Red Data Book of Ukraine» as of 07.02.2002 № 3055-III¹⁰⁰ 129 flora species are protected by the state in the region, a big part of which grow in the steppe. From 17 steppe plant species of Ukraine, which are included in Convention on the Conservation of the European Wildlife

⁹⁸ http://www.menr.gov.ua/docs/activity-dopovidi/districtalni/rehionalni-dopovidi-u-2012-rotsi/luganska_2012.pdf

⁹⁹ <http://www.menr.gov.ua/docs/activity-dopovidi/districtalni/rehionalni-dopovidi-u-2012-rotsi/donetska%202012.pdf>

¹⁰⁰ Gazette of the Verkhovna Rada of Ukraine (GVR), 2002, № 30, cr. 201

and Natural Habitats (1979) (hereinafter — Berne Convention)¹⁰¹, 7 species grow on the territory of the region.

Fauna of the region includes 428 vertebrata species, which belong to 87 families and 6 classes, represented by 1 species of cyclostomes, 48 species of fish, 9 species of amphibia, 12 species of reptiles, 281 bird species and 77 mammal species. 76 species of vertebrata are included in the Red Book of Ukraine¹⁰².

Reduction of natural habitat, poaching, man-made and anthropogenic load on the environment and excessive recreational load on natural complexes in the period of wild animals breeding cause depauperization of species and population of fauna in the region.

2.6. NATURE RESERVE FUND

Nature Reserve Fund of Donetsk region includes 114 territories and sites with the general area of 108,5249731 thousand ha (actual area — 91,8308231 thousand ha), 21 units of them with the area of 69,4272531 thousand ha are of nationwide significance, 93 units with the area of 39,09772 thousand ha are of local significance. The ratio of the area of nature reserve fund and the area of Donetsk region («reserves index») is 3,47 %.

On the territory of Donetsk region there are wetlands of international significance «Zatoka Kryva ta Kosa Kryva» (Kryva Bay and Kryva Spit) and «Zatoka Bilosarayska ta Kosa Bilosarayska» (Bilosarayska Bay and Bilosarayska Spit), five sites, which correspond to the criteria of Emerald network, are included in the recommended list by the Ukrainian party of the convention:

- Ukrainian Steppe Nature Reserve,
- National Nature Park «Sviati hory»,
- Regional Landscape Park «Donetskyi Kriazh»,
- Regional Landscape Park «Kleban-Byk»,
- National Nature Park «Meotyda».

Nature reserve fund of Luhansk region includes 168 sites, which occupy the area of 87970,4045 ha, from which 7 sites with the area of 12562,0155 ha are of nationwide significance, 161 sites with the area of 75408,3890 ha are of local significance.

As of 01.07.2013 nature reserve fund of Luhansk region consists of 183 sites with the general area of 92336,3751 ha. The region «reserves percentage» is 3,41 %. For the Luhansk region there is the following division of landscapes within NRF: 29 % of steppe, 10 % — nominal natural forest, 18 % — homogenous forest, 1 % —

¹⁰¹ Ukraine joined on 29.10.1996 p. ground - 436/96-bp. http://zakon4.rada.gov.ua/laws/show/995_032

¹⁰² http://www.menr.gov.ua/docs/activity-dopovidi/districtalni/rehionalni-dopovidi-u-2012-rotsi/luganska_2012.pdf

water bodies, 2% — residential places and 40% — plough land. Therefore, the reserves index is overrated, because 60% of NRF area are artificial anthropogenic landscapes. Correspondingly, the part of natural territories of Luhansk region, protected by the state, is more than twice smaller of the formal significance. This picture is particularly depressing because there are particularly large areas of natural landscapes of the steppe zone of Ukraine in Luhansk region.

The area of steppe ecosystems of Luhansk region, including secondary grazing lands and hayfields, is around 652 thousand ha, which is almost ten times bigger than the total area of the region's NRF. In NRF, steppes occupy 29% of the area of 23,757 thousand ha. Thus, 3,6% of the natural steppes of the region are provided with territorial protection.

The upper part of Donetsk range in the south of the region is particularly noted for its uniqueness, where there are large territories of steppe and natural ravine forest with biodiversity, which is typical of it. Correspondingly, natural landscapes of Antratsit and Sverdlovsk districts occupy the biggest part in comparison with other districts of the region. However, reserve percentage here is one of the lowest.

2.7. WASTE

Industrial activity of mining enterprises of Donetsk region leads to worsening environmental situation in the region. On the books of PE «Donvuhlerestrukturyzatsiya» there are 180 waste dumps, 49 of them are burning waste dumps. The area occupied by waste dumps is 958,4 ha.

One of the biggest environmental problems in Donetsk region is the problem of waste disposal. Industrial waste of the region is over 2,8 billion tons. The area of land, occupied by waste, is almost 2% of the region's territory¹⁰³.

As for all-Ukrainian amount of waste, 20–30% of waste is from Donetsk region. In special places or sites (grounds, complexes, buildings, subsurface sites etc.) and on the territory of enterprises of Luhansk region there are 877 thousand tons of hazardous waste of classes I–III of hazard, from them class I — 14 thousand tons, II — 69 thousand tons, III — 793 thousand tons, waste of class IV of hazard — 1469993 thousand tons. There are no waste recycling and wasteburning plants on the territory of the region. All household waste is dumped on landfill sites.

One of the biggest factors of environmental pollution is toxic waste. The overall mass of hazardous waste in Luhansk region as of 01.01.2013 was 877,265 thousand tons (in 2007 — 928,811 thousand tons, in 2008 — 921,7 thousand

¹⁰³ http://dspace.nbu.gov.ua/xmlui/bitstream/handle/123456789/2795/st_33_10.pdf?sequence=1

tons, in 2009 — 902,6 thousand tons, in 2010 — 901,6 thousand tons, in 2011 — 904,8 thousand tons), waste of class 4 of hazard — 1469993,78 thousand tons (in 2011 — 1460352 thousand tons). Waste of classes I–III of hazard constitute a small part of the general quantity, however, it is health and environmental hazard¹⁰⁴.

One of the biggest places of industrial waste discharge as for the amount of waste discharge in Luhansk region are the sites of PJSC «Alchevskiyi Metalurhiynyi Kombinat» («Alchevsk Metallurgy Plant»), which has 5 acting disposal sites — an industrial waste landfill, 2 slag disposals, a sludge collector and sludge catcher dispose of technological waste of class 4 of hazard. At the industrial combine's disposal sites there are over 25 million tons of waste, the overall occupied area of waste disposal sites is 251,21 ha¹⁰⁵.

The accumulated amount of waste has a considerable impact on the environment and the environmental safety of population. There are no specialized enterprises for toxic waste recycling and neutralization, which are accumulated on the territory of industrial enterprises, departmental landfills and solid domestic waste landfills.

¹⁰⁴ http://www.menr.gov.ua/docs/activity-dopovidi/districtalni/rehionalni-dopovidi-u-2012-rotsi/luganska_2012.pdf

¹⁰⁵ <http://www.novaecologia.org/voecos-870-1.html>

CHAPTER 3.

THE EPL RESEARCH ON THE POLLUTION AND DESTRUCTION OF NATURAL ENVIRONMENTAL LOCATIONS AND FACILITIES IN UKRAINE'S EAST AS A RESULT OF MILITARY ACTIONS, AND DAMAGE EVALUATION

Back on 21 September 2014 at the international simposium «Human Rights and the Environment in New Ukraine: in Honour of Prof. Svitlana Kravchenko», which took place in Lviv, EPL and the Environmental Law Alliance Worldwide (ELAW) appealed to the world community of environmental lawyers to do their best to stop the military aggression in Ukraine's east and stop environmental destruction in the war-zone¹⁰⁶.

Since then, the situation in Ukraine's east has not improved or stabilized, on the contrary, it gets worse every day: people die, the infrastructure and environment are totally destroyed.

The risks, connected with damaging communications, enterprises and other sites, which are of higher environmental hazard, are of particular importance, since under the conditions of no control and no possibility to recover from their negative consequences, the scale of negative effect increases every day. The majority of the obvious threats, caused by war, the consequences of which are easy to imagine, are connected either with the mechanical damage of natural landscapes or with the temporary loss of state control over violations and technological processes in the battle zone.

The present situation requires taking measures for the immediate discovery of the present anthropogenic environmental problems, caused by the war, informing the public about the level of hazard, localization of each problem and making a detailed plan of their liquidation depending on the level of hazard or the dynamics of the development of each problem.

Ukraine needs help on behalf of the international community to assess the damage and restore the environment. The first step lies in the verification of damage done both to the infrastructure and the environment. Only after damage assessment and cease of bloodshed, may works on environmental restoration start.

¹⁰⁶ <http://epl.org.ua/novini/anons/browse/5/backPid/393/article/7140/>

EPL works on the assessment of damage, done to the environment as a result of military actions in Ukraine's east, which will become one of the instruments in the adoption of managerial decisions on the state and international levels and the driving force in order to attract the attention of the world community for the establishment of peace for the sake of life in the context of environmental conservation and protection.

In the third chapter, the results of EPL research on the environmental impact of military actions in Ukraine's east are provided.

3.1. CHANGES IN THE ATMOSPHERE ACCORDING TO THE RESULTS OF MONITORING

One of the negative effects of the military actions in Ukraine's east is atmosphere pollution by hazardous gases, which are formed as a result of constant artillery bombardment and explosives application.

During explosion all substances undergo full oxidation, and the products of chemical reaction are released into the atmosphere, the main of which — carbon dioxide and water steam — are not toxic and are harmful only in the context of the global climate changes, as they both are greenhouse gases. However, 1 kg of explosives also forms several dozens of cubic meters of toxic gases: SO_2 , NO_x , CO, among which there are also dangerous underoxidized organic compounds, namely aromatic ones, which are a lot more toxic than the usual ones.

In the atmosphere, sulfur and nitrogen oxides cause acid rains, which change soil pH and cause plant injuries, to which conifers are particularly prone. Acid rain has a negative effect on human health as well, contributing to respiratory illnesses. In high concentration, sulfur trioxide causes higher release of mucus in air passages, coughing, hoarseness, smarting eyes. Carbon monoxide, even in small quantities, causes dizziness and nausea. It forms comparatively stable compound with hemoglobin — carbominohemoglobin, as a result of which blood loses its ability to transfer oxygen to the tissues, and hypoxia develops. Nitrogen oxides cause mucous membrane irritation.

Apart from it, even low concentrations of this gas (4 permille) may lead to breath-holding. The influence of nitrogen dioxide on the human body leads to the decrease of disease resistance and tissue oxygen deficiency, especially in children. This gas affects the sense of smell and night vision. The negative effect on the eyes starts at the concentration of 0,14 mg/m³. Breathing difficulties start at the concentration of 0,056 mg/m³. When inhaling the vapour of aromatic hydrocarbon, the effect similar to narcotic is observed, then gradual difficulties, spasms, respiratory arrest. Damage to the hemic system and hematopoietic organs, nervous system disfunction, liver and internal secretion organs disorders are typical. The influence of aromatic hydrocarbon vapour leads to phacoscotasmus.

EPL researched the concentration of hazardous combines in the air during bombardment of the town of Shchastya in Luhansk region. As a result of the research, it was discovered that the concentration of hazardous substances in the air grew considerably, certain values exceeded the limits considerably.

The research was conducted using the data of the automated environment monitoring system of Luhansk region¹⁰⁷. Namely, the research used the data, registered by automated monitoring station, which worked in Shchastya until mid August 2014. The data on air composition was automatically registered by the station until it was destroyed during one of the bombardments. Considerable exceedance of the concentration of sulfur dioxide (SO₂), nitrogen dioxide (NO₂) and carbon oxide (CO) were registered. Namely, on 13 August the concentration of sulfur dioxide was 5 times higher than CPC, while on 14 August — 8 times (fig. 1).

The increase in the concentration of hazardous substances is connected with city bombardment. Before September 17 there were mortar attacks on the town of Schastya and its suburbs¹⁰⁸. In the below figure 2, it is shown how concentration peaks coincide with the dates of bombardment.

Also, it is important to mention that the dynamics of concentration of the indicated substances in the air is not connected with the work or interruption in the work of Luhansk CHP, located in Shchastya. CHP worked without interruptions until 17.08.2014, when a shell hit the transformer, which ended both the work of CHP and automated monitoring system, which stopped recording data due to blackout¹⁰⁹.

Exceedance of sulphur, carbon and nitrogen oxide in the air is by all means a health hazard for people. Apart from this, these substances are dangerous for pine woods which surround the town.

During bombardment, it is very important to stay inside and breathe through wet gauze bandage, which binds acid gases and prevents them from getting into respiratory passages.

3.2. WATER AND Soil RESEARCH AND WASTE DISPOSAL

Military actions in Ukraine's east led to the destruction of entire natural landscapes. Contamination of water, soil, air, and the destruction of bioresources is enormous, and the restoration of these natural sites will take a long time. The absence of the possibilities to control the whole territory of Donetsk and Luhansk regions, the actual absence of control bodies and constant bombardment do not allow

¹⁰⁷ <http://aisem.org.ua/>

¹⁰⁸ <http://nbnews.com.ua/ua/news/129770/>

¹⁰⁹ http://www.dialog.ua/news/18965_1411019436

objective assessment of the damage done to the environment for the period of armed attacks.

Taking into consideration the fact that before military aggression there was huge anthropogenic load on the environment on the territory of the eastern regions of Ukraine as a result of extraction of coal, ore and other fossils, metallurgical production, a large amount of waste, the presence of hazardous industrial chemicals, damage, done nowadays to the environment, multiplies, is enormous and can hardly be compensated in the near future.

Nowadays, water contamination in Ukraine's east cannot be ignored by the general public. Today, the destruction of the infrastructure connected with water supply and sewerage, chemical contamination, blackout of facilities that dump sewage, pose threat not only to water resources, but to the ecosystems on the whole.

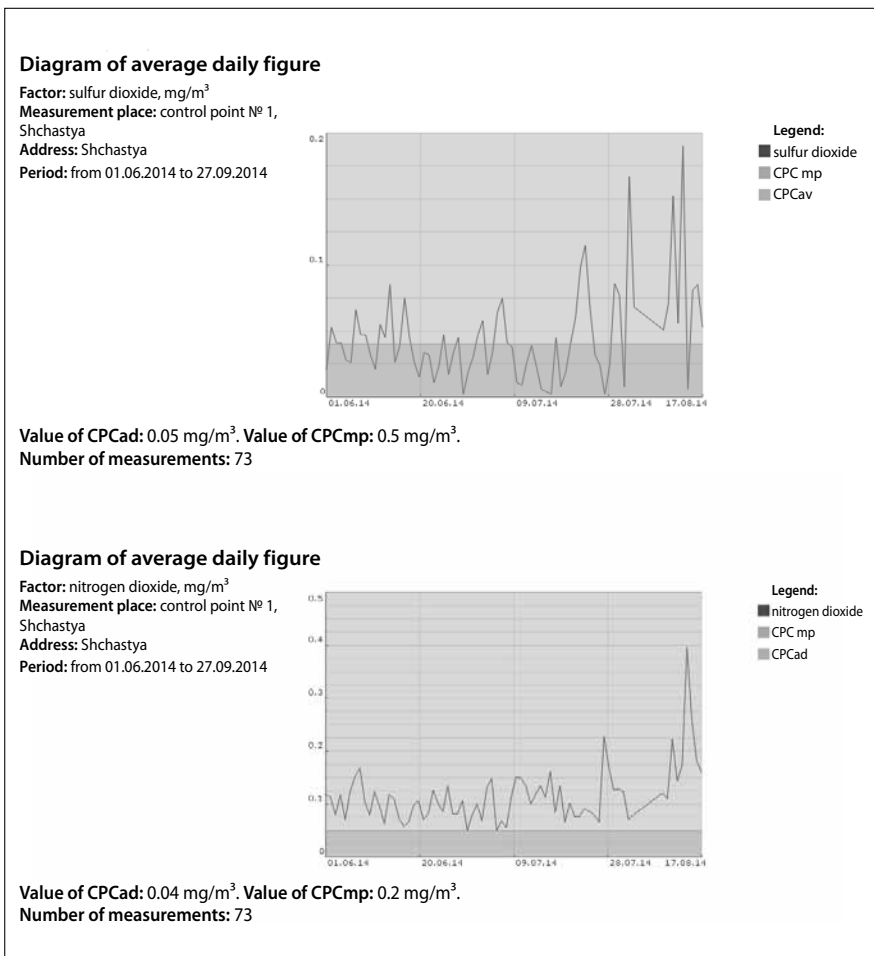


Fig. 1. Diagram of average daily figure

At the beginning of 2014, there were 525 facilities of decentralized water supply in Luhansk region, 1101 — in Donetsk region, however, the smaller part of these facilities is nowadays outside the control of state epidemiological bodies due to military actions (fig. 3).

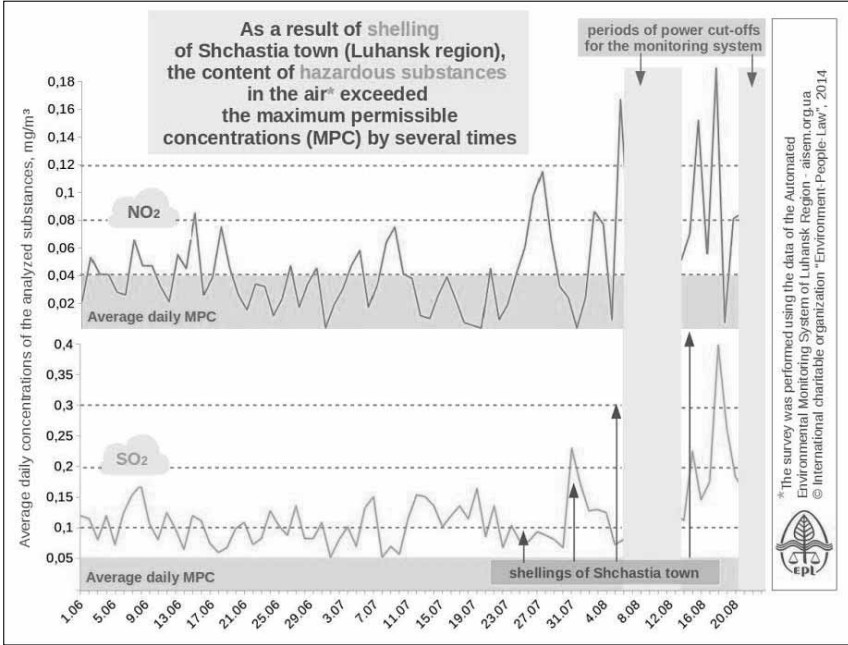


Fig. 2. Correlation of pollutants concentrations and shelling

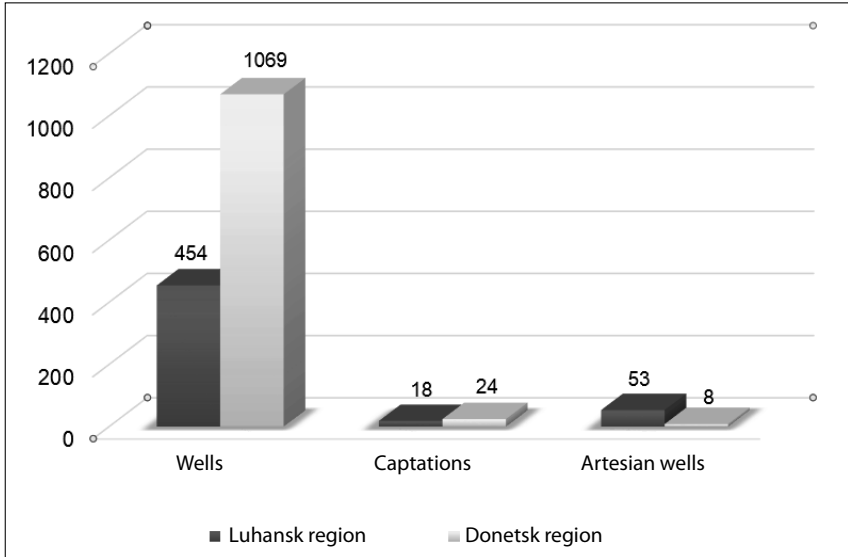


Fig. 3. Decentralized water supply sources in Ukraine's east as of 01.01.2014

As a result of military actions, Luhansk water and wastewater treatment plant was on the verge of industrial and sanitary disaster. Using the confrontation, prowlers stole cable lines and even separate parts of pipes. Thus, many emergency situations appear on water supply and sewerage networks. The residents of Luhansk region mainly consume water from surface springs, which requires considerable decontamination. The routes of chlorine and hypochlorite supply lie through the places of military actions, which have been dysfunctional for a long time.

Also, there was no water supply and sewerage in a part of Luhansk region, namely, Zhovtnevi purification plants in Mala Verhunka, sewerage pump stations № 10, 11 and 18, second stage pump station in Vatutin square, fourth stage pump station, supplying water to Kamyanobrid district, stopped working for a long time¹¹⁰.

During artillery bombardment of Slovyansk, the purification plants were damaged on the territory of the pump station of channel Siverskyi Donets — Donbas. The shutdown of pumping units led to limited supply of both drinking and technical water to the city.

The first stage of the channel «Siverskyi Donets–Donbas» was also bombarded¹¹¹. At that time water in Donetsk was supplied by hours, because military actions in Slovyansk district complicated the repair work of the damaged pumping station and waterpipes.

As a result of military actions, purification plants in Yenakiieve worked according to the temporary scheme of energy supply, since the main power line was damaged. As a result of artillery bombardment in Slovyansk, filtration and purification plant¹¹², 19 sewage pumping stations and 3 hydraulic pump stations, almost 20 km of sewerage systems and 36 km of water supply systems were damaged. Donetsk filtration plant was left without power.

In 2013 State Sanitary and Epidemiological Service of Luhansk and Donetsk regions checked the quality of water in 4 and 26 locations of water bodies of category I correspondingly. Because of the present situation, nowadays it is impossible to obtain data on the control of drinking water in 2014 from the central administrations of Donetsk and Luhansk regions.

The consequences of water contamination can be unpredictable and extremely dangerous for the society. Nowadays, it is impossible to provide proper control of drinking water quality on the territory of military actions in the east.

¹¹⁰ <http://www.5.ua/ato-na-shodi/skhidna-chastyna-luhanska-zalyshylasia-bez-vodota-elektropostachannia-56729.html>

¹¹¹ http://espreso.tv/news/2014/07/14/u_donecku_vidnovyly_robotu_kanal_u_siverskyy_donec_donbas

¹¹² http://www.ukrinform.ua/ukr/news/na_vidbudovu_slovyanska_potribno_pivtora_milyarda_griven_1957349

The volunteers selected water samples from the Siverskyi Donets river near the bridge in the town of Shchastya, Luhansk region, and from water channel near the river. The sites where the samples were taken are marked on the planimetric map (fig. 4).

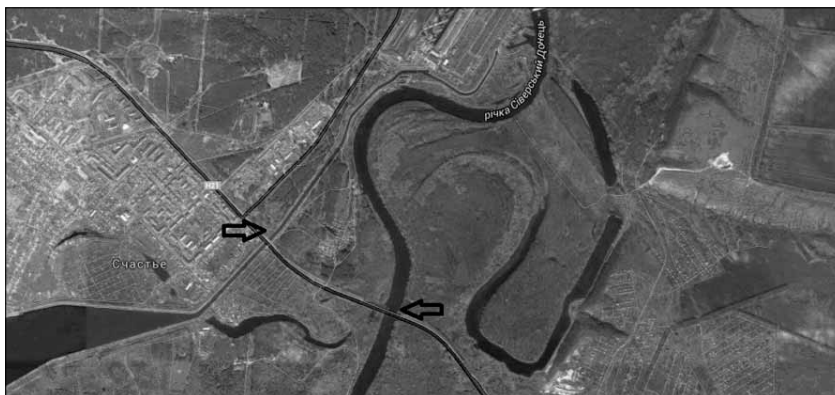


Fig. 4. Planimetric Map of Water Samples Selection Sites

Our research showed that in the river Siverskyi Donets there is exceedance of sulphates by 5 times and nitrites — almost twice as compared to maximum permissible concentrations¹¹³.

In the water channel near the river Siverskyi Donets sulphates exceedance is by more than four times and a slight exceedance of nitrites has been registered. Nitrites are oxygenates of ammonia under the influence of microorganisms in the process of nitrification. The presence of nitrites in the amounts exceeding 0,002 mg/dm³, testify to previous contamination — in the river Siverskyi Donets nitrites concentration is 0,152 mg/dm³.

The presence of sulphates in the natural water of the river Siverskyi Donets is most probably caused by dumping unpurified industrial and sewage water. The presence of sulphates in the water in the amount exceeding 500 mg/dm³ (in the river Siverskyi Donets sulphates concentration is 502 mg/dm³) gives it salty taste and leads to the perversion of the digestive organs in people.

Water contamination is caused by the destroyed purification plants, enterprises, disposal sites and storage of chemical substances. EPL gathered facts about the destroyed facilities at the beginning of 2015 in Ukraine's east as a result of ATO, connected with water supply and sewerage systems.

Namely, on 17 January 2015, the Coke and Chemical Plant in Avdiivka stopped functioning because of shell hits. Shells hit the second coke battery of the first operating department, as a result of which there was its subsidence. The productive capacity of this department is almost completely destroyed.

¹¹³ <http://epl.org.ua/novini/anons/backPid/393/article/7617/>

The territory of Petrovsk service of Municipal Enterprise «Donetskmiskvodokanal» was bombarded by artillery on January 20, as well as pumping compartment of pumping station № 1 in Petrovsk district¹¹⁴.

On January 21, Upper-Kalmius water reservoir (one of the off-channel pipelines to Donetsk¹¹⁵) was damaged, on January 22 a water tower in the town of Popasna was damaged. On January 23, Myronivska CHP stopped working because of bombardment. A shell hit mazut-handling equipment and damaged mazut tank. All three waterpipes, which supplied Luhansk with water, on January 26 (Petrovsk, Aidar, Kondrashevsk) stopped working because of constant bombardment.

Water supply piping was damaged on January 27 on Horlivka part of the channel Siverskyi Donets–Donbas¹¹⁶. Level 1 pump station of Southern Donbas water pipe was deenergized. Transformers on pump station of Upper-Kalmius filtration plant were damaged, as well as the building of filters on Volynsivska filtration station.

In Donetsk, some systems of pressure regulation stopped working on January 27 because of direct shell hits. Numerous water supply and sewerage manholes were destroyed in Kyivskiy, Petrovskiy, Kirovskiy and Kuybyshevskiy districts. On January 26, 18 breakdowns on water pipeline and 46 breaks in the sewerage network of the city were eliminated in Donetsk. On January 28, shells hit Nitrogen plant of Donetsk. On January 28, at the conclusion of Luhansk SES (Sanitary and Epidemiological Station) water from the river Luhan cannot be used even for technical purposes, since it does not correspond to the norms of SANPiN4630–80 (Sanitary Regulations and Standards)¹¹⁷. Such great destruction of water supply and sewerage facilities does not allow using drinking water from centralized water supply system.

Military actions in Ukraine's east have a disastrous effect both for the local residents and the environment. One of the most negative and destructive effects is caused by shell bursts, which occur on the territory of ATO with incredible frequency. As a result, there are not only dead bodies, but also destroyed, dug over earth, poisoned by numerous chemical substances and polluted with pieces of metal. Thousands of burst shells and grenades and tons of contaminators released into the air were the reasons for our research of heavy metals and phosphorus in soil at the sites of shell bursts in Donetsk and nearby settlements. At the site of shell burst, a crater appears — it is a hole in the soil or hard rock, formed as a

¹¹⁴ <http://ukr.segodnya.ua/districts/donetsk/vodosnabzhenie-neskolkih-districtov-donecka-narusheno-585597.html>

¹¹⁵ <https://uk.pointerst.com/ua/dolya-1/news>

¹¹⁶ <http://www.rbc.ua/ukr/news/gorlovskiy-uchastok-kanala-severskiy-donets-donbass-vozobnovil-27072014115900>

¹¹⁷ <http://slavyanoserbsk.com/?p=8471>

result of explosive charge burst. At the sites of constant shell usage, the density of craters is so high that they can be noticed on satellite images, moreover, such images allow researching and analyzing such information.

One of such places, full of craters, is a part of Amvrosiivka and Shakhtarsk districts of Donetsk region. Amvrosiivka district is situated in the southern part of Donetsk range, 82 km from Donetsk, it borders on Shakhtarsk district in the north, on Rostov Region of the Russian federation in the south-east, there are 73 km of borderline there. Shakhtarsk district is situated 170 km from Mariupol sea port.

On the territory of these two districts there is a Regional Landscape Park «Donetskyi Kriazh», which is of high natural and recreational value. The territory of the park is represented by ravine forests and man-made forests and also by the elements of grassland fescue-and-stipa steppe. Flora and fauna of the park includes endemic species as well as those included in the Red Data Book of Ukraine. The territory is special due to the complex «Savur-Mohyla» — a mound, on the territory of which there were active fightings in the summer of 2014. As a result, the forest in this regional landscape park was almost completely destroyed by fire, and the soil was destroyed by numerous craters which were formed as a result of shell bursts.

EPL researched this territory with the help of satellite images. Namely, they identified the size and number of craters, the shell types which led to crater formation, also they estimated the scale of soil destruction and the damage to the state. A free of charge, easily downloaded program Google Earth shows a virtual globe, it has satellite images of high quality, which were used during the research. Owing to them, it was easy to identify craters, divide them into categories and conduct calculations. There is an example of such image with craters in fig. 5.



Fig. 5. Bombardment Sites near the Village of Stepanivka

Satellite images helped to identify four types of craters depending on the diameter, which appeared as a result of shell bursts of four different calibers, and also to count their number. The typization of craters is included in Table 2.

Table 2

Typization of Craters

Crater diameter, m	Shell caliber, mm	Weapon used	Number of craters of the given type
1	82	Mortars with 82-mm fragmentation and ground blast fragmentation mines	4342
2,5-3,5	120	Grad multiple rocket launcher systems, field and self-propelled howitzers	2775
4-6	152	Mortars with 152-mm shells, towed guns and howitzers, self-propelled howitzers	8347
7	220	Multiple launch rocket system «Uragan»	41

Fig. 6 shows a satellite image with the indicated types of craters, marked with different colours. White colour — from shells of 220 mm caliber, red — 152 mm, yellow — 120 mm, blue — 82 mm .

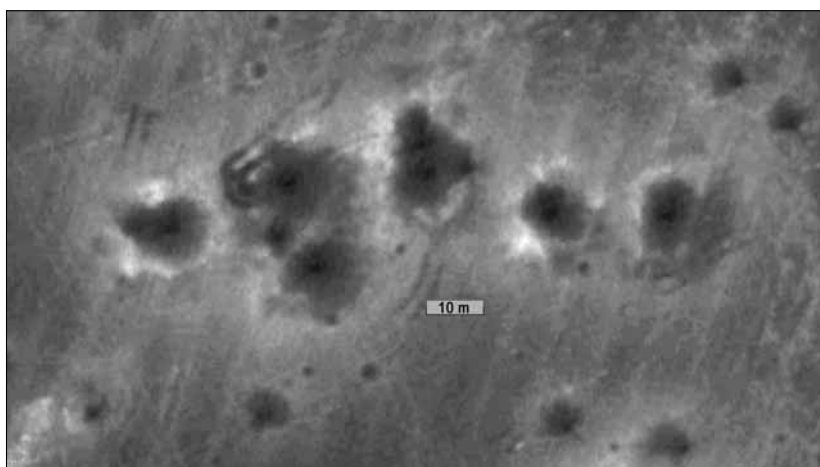


Fig. 6. Types of Craters

EPL estimated that on the territory of 225 km², 15 505 craters were formed as a result of shell bursts. In the sites of high density of craters, there is a mixture of soil, bedding rock, as well as numerous pieces of cast iron. Apart from this, tons of toxic substances, which are formed during detonation and poison soil and atmosphere, are released into the environment. As of now, it is known that at least 392 tons of

metal pieces of shells are dispersed on this territory, which makes it unsuitable for agricultural usage. Moreover, oxidation products from at least 58 tons of explosive substances ended up in the environment, as well as 70 tons of aluminium oxide, which were formed as a result of pulverous aluminium oxidation, which is used together with tolite as explosive substance called amatol. The composition and amount of explosive substances from 15 505 craters of 82, 120, 152 and 220 calibers, are listed in Table 3.

Table 3

Composition and Amount of Explosive Substances

Caliber	Explosive substance	Number of craters of the given caliber	The amount of explosive substance, tons
82 mm	Amatol	4342	1,737
120 mm	Hexogen	2775	10,406
152 mm	Hexogen	8347	43,822
220 mm	Hexogen	41	1,599

During amatol and hexogen detonation, a number of chemical compounds are formed — carbon monoxide (CO), carbon dioxide (CO₂), vapour (H₂O), nitrous oxide (NO), nitrogen oxide (N₂O), nitrogen dioxide (NO₂), formaldehyde (CH₂O), vapour of cyanic acid (HCN), nitrogen (N₂), and also a large amount of identified and unidentified toxic organics. The surrounding soil, wood, turf and constructions are oxidized. It is worth mentioning that craters are only a visible part of shell bursts, since smoke, incendiary and fragmentation shells do not leave craters, but they release substances which are impossible to estimate even approximately. Apart from this, metal pieces, which end up in the environment, also are not safe and absolutely inert. Cast iron with steel impurity is the most widespread material for the production of ammunition casings; it contains not only standard iron and carbon, but also sulfur and copper. The percentage of the components is provided in fig. 7.

The quantity of the above-mentioned chemical elements which ended up in the soil as a result of 15 505 shells bursts, depending on the caliber, is provided in table 4.

Artillery shells of 120 mm and 152 mm caliber give the following quantity of pieces weighing more than 1 g: 1600–2350 and 2700–3500 correspondingly¹¹⁸. The smaller the pieces, the larger the ratio of their surface area and weight is. As a result, the chemical elements, indicated in the table, will oxidize from the surface of the pieces, get to the circulation of elements in the environment and become parts of trophic chains. If one 122 mm shell makes from 1600 to 2350 pieces, 2775 such shells will create from 4,44 million to 6,5 million pieces, and it is only as far as the Grad system is concerned. Thus, the chemical substances,

¹¹⁸ Derevyanchuk, A. Y. *Artillery Weapons and Ammunition* [Text]: a textbook. / A. Y. Derevyanchuk, M. B. Shelest. - Sumy : SumDU, 2010. - 415 p.

which ended up in the soil, are very dispersed, which will contribute to their quick distribution, namely, into ground waters and from there — into surface waters. The consequences of such migration may lead to the distortions in the activity of living organisms, as copper is a heavy metal, separate compounds of which can be rather toxic.

Table 4

The Quantity of Chemical Elements, which Ended up in the Soil

Shell caliber	Number of craters of the given caliber	Iron mass, tons	Carbon mass, tons	Sulfur mass, tons	Copper mass, tons
82 mm	4342	12,50	0,20	0,23	0,09
120 mm	2775	47,95	0,75	0,90	0,35
152 mm	8347	312,51	4,88	5,86	2,28
220 mm	41	3,90	0,06	0,07	0,03

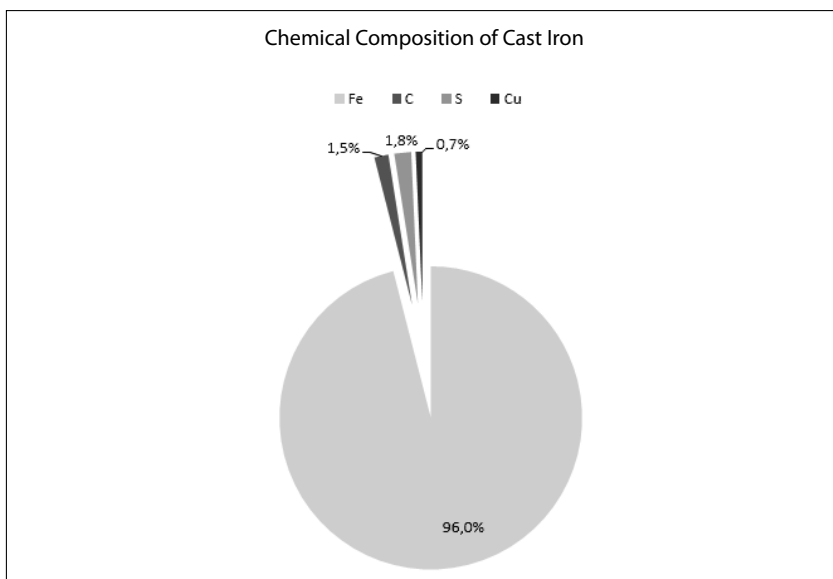


Fig. 7. Chemical Composition of cast iron

In order to imagine the number and density of craters on the researched territory, we provide two satellite images, where all 15505 craters which were identified on the satellite images of the part of Shakhtarsk and Amvrosiivka districts are depicted. The first satellite image (fig. 8) shows all depicted craters, the second one (fig. 9) shows a close-up of a part of the previous image, outlined in white colour. Craters from 82 mm caliber shells are marked with blue colour, 120 mm — yellow, 150 mm — red, and 220 mm — white.

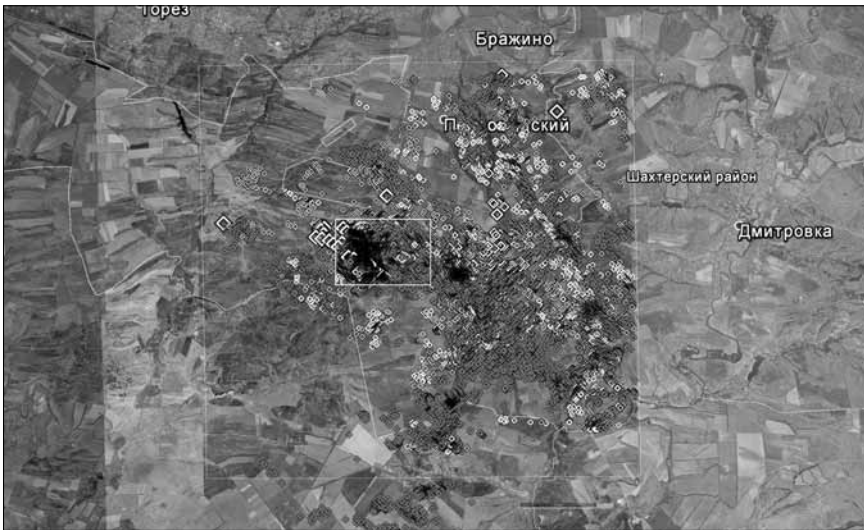


Fig. 8. 225 km² Territory with Indicated Craters



Fig. 9. A Part of Craters in Close-Up

Craters of such density almost completely destroy the soil cover and make it unsuitable for usage. All modern high-explosive shells and high-explosive fragmentation shells on average throw out 1,2–1,5 m³ of soil for 1 kg of explosive substance. Calculation of thrown soil as a result of shell bursts is provided in Table 5.

Table 5

The Volume of Thrown Soil as a Result of Shell Bursts

Shell caliber	Mass of explosive substance of all used shells of a given caliber, kg	Volume of thrown soil , m ³
82	1736,8	from 2084,16 to 2605,2
120	13875	from 16650 to 20812,5
152	58429	from 70114,8 to 87643,5
220	2132	from 2558,4 to 3298
Total:	76172,8	from 91407,36 to 114259,2

According to the abovementioned data, as a result of 15505 shell bursts, at least 91407,36 m³ of soil were thrown. One Kamaz dump truck contains 8–9 m³ of soil, i.e. the amount of soil thrown near Savur-Mohyla may fill at least 11425–10156 trucks. If this territory is recultivated in future, it will require at least aligning landscape, i.e. putting back the same amount of soil, let alone cleaning it from chemical substances and pieces of metal cover of shells. It is worth mentioning that it is typical of explosive shells not to detonate in 3 % of shells, i.e. they remain unexploded. That is, if 15505 craters is only 97 %, it means that there are approximately 480 shells in the soil at different depth, which are waiting for their time to come. It means that recultivation will not only be a lengthy process, but also very dangerous.

The scale of destruction on this small territory is impressive. Dozens of tons of chemical substances and metal pieces made 225 km² of agricultural land unsuitable for usage, while the craters destroyed the natural value of the Regional Landscape Park «Donetskyi Kiazh». It will take hundreds of years to restore land resources from contamination, and recultivation of the polluted and damaged land is possible only in peacetime.

EPL organized inspection of the most valuable conservation areas of Donetsk region, the territory of which suffered during military actions. The objects of research were National Nature Park «Sviati hory» and Steppe Reserve «Kreidiana Flora», situated near Slovyansk. EPL experts researched the scale of the damage, selected samples of water from the river Siverskyi Donets and soil samples from burned areas and at the sites of bombardment for further analysis.

The results of soil research testify to a considerable amount of heavy metals at the sites of shell bursts. For example, titanium concentration in the soil sample taken at the site of shell burst on the territory of Steppe Reserve «Kreidova Flora» 150 times exceeds background concentrations of this metal. Vanadium concentration in the same sample is 100 mg/kg, compare — in a clean sample, vanadium is absent at all (fig. 10). Titanium-vanadium alloys are used in aviation and rocket technology.

Also, there is exceedance of sulphates by 2,3 times, moving forms of heavy metals: lead — 1,3 times, cadmium — 1,5 times (fig. 11).

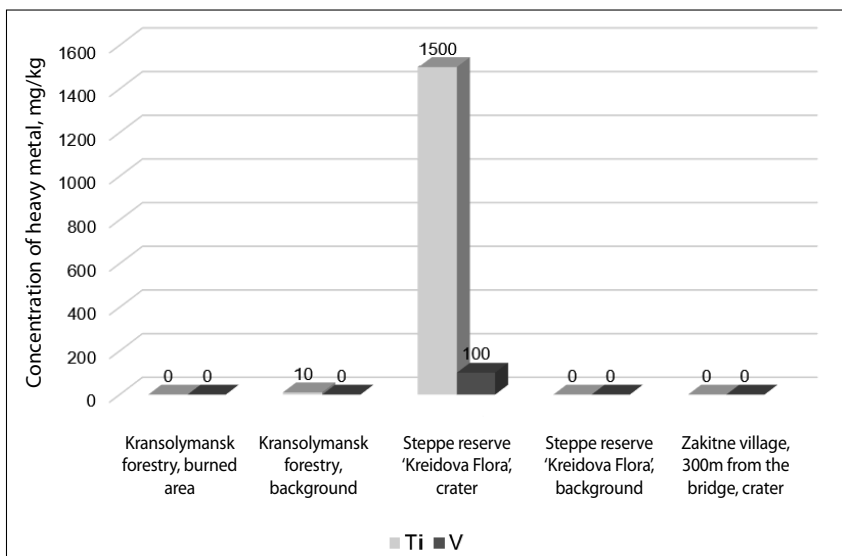


Fig. 10. Research of Gross Form of Heavy Metals in Soil

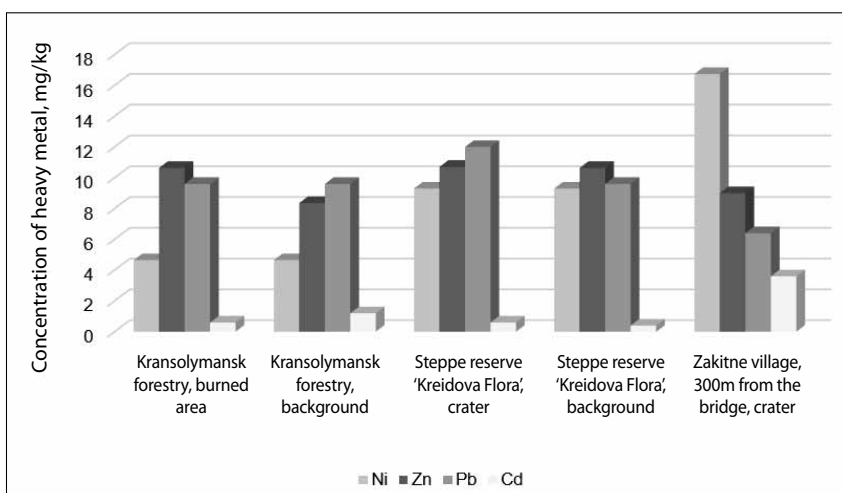


Fig. 11. Research of Moving Form of Heavy Metals in Soil

Exceedance of strontium was discovered at the site of shell bursts in the village of Zakitne, the concentration of which is 150 mg/kg (fig. 12), at the site of crater formation with the area of 12 m². In the same soil sample there is 4-time exceedance of sulphates in comparison with background concentrations, cadmium — 9 times.

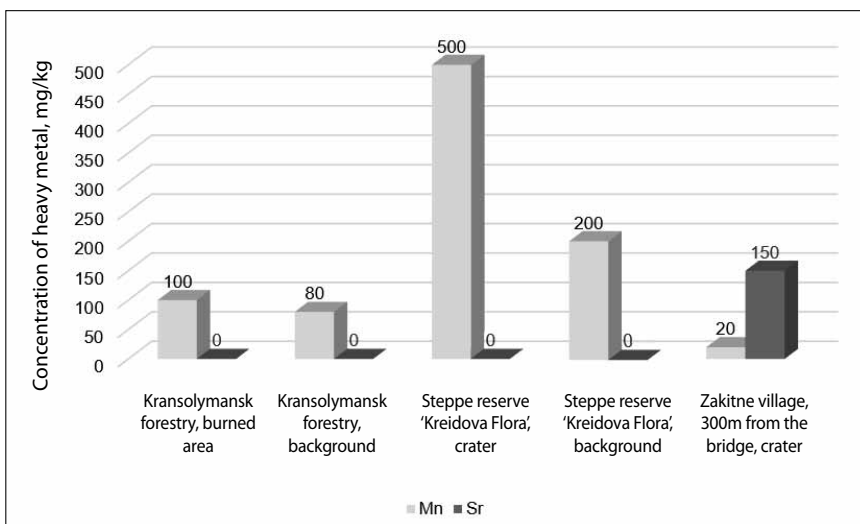


Fig. 12. Research of Gross Form of Mn and Sr in Soils

The research, conducted on the territory of Donetsk region in November 2014, showed that there is considerable pollution of soil in the Steppe Reserve 'Kreidova Flora' with strontium, titanium, vanadium and cadmium in comparison with background figures¹¹⁹. In January of the current year EPL had a round table discussion with the experts on environment and nature protection, representatives of central executive bodies, scientists and journalists regarding environmental and health hazards and the consequences as a result of military actions; recommendations concerning the response during military actions were elaborated¹²⁰.

In 2015, EPL researched which changes take place in the environment, namely, in soil at the sites of shell bursts on the territory of Donetsk region, concentration of moving forms of heavy metals, which can migrate to plants and human bodies, insoluble metal forms.

The volunteers selected soil samples in the hottest spots at the sites of shell bursts in Donetsk and nearby, in the settlements of Pisky, Opytne, Mineralne of Yasynuvata district, Kremynets of Mariinka district, Vesele of Volodarsky district and in Donetsk airport (fig. 13).

¹¹⁹ Research of Impact of Military Actions on the Environment in Eastern Ukraine / O. V. Kravchenko, O. V. Vasyluk, K. M. Norenko // Eastern-Ukrainian Conflict in the Context of Global Transformations. Ukrainian Institute of Global Development Strategies and Adaptation; Ukrainian Culturological Center; LLC «Skhidnyi Vydavnychi Dim». — Donetsk, 2015. — P. 289.

¹²⁰ <http://epl.org.ua/novini/anons/browse/2/backPid/393/article/7582/>

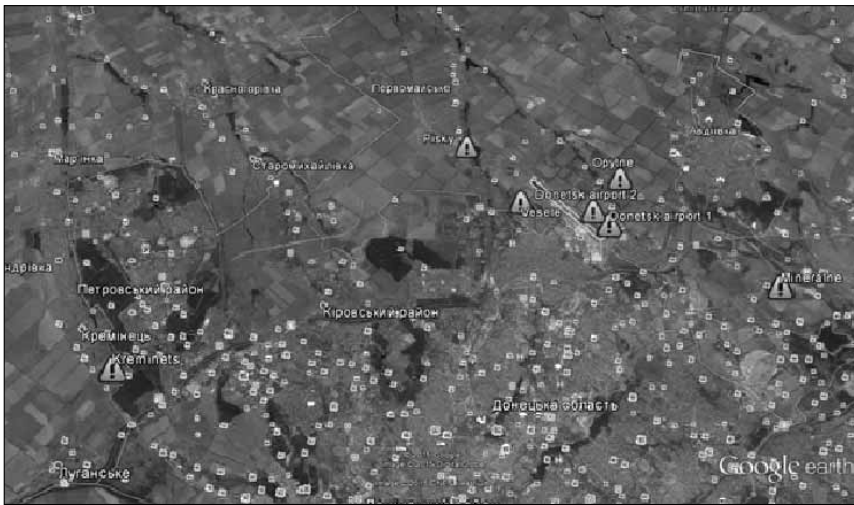


Fig. 13. The Scheme of Selecting Soil Samples on the Territory of Military Actions in Donetsk Region

Thousands of disrupted shells and grenades as well as the aggressors' and terrorists' usage of weapon of unknown origin urged us to carry out a detailed research since the damage done to the environment will affect many generations. And we must clearly understand it and not keep silent about it.

At the sites of shell bursts, i.e. in craters, except the village of Pisky, exceedance of moving forms of heavy metals was registered, namely, manganese, copper, iron, lead, cadmium, chromium and zinc. At the sites of craters, combined samples were selected, in every settlement, background samples were selected at the distance of 4 meters from the craters in order to exclude natural spread of the abovementioned microelements.

Exceedance of moving forms of heavy metals were registered in Kreminec village (8,2 times), Opytne village and Donetsk airport (1,8 times), Vesele village (1,6 times). In Mineralne village there was 2,5 times cadmium exceedance as compared to background concentration, while in Donetsk airport (sample 1) — more than 12 times. 3,2 times exceedance of zinc was discovered only in Opytne village, in this crater the concentrations of iron (10,8 times), manganese (3,3 times), copper (2,4 times) and chromium (1,9 times) were the biggest. Slight deviations from the background concentrations of manganese were discovered in Vesele village and Donetsk airport (sample 1) and of copper in Mineralne village — 1,3 times (fig. 14).

The samples from the craters in the abovementioned settlements were also analyzed as for the presence of insoluble heavy metal forms, that is gross metal. Again, no exceedance of any metal was discovered in the sample from the crater in Pisky village of Yasynuvata district. In all other samples exceedance of the following gross metals was discovered: manganese, stannum, chromium, gallium, nickel, vanadium, titanium, copper, yttrium, zirconium, cobalt and strontium.

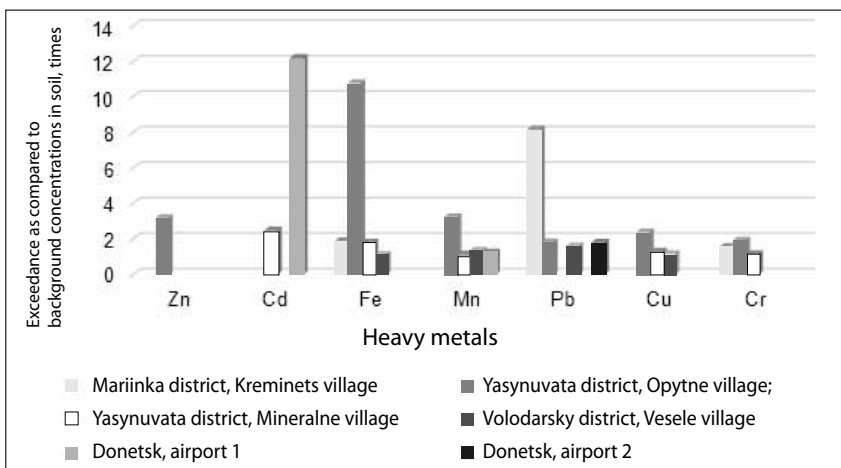


Fig. 14. Research of Moving Forms of Heavy metals in Soil at the Sites of Shell Bursts as a Result of Military Actions in Donetsk Region

The biggest concentrations were registered in Donetsk (sample 1) of gross manganese (3,2 times), exceedance of nickel (3,1 times), vanadium (2,8 times) and copper (2,4 times) in Vesele village, chromium, cobalt by more than 3 times, zirconium (1,4 times), vanadium (2,5 times) and strontium by 1,5 times in Opytne village of Yasynuvata district. Slight exceedance of chromium was registered in Donetsk airport (sample 2) — 1,3 times.

Rare earth metal yttrium in the concentration which exceeds background concentration by 2,9 times was discovered in Mineralne village of Yasynuvata district. Exceedance of stannum (2,8 times) was registered in Kreminets village of Mariinka district. Stannum may be one of the components of titanium alloy. Also in this sample, at the site of the crater, there is exceedance of manganese (1,6 times), chromium (2,1 times), gallium (2 times), nickel and titanium (1,4 times), copper (1,5 times), zirconium (1,2 times), cobalt (2,5 times).

Exceedance of gross forms of heavy metals, discovered by us, are shown in more detail in figures below, namely in fig. 15 and 16.

Taking into consideration the fact that different types of shells may contain phosphorus¹²¹, the research of gross phosphorus in all samples was carried out. EPL discovered that the exceedance of gross phosphorus was found in the samples from the villages of Kreminets (4 times), Mineralne (1,5 times), Vesele (4,5 times) and from Donetsk airport (sample 1) — 1,8 times as compared to background concentrations (fig. 17).

¹²¹ Ukrainian soldiers were bombarded with shells which cause painful and slow death [Electronnic resource]. — Available at: http://antikor.com.ua/articles/36681-ukrajinsjkih_bijtsiv_zakidali_bojepripasami_shcho_sprichinjajutj_bolisnu_ta_poviljnu_smertj

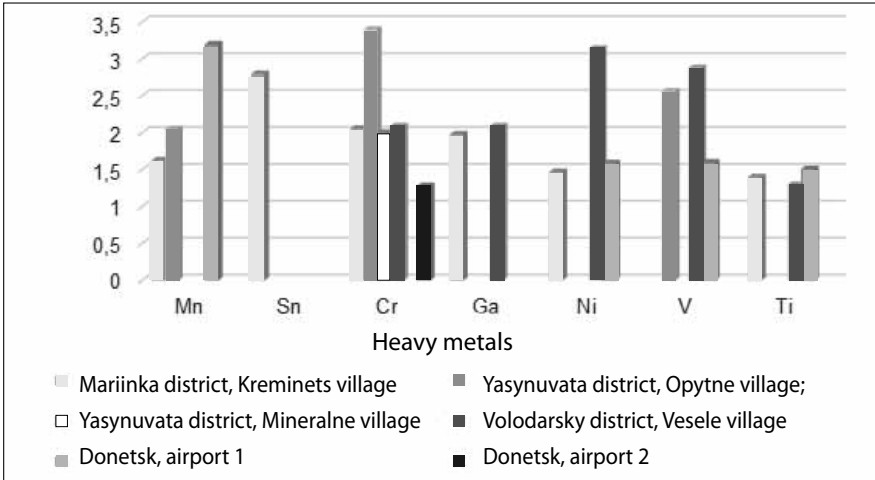


Fig. 15. Research of Gross Forms of Heavy Metals in Soil at the Site of Shell Bursts as a Result of Military Actions in Donetsk Region

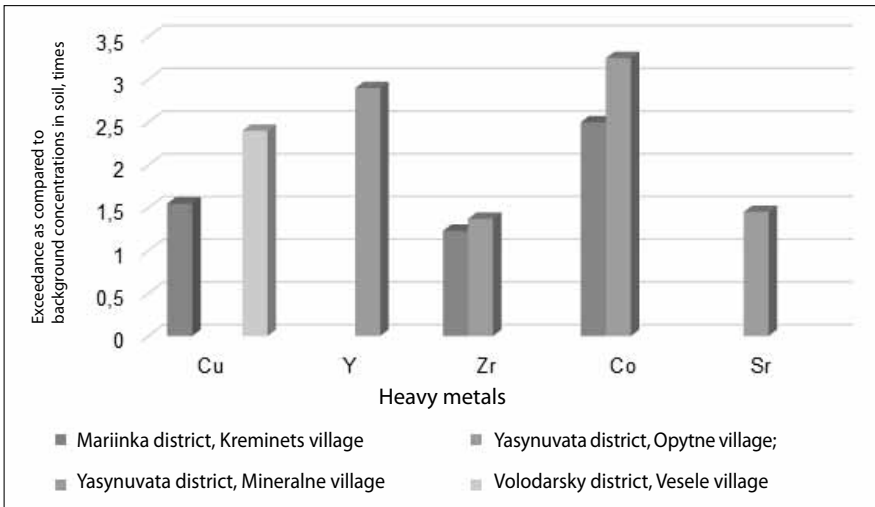


Fig. 16. Research of Gross Forms of Heavy Metals in Soil at the Site of Shell Bursts as a Result of Military Actions in Ukraine's East

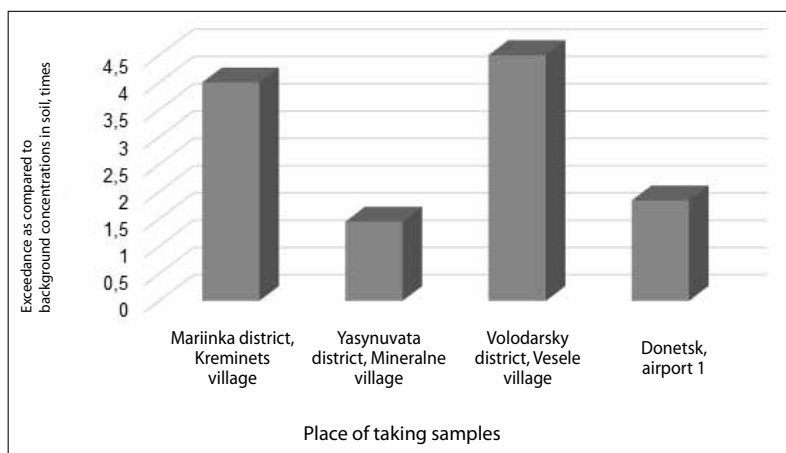


Fig. 17. Research of Gross Forms of Phosphorus in Soil at the Site of Shell Bursts as a Result of Military Actions in Donetsk Region

Thus, the range of chemical substances, the exceedance of which was discovered at the site of shell bursts, testifies to considerable soil contamination on the territory of military actions in Donetsk and nearby. Moving forms of heavy metals will migrate to living organisms causing negative effect on the environment and health. Heavy metals remain in the environment for hundreds of years, while their excessive concentration has extremely negative effect on people's health.

We have researched inorganic substances, however, during shell bursts organic substances may also be formed, which spread on large distances through air and water. Many generations will suffer the negative consequences, which refers not only to Ukraine, but also to the aggressor country.

The risks, connected with damaging communication lines, enterprises and other facilities, which are of high environmental hazard, are particularly important, because under the conditions of the absence of control and the possibilities to eliminate their negative effects, they potentially increase the negative effect every day.

Thus, out of ten facilities, which are the largest contaminators of environment on the state level, 5 enterprises are situated in Donetsk and Luhansk regions, namely:

- PJSC «Mariupolskyi Metalurhiynyi Kombinat Imeni Illicha» (Mariupol Illich Steel Mill) (Mariupol).
- PJSC «Metalurhiynyi kombinat «Azovstal» («Steel Mill «Azovstal») (Mariupol).
- «Starobeshivska TES» (Starobesheve Combined Heat and Power Plant) PJSC «Donbasenerho» (Novyi Svit urban-type settlement).
- PJSC «Alchevskyi Metalurhiynyi Kombinat» («Alchevsk Metallurgy Plant) (Alchevsk).
- PJSC «Lysychanska soda» (Lysychansk).

One of the factors, according to which these enterprises were included in the list of ten largest contaminators, is waste, produced at these plants.

Industrial waste has considerable technological environmental impact under normal circumstances. However, while burning with the lack of oxygen (at low temperatures), this impact is hundreds times bigger or more. Also, as a result of emergency power cutoffs, a considerable amount of hazardous substances is released into the air.

Nowadays, there is huge anthropogenic load as a result of military actions in Ukraine's east, namely, artillery bombardment caused fire on several environmentally hazardous enterprises: Avdiivka and Yasyniv Coke and Chemical Plants, Lysychansk Oil Refinery Plant and Kramatorsk Heavy Machine Tool Building Plant, «Tochmash» and «Stirol».

At the beginning of the current year there were 10,16 t of waste (pesticides) in Donetsk region, in Luhansk region — 11,23 t of waste. The formed waste belongs to classes I, II and III of hazard (fig. 18 and 19).

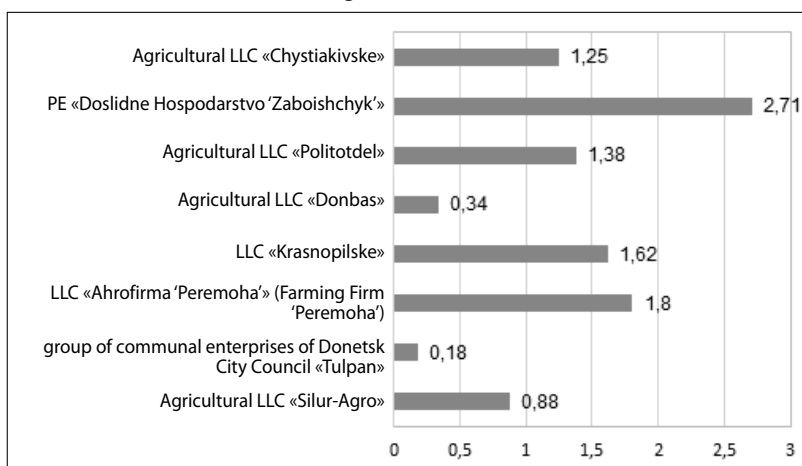


Fig. 18. Amount of Waste (Pesticides), in Donetsk Region as of 01.01.2014, tons

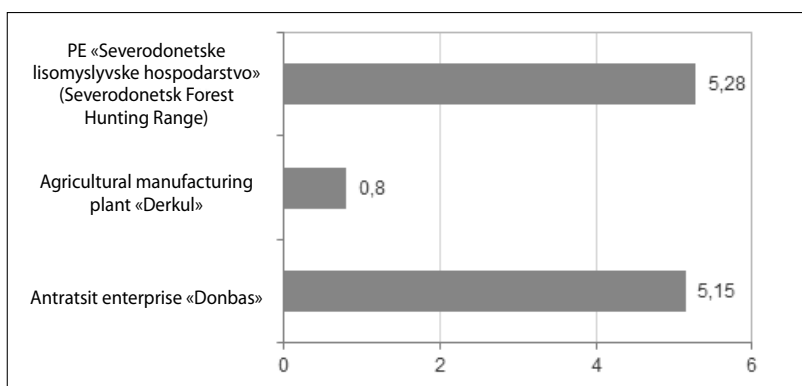


Fig. 19. Amount of Waste (Pesticides), in Luhansk Region as of 01.01.2014, tons

As of 01.01.2014, 1,8 thousand tons of extremely hazardous waste (class I of hazard) were registered on the territory of Donetsk region, including 87,52 tons of used luminescent lamps. In Luhansk region the amount of extremely hazardous waste was 14,2 thousand tons, among them 17,81 luminescent lamps (fig. 20 and 21).

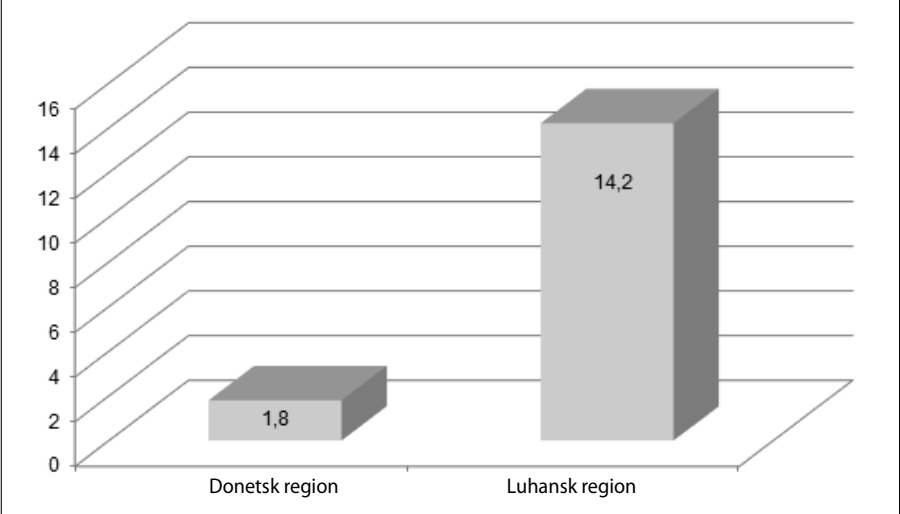


Fig. 20. Class I of Hazard Waste in Donetsk and Luhansk Regions as of 01.01.2014, thousand tons

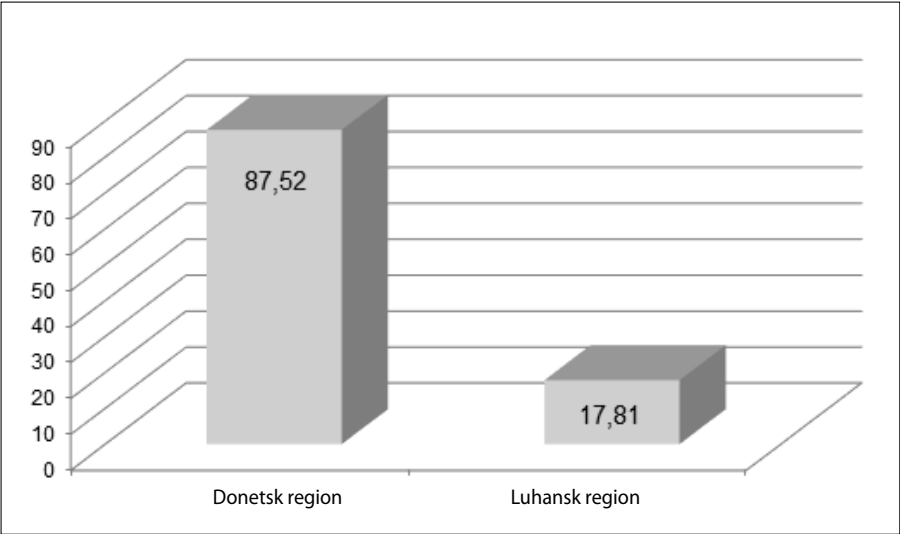


Fig. 21. Mercurial Waste (Hazard Class I) in Donetsk and Luhansk Regions as of 01.01.2014, tons

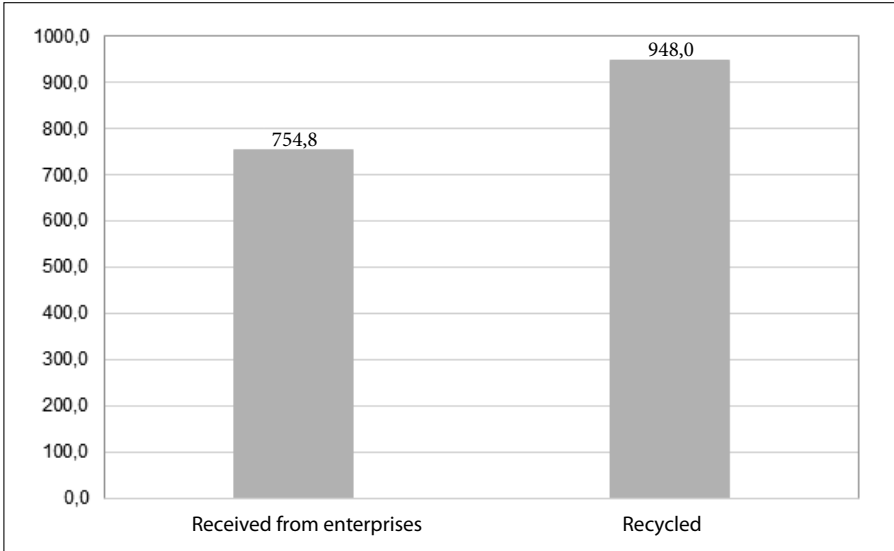


Fig. 22. The Amount of Mercurial Waste of Hazard Class I, Received by LLC «Mykytrtut» and Recycled in 2013, tons

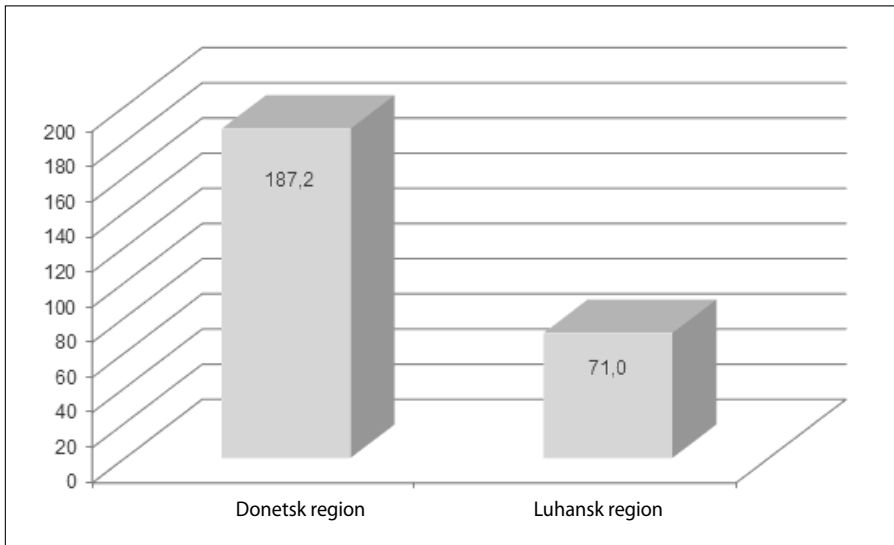


Fig. 23. Class II of Hazard Waste in Donetsk and Luhansk regions as of 01.01.2014, thousand tons

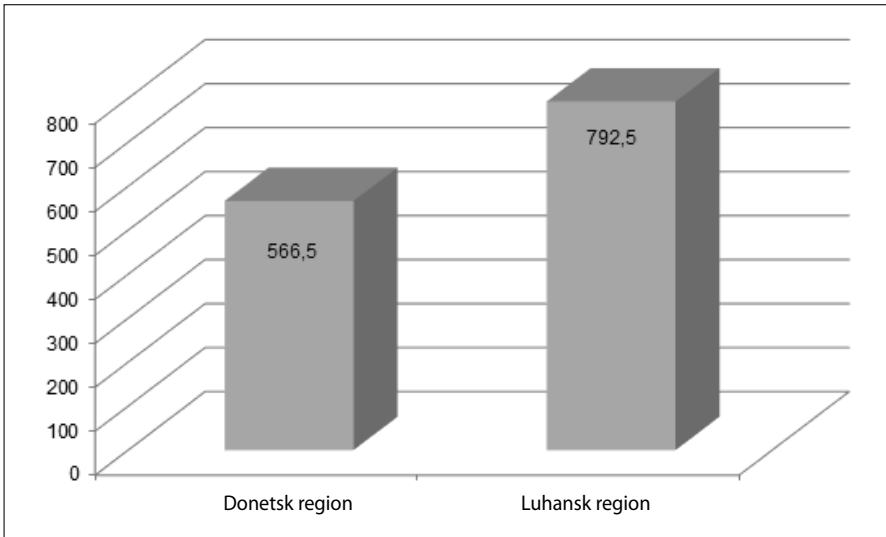


Fig. 24. Class III of Hazard Waste in Donetsk and Luhansk Regions as of 01.01.2014, thousand tons

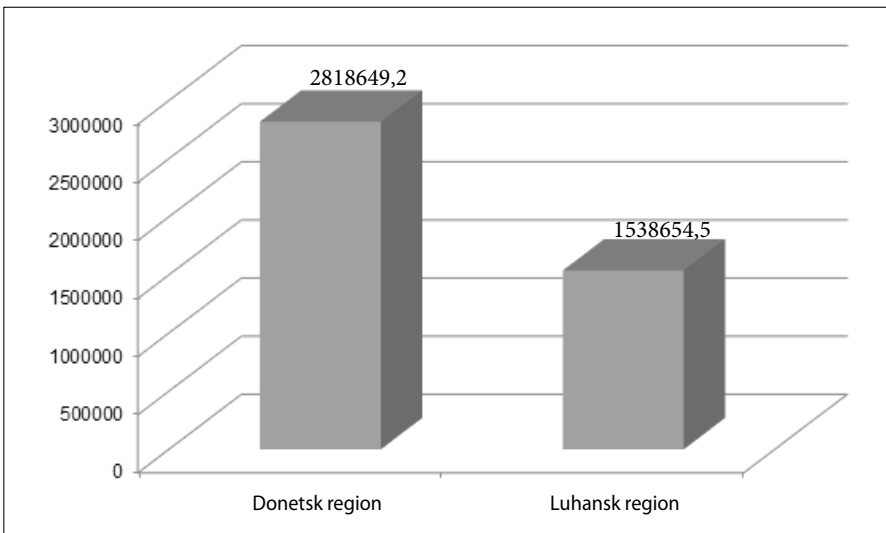


Fig. 25. Class IV of Hazardous Waste in Donetsk and Luhansk Regions as of 01.01.2014, thousand tons

The abovementioned amount of waste of all classes of hazard, registered in Ukraine's east, cannot be ignored by the environmental and environmental-legal community. Even class IV of hazard waste, to which belong waste heaps (terricones), releases into the atmosphere a large number of toxic substances when burning.

Gob, which actually constitutes terricone, contains almost all periodic table of the elements, including radioactive elements. Since terricone's body can combust spontaneously even without the influence of anthropogenic factors, when such combustion is intensified by the explosion of grenades, missiles, rockets and other weapon, thousands of tons of carcinogenic substances are released into the air, the ozone layer is being destroyed, contaminants also migrate to the soil, aquifers and bioresources polluting them and, as a result, they end up in the human body.

A considerable amount of highly hazardous waste on the territory of military actions raises concern and fear as for the preservation of clean environment for the future generations. The subjective motivation of the present situation or the ambitions of one person or several people may have cruel and unpredictable consequences for our descendants.

The National Security and Defence Council of Ukraine reported a lot of times about the danger of radioactive contamination, namely, about depressurization of the plant with radioactive gas radon in Slovyansk if artillery shell hits it. Moreover, the Security Service of Ukraine apprehended 9 persons on the territory of Chernivtsi region in September 2014, from whom they confiscated 1,5 kg of radioactive substance. The cargo was brought from Transnistria and was intended for making «a dirty bomb». Diversions with radioactive materials are possible.¹²²

The consequences of Luhansk airport assault give us reasons to talk about the usage of powerful weapon by the Russian mercenaries and the Russian regular army. Ukraine will investigate whether they used uranium-contaminated weapon¹²³.

Another problem is the problem of radioactivity on terricones, both natural and caused by the application of weapon. Usually, radioenvironmental situation is defined by radiation from technogenically reinforced sources of natural origin and radioactive environmental pollution by radionuclides of uranium and thorium series. 3 mines in Luhansk region were discovered, the activity of which had a considerable impact on the general radiological situation — «Luhanska», «Proletarska» and the mine named after H. H. Kapustin, and caused recultivation (conservation) of radiation hazardous sites and decontamination of the polluted land. At present, there is no information of their condition. The worst safety

¹²² 1 <http://galinfo.com.ua/news/176600.html>

¹²³ <https://ukr.media/ukrain/212835/>

performance of using ionizing radiation sources (IRS) is also at the coal industry enterprises, and often problems on terricones are caused by the lost IRS.

According to intelligence data, near Rostov-on-Don, the placement of modern heavy military equipment of the Armed Forces of the Russian Federation was registered. Namely, these are TOC-1 «Buratino», 3PK (Air Defence missile system) C-300B, PC3B 9K58 «Smerch», PC3B 9K57 «Uragan», armoured vehicles T-90 and T-72B3, БТP-80AM¹²⁴. Such armament is regularly transported to the territory of Ukraine and is used for bombarding the positions of the Armed Forces of Ukraine. Also, new complexes of electronic reconnaissance, electronic warfare and small arms are tested.

3.3. FIRES

3.3.1. ENVIRONMENTAL IMPACTS OF FIRES

To study the territories affected by fires, the following outputs were used: spatial feature data with forest outlines (the materials provided for the study by VISICOM Joint-Stock Company¹²⁵, scale 1:50000), steppe outlines (individual research findings by Vasyliuk et al, 2012), the data of real-time satellite imagery Landsat 8 Global Fires and materials of ERS Terra MODIS¹²⁶ with prior processing performed by ScanEX R&D Center¹²⁷.

Specifically, we used the data on fire locations and scale for the period from June 1 to September 30, 2014 when most of the fires related to the hostilities in the ATO area occurred and which are still available for remote sensing. Given the fact that we used the data on fire locations and scale provided by ScanEX through mathematical modeling, we consider it necessary to outline briefly the methods of fire assessment which served as a model for the data acquisition. As a basic service component we used the technology which is based on the algorithm of automatic fire detection through MODIS thermal satellite survey. The data on fires (a mask of fires) is a product of automated content classification of MODIS data — images received from the Terra and Aqua satellites. The period and time for the data update depends on the period and time when the satellite flies over a specific territory. The average frequency is four times a day. Satellite orbits are designed in such a way that each of them flies over the same area twice a day (one flight during the day and one at night). Fire detection algorithms in an automated regime are based on their strong infrared radiation. The difference

¹²⁴ <http://www.pravda.com.ua/news/2015/01/17/7055377/>

¹²⁵ <http://visicom.ua>

¹²⁶ <https://earthdata.nasa.gov/firms>

¹²⁷ <http://scanex.ru/ru/index.html>

in temperatures of the Earth's surface and a fire location changes the intensity of pixels and the information coming from other spectral channels helps to disguise the clouds. Using the same Terra MODIS data utilized for fire detection, RGB synthesis is carried out in order to visualize the observation coverage for the current day. The areas of fire outbreaks are detected with the help of infrared Terra MODIS channels, with linear resolution of 1 km for 1 pixel. This means that each detected area is displayed as a point in the center of the pixel with the scale 1 km x 1 km. In fact, the fire can be localized approximately within the central part of this area; however its real area can be smaller in reality. Despite the fact that the pixel area (elementary observation area) in infrared channel is 1 km², on average MODIS detects open areas and smoldering fires in the area of 1/10 hectare and more. Brighter areas with a higher flame temperature can be recorded in a smaller fire area. Fire intensity assessment is carried out by means of analysis of the available information, received from ERS. Automated clustering of thermolocations enables detection of an approximate area of active fire on the outlines, by limiting the points inside the cluster. It is considered that clusters correlate with the areas of burned territories. However, it is important to understand that the automated fire detection data received from Terra MODIS products are selective, but they allow to receive a picture of the scale and locations of fires.

On the basis of received outputs about the fire scale, identified via the central pixel of a hypothetical field, we built a polygonal object around each pixel which serves as its buffer, the area of whose polygon matches the specified area in attributive data of the original source. The information about exact boundaries of each fire that occurred at different time cannot be obtained. Thus, further calculations are carried out relying on the outlines which had been previously modeled around the primary pixels. Taking into account that we obtained the data on fires for full four months, in some cases at different time in geographically close areas the fires occurred in such a way that the modeled polygons of the specified area of its likely location overlap. Using the function of «aggregate», polygons (ArcGIS) which overlap are joined in single objects, as this is the only way to receive information on the number of lands damaged by fire within the above mentioned time span. Repeated detection of fires in the same territory is likely if the first one had not completely destroyed the plant biomass on site. This aggregating of polygons' overlapping serves as additional data verification.

The scale of fires that significantly stands out of other negative war-triggered factors in the surveyed area determined the choice for further research. In addition, availability of the data, covering entirely the area of the conflict zone contributed to such studies. See Fig. 26.

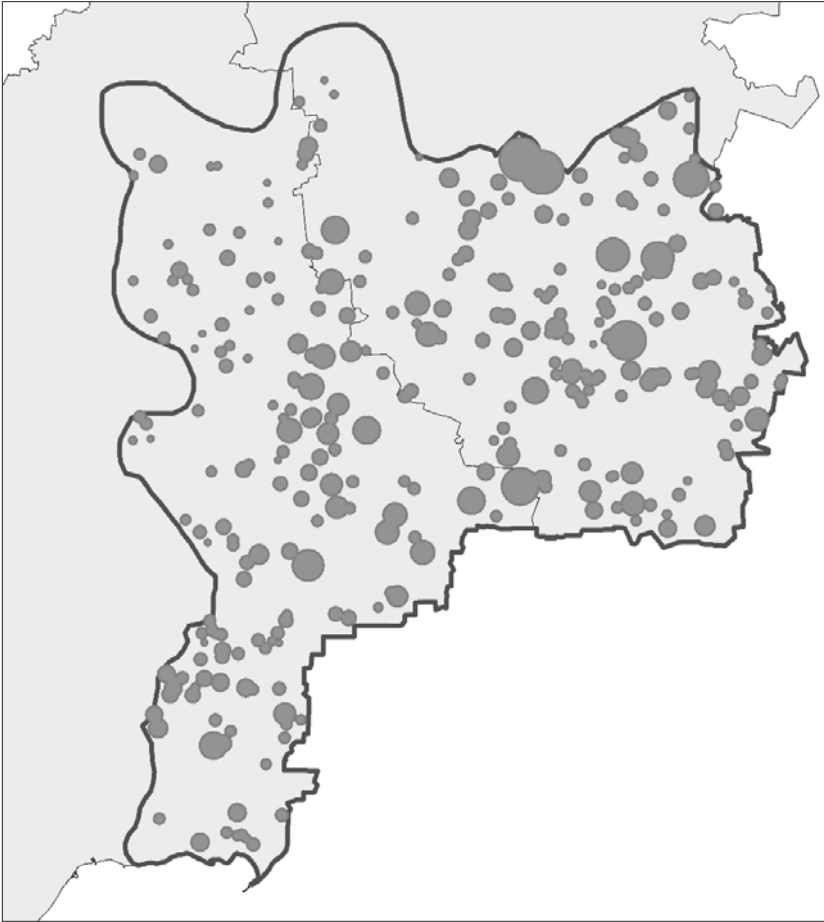


Fig. 26. Scale of Fires

A significant increase in the number of fires in natural areas of the ATO in 2014 is attributed to the following overlapping factors:

- large pine plantations which are the main fire hazard group of forests in Ukraine among the forest ranges of the studied area;
- dry season (June–August), commonly accompanied by the increased dry vegetation fires in the region;
- massive shelling and fire-setting of vegetation for tactical targets during hostilities to increase the number of flame-spread epicenters in natural land of the region;
- mined forest areas, continuous shelling and absence of governmental control in the region which prevent fire-fighting operations by the Ministry of Emergencies of Ukraine or the State Agency of Forest Resources of Ukraine.

The study revealed that 2,091 cases of fire outbursts were registered in the ATO area from June 1 to September 30, 2014. To determine the boundaries of the territories

analyzed concerning fires, we created a polygonal vector background which includes all layout changes of the ATO area over the studied period. Thus, the study encompasses all fires that occurred in the ATO area at the time when they were part of its territory. Overall, the number of fires recorded by the satellite is 14.1 times higher as compared to 2013 (208 fire outbursts), 5.2. and 5.9. times higher than in 2012 and 2011 (566 and 501 fire outbursts respectively), and 2.4. times higher comparing to 2010 (Fig. 27).

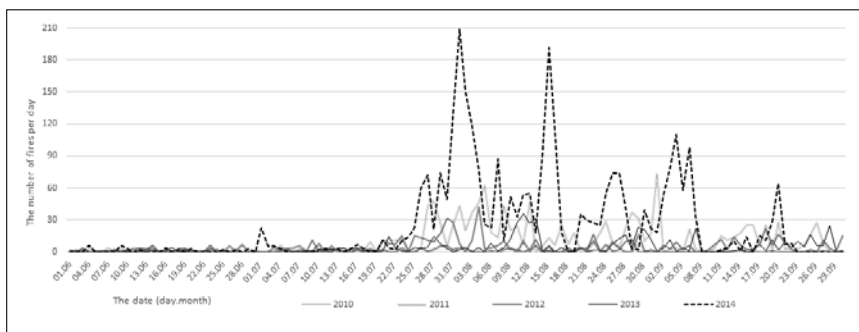


Fig. 27. Comparison of Numbers of Fires within the ATO Area in 2010–2014

Comparison of the number of fires in the ATO area with the similar periods over the last four years has shown that the general trends toward the dynamics of the fire cases are similar: each year there is an increased number of fires in mid-July and the third week of August. This fact can be explained by the traditional for this area crop residue burning. However, the period from June 1 to September 30, 2014 is characterized by the outbursts of fires spatially and temporally related to the hostilities.

In addition, fire hazard periods in 2010–2013 demonstrate higher density of separate cases of fires outside the ATO area in the studied territory (Luhansk and Donetsk regions). In the ATO area, fields and populated areas cover significantly less territory in comparison to the studied regions outside the ATO area. Nevertheless, in 2014 there was greater density of fires in the ATO area as compared to its outside territory. We consider that the major reason for such an outburst of recorded fires is their free spread in territory and time, which demonstrates the lack of fire-prevention measures and fire-fighting operations. Moreover, there were separate localized outbursts of fire as compared to the general dynamics of the studied period over the years. The study of such peaks reveals their overlapping with areas and time of massive shelling (as reported by the National Security and Defence Council of Ukraine). Some of the examples are the periods of hostilities characterized by the special density of localized fires near the villages of Dmytrivka (July 24, 2014), Nova Vilkhova (August 1, 2014), the town of Chervonopartyzansk (August 3, 2014) and the village of Stakhanovets (September 20, 2014)¹²⁸ (Fig. 28).

¹²⁸ <http://texty.org.ua/mod/datavis/apps/atomap/>

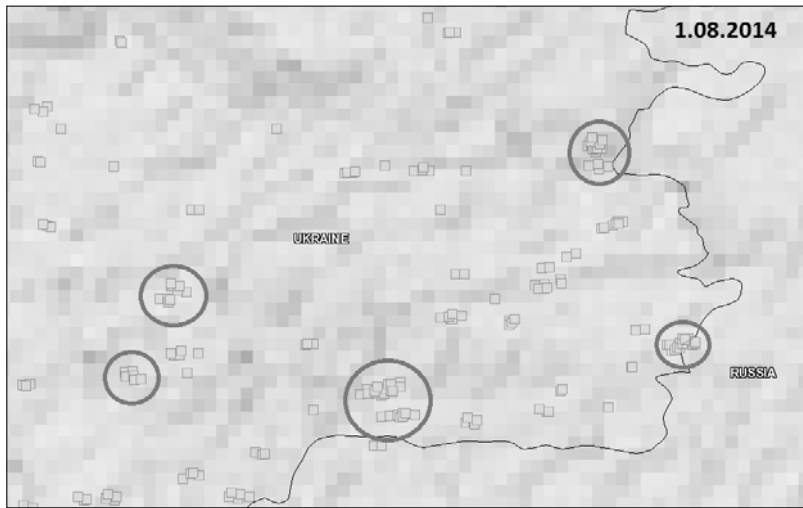


Fig. 28. Image of Fire Density

One should also mention the target actions concerning fire safety and forest protection. Separate condition of plantations is linked to the sites of checkpoints. On the one hand, in many places near the checkpoints the trees were cut down or burnt. Many cases of using diesel for trees burning were recorded. On the other hand, in order to create a tactic advantage, a great deal of forest plantations is covered in oils, automobile oils and other fire accelerants. The purpose of their use is to prepare the forest plantations for potential operative fire-setting, which might turn them into a fire barrier and this way possibly stop the advancement of the enemy forces or create a smoke and fire curtain, which will help to organize the retreat. The areas where such tactics is used can be tracked using MODIS images, which includes such attributive data as the warmth of FRP light helping to distinguish between the burning of oils and burning of trees on ERS materials.



Fig. 29. Forests from the Satellite



Fig. 30. Forests from the Satellite

On the basis of the received model demonstrating the coverage of the ATO area by fires, we calculated the area of the territory that was covered by fire in June-September 2014. The total area of this territory according to the model is 331471,4 hectares, out of which 34465,45 hectares are spatially imposed on construction sites and reservoirs. Thus, the model illustrates the territory of 297005,9549 hectares covered by fire, which makes 14% of the recorded territory of the ATO area (Fig. 31¹²⁹). The study of the locations of detected fire sites showed that 81 % of all the cases occurred in the areas of natural steppe, forest vegetation and in the fields. Only 19% are related to residential areas.



Fig. 31. Forest Fires in the ATO Area from the Satellite

¹²⁹ <http://maps.kosmosnimki.ru/api/index.html?DAB5A856B6AE4329A7759DF257614B45>

Taking into account that the majority of forests in the ATO area are plantations rather than sand arenas, such sites after burning become bare sands which are not fixed by vegetation and are open to erosion.



Fig. 32. Image of the Outskirts of the Town of Shchastia before the ATO

Fig. 33¹³⁰ shows the forest plantation turned into bare sand. Imposing of the outlines of modeled fire-burnt areas on the available classes of spatial data, made it possible to assess the territorial distribution of the areas covered by fire according to the classes and calculate the area of such overlapping. Actual areas of each of the classes of landscape damaged by fire will differ to some extent, depending on the results of our model as the data received is a model built on the data obtained remotely rather than the direct measurements. However, this model allows to see the scale of fires and distribution of the fire-burnt areas between the classes of surface. The obtained data are as follows: the fires damaged 36226,19 hectares of forests which amounts to 18 % of the forest areas of the ATO area and 12.9 % from the total area of the fire-burnt territory; 113735,2 hectares of steppes which amounts to 23.19 % hectares of the total area of steppes in the ATO area and 38.29 % of the total fire-burnt area; 147044,56 hectares of the arable land which amounts to 14 % of the arable land and 49.5 % of the total fire-burnt area. Thus, commensurate areas of natural and semi-natural territories turned into the burned areas.

¹³⁰ <http://maps.kosmosnimki.ru/api/index.html?DAB5A856B6AE4329A7759DF257614B45>



Fig. 33. Image after ATO

To imagine the extent of specific fires, it is enough to provide the largest of them in terms of the area as an example (Table 6).

Table 6

The largest areas of fire

Area (km ²)	The closest settlements	Date	X	Y
54,1	the village of Novosvitlivka, Luhansk region	August 15-16, 2014	48,49667	39,50722
56,1	forests on the south-east of Luhansk	August 12-16, 2014	48,505	39,35111
63,3	area between the villages of Vilkhove and Kolesnykivka, Luhansk region	July 24-August 5, 2014	48,67917	39,62667
71,1	the village of Verkhniy Kut, Donetsk region	July 31-August 3, 2014	47,96833	39,02778
79,8	south of the village of Pershozvanivka, Luhansk region	July 30-August 4, 2014	48,30583	39,39667
97,9	the village of Malynove, Luhansk region	September 2-7, 2014	48,69667	39,10472
98	the town of Slaviansoserbsk, Luhansk region	August 15, 2014	48,72583	39,03139

Obviously, the actual areas of the each class of the landscape will differ to some extent as the data obtained are a model rather than the direct measurements. However, this model makes it possible to see the scale of fires and distribution of the fire-burnt areas between the classes of surface. Therefore, special attention should be devoted to the extent of the forest damages, which unlike burnt fields or steppes might lead to serious financial losses in the future.

It is important to note that here we speak about a step zone which is characterized by a special climate. In the present situation creation of new forest plantations in this area is very difficult¹³¹ as new kinds of plants adjust poorly and already in the first year of planting more than a half of the plants die. This means that it is virtually impossible to plant new forests in a steppe zone for the time being.

Thus, the loss of forests in fires in the ATO area practically means that it will be impossible to restore these forests in the future. It is important to note that historically forest planting in a steppe area had been changed to create areas with microclimate conducive for human life. Most of the forests around the settlements in the past were created to form a humid and cool climate as compared to the natural one in a steppe zone. Therefore, the loss of forests will inevitably lead to the worsening of living conditions for people.

From the perspective of steppe protection, the obtained data show the increased risk for some kinds of vegetation. Awareness of the gravity of the consequences of the detected fires comes after the imposing of the fire data on geobotanical zoning. The ATO area and the area of intensive fires includes such geobotanical zones as 133, 135, 136, 137, elements of the flora of rocky steppes of the Donetsk Range and partially zones 132, 138, 134, and 164. Thus, around 20 % of all rocky steppes in Ukraine were affected by fire in June-September 2014 which is significantly higher indicator than the average one.

Additionally, it is important to note that the fires damaged the territory of a range of the objects of the nature reserve fund, in particular the branch of Luhansk nature reserve «Provalskyi Step» and such sanctuaries as «Naholchanskyi», «Volnukhynskyi», «Novozvanivskyi», «Aloshkin Buhor», «Bilorichenskyi», «Bilohorivskyi», «Luhanskyi», «Perevalskyi», «Murzyne», «Znamianskyi Yar», «Eremusovi Shhyl», «Balka Ploska», «Naholnyi Kriazh», and «Pishchanyi». Hrushiv branch of Luhansk nature reserve «Provalskyi Step» was burnt to ashes on August 1, 2014 (Fig. 34).

Spatial data on the fires were also imposed on the geobotanical zoning scheme of the territory. The ATO area and the area of intense fires in 2014 respectively fully covers geobotanical zones 133, 135, 136, 137 that form the vegetation of rocky steppes of the Donetsk Range and partially zones 132, 138, 13, and 164. 20 % of all Ukrainian rocky steppes, most of which are located within the ATO area, were affected by the fires in June-September 2014.

We obtained the data on distribution of the plants included in the endangered-species list of Ukraine (the Red Data Book of Ukraine) in the ATO area. Such data were collected thanks to a public campaign «Save

¹³¹ State financial audit of budget programs realization in the system of the State Committee of the Forestry of Ukraine in 2008, 2009 and the completed accounting period of 2010

Ukrainian Steppes!»¹³² under the framework of «Stepovyi Inventory»¹³³. Some information was published in 2014¹³⁴. The data represent the exact coordinates of species habitats included in the Red Book of Ukraine. Obviously, given the wide coverage of the natural landscapes in the ATO area by fires, a great number of the endangered species habitats are also covered. However, dense structure of habitats of each of the species caused by the fragmentation of landscapes leads to the fragmentation of populations, thus increasing the likelihood of their survival in case of fire. The territories covered by fires are reflected at Fig. 34.



Fig. 34. Fires at the objects of NRF

We also paid attention to the endangered species of plants that might be found only in a few locations in eastern Ukraine. The loss of each such habitat inevitably affects conservation of the species as such.

These are the following plants: *Adonis vernalis* (50 % of habitats), *Caragana scythica* (50 %), *Onosma tanaitica* (30 %), *Atraphaxis frutescens* (50 %), and *Delphinium puniceum* (30 %). Also among the flora of the ATO area according to the literary sources, there is the only habitat of the species of *Calophacawolgarica* in the branch of Luhansk Nature Reserve «Provalskiyi Steppe». However, according to the latest data, the existence of this species had been disproved before the beginning of hostilities.

¹³² www.pryroda.in.ua/step

¹³³ Vasyliuk A. The First Steppes to Create a Steppe Inventory of Ukraine // Steppe newsletter, № 32, summer 2011

¹³⁴ 50 Rare Plants of the Luhansk Region. Atlas-Reference Book / M. Perehrym, O. Vasyliuk, D. Shyriaeva, H. Kolomytsev. - K.: Veselka, 2014, 60 p.

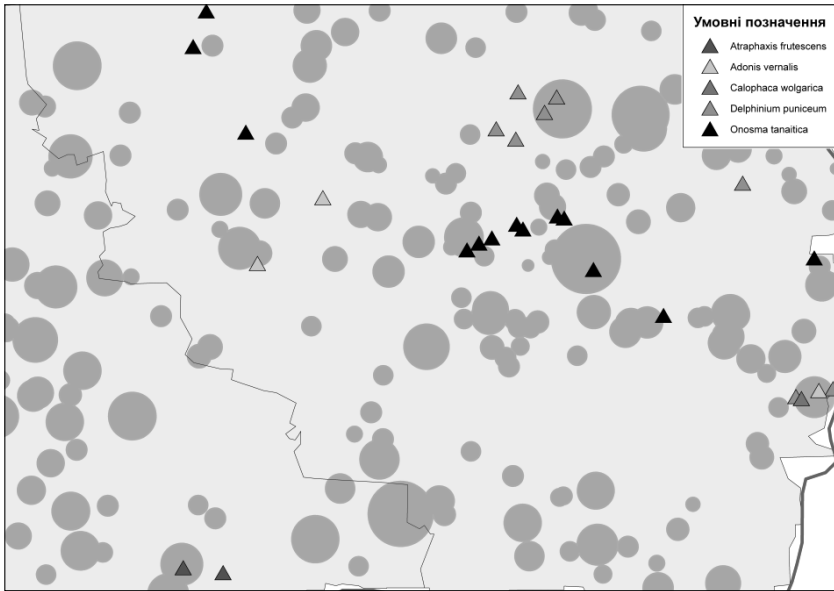


Fig. 35. Fires in the ATO Area

The largest forests in terms of area in the ATO area are plantations created to replace sand arenas. Therefore, after fires the sites that used to be forests become bare sands not fixed by vegetation and open to erosions. At the same time, natural ravine deciduous forests that are the centers for forest biodiversity of the region are present in this territory. Forestry enterprises often planted forest plantations near natural ravine forests with the aim to use natural moisture and shade of the existing forests for new artificial plantations.

Thus, nowadays natural ravine forests and pine plantations often form dense forests. Fires that are quickly spread in pine plantations may also lead to the destruction of natural deciduous forests.

The study of localization and spatial layout 2901 of the detected fire from June 1 to September 30, 2014 in the ATO area shows significant damages caused to natural landscapes: 18% of the forest area and 23.19% of the steppe area in the ATO area. At the same time, the areas of damages of natural and semi-natural complexes of the studied region are commensurable. From the perspective of steppe biotope conservation, the obtained data enable us to draw conclusions about the severe damages of the rocky steppes in the region which are endemic biotypes in the territory of Ukraine.

One should pay particular attention to the scale of affected forests, which are overwhelmingly forest plantations and lead to significant financial losses for the region. At the same time, destruction of natural ravine forests is an important factor of influence on the biodiversity of the region since forest types are common in eastern regions on relatively small land areas.

After fighting in eastern Ukraine stops, using the established algorithm, it is important to study the impacts of fires over the entire period throughout the whole territory of the hostilities; to assess the total damage of forests by fires and damages caused to the state; to develop measures to restore affected forest plantations in new areas instead of existing afforestation programs; and to examine the condition of the territories of nature reserve fund which were affected by fires.

3.3.2. FIRES AT CHEMICAL PLANTS

Eastern Ukraine is an industrially developed region. There are more than 560 major industrial plants in the Luhansk region that pollute the environment, more than 1,100 in the Donetsk region, and more than 1,660 in total. To illustrate this, one may consider the fact that out of ten objects which are the top polluters of the environment in the country, five of them are located in the Donetsk and Luhansk regions, including:

- PJSC «Mariupolskyi Metalurgiynyi Kombinat Imeni Illicha» (Mariupol Illich Steel Mill) (Mariupol);
- PJSC «MMK «Azovstal» («Azovsteel») (Mariupol);
- «Starobeshivska TES» («Starobesheve Combined Heat and Power Plant» PJSC «Donbasenerho» (the urban-type-settlement of Novyi Svit);
- PJSC «Alchevskyi Metalurhiynyi Kombinat» («Alchevsk Metallurgy Plant»)
- OJSC «Lysychanska soda» (Lysychansk).

Even in peaceful time the activities of these 1,660 plants is classified as dangerous for the environment. Accordingly, in times of hostilities there arises an additional threat in the form of possible shell hits which might cause a fire at plants.

There were already some reported cases of destruction of the objects of chemical industry as a result of falling shells. Thus, according to the official data of the State Emergency Service of Ukraine in the Donetsk region, on September 20, 2014 an explosive object hit the warehouse of the Donetsk state-owned plant of chemical products¹³⁵, located in the territory of Kuibyshevskyi district in the city of Donetsk, Sofiivska Street. In some five kilometers from the plant's basic premises there was a warehouse hit by a shell. The explosion caused a flash. Deputy Head of the Voroshylivskyi district council of the city of Donetsk Ivan Prykhodko said that there was a direct hitting of the industrial explosives in workshop 47¹³⁶. It was followed by detonation and another explosion. Below Fig. 36 shows a huge pillar of smoke at the plant caused by the fire.

¹³⁵ Luhansk is slowly recovering; shelling of the Donetsk chemical plant. — *Ukrainska Pravda*. — September 20, 2014. <http://www.pravda.com.ua/news/2014/09/20/7038377/>

¹³⁶ Explosion at the Donetsk chemical plant has not affected background radiation - the city council. - *Ukrainska Pravda*. - September 20, 2014. <http://www.pravda.com.ua/news/2014/09/20/7038394/>

A massive explosion occurred in the territory of the same plant on the night of February 9, 2015. It was heard not only in Donetsk, but also in the surrounding residential areas. The blast wave knocked out windows in residential buildings located just a few kilometers from the explosion epicenter¹³⁷.



Fig. 36. Fire at the Donetsk State-Owned Chemical Plant

In addition, according to the «Komunist» online source, there was a fire in the coal warehouse of the Yasynuvata Coke Plant situated in Makiivka between the small town of Batman and Cheremushka microdistrict¹³⁸. The employees of the plant were evacuated and production was suspended. The shell hits in Donetsk also started a fire in the tire warehouse which led to acrid black smoke rising above the city.

According to media reports, as a result of the shelling of the Kyivskiy district of Donetsk, a shell hit the premises of «Tochmash» plant, which was followed by a fire¹³⁹ (Fig. 37).

On October 20, 2014, it was reported that there was an explosion on the premises of the Donetsk military commissary¹⁴⁰ (Fig. 38).

¹³⁷ Explosion at the Donetsk chemical plant where militants kept ammunition. — Ukrainska Pravda. — February 9, 2015. <http://www.pravda.com.ua/news/2015/02/9/7057909/>

¹³⁸ Fire at Yasynuvata coking plant. — Komunist — September 3, 2014. http://www.komunist.com.ua/article/16/16573_u.htm

¹³⁹ Militants hit the plant, a fire starts. — Ukrainska Pravda. — September 28, 2014. <http://www.pravda.com.ua/news/2014/09/28/7039145/>

¹⁴⁰ Photo of the explosion at the military commissary. <https://twitter.com/novostidnua/status/524140391399190529/photo/1>



Fig. 37. Fire at the Donetsk «Tochmash» Plant



Fig. 38. Explosion on the Premises of the Donetsk Military Commissary

The largest in Europe coking plant, Avdiivskyyi koksokhimichnyi zavod («Avdiivka Coke and Chemical Plant»), has been suffering from shelling since July 2015. Since that time, more than 150 shells have exploded on its premises. On the night of July 22 the plant was shelled, causing a fire. The witnesses complained about a very strong smell in the town. More than 10 shells exploded on the night of November 29. The shells hit various damage repair shops and also the benzene storage. Fortunately, when the hostilities broke out, the director of the plant decided to remove all hazardous chemicals, including benzene, from the premises. Therefore, the environmental threat was

significantly reduced. On February 10, 2015, the fire broke out on the plant's premises and it took five hours to extinguish it. The gas pipeline was on fire and the supply of coke was temporarily suspended¹⁴¹. Furthermore, constant shelling damages power lines and transformer substations. Extended power outage may lead to a technogenic disaster. It may result in massive discharge of untreated wastewater, containing a variety of such polluting chemicals as ammonia, phenols, resins, thiocyanates, and others.

Another plant in danger is «Stirol» concern in Horlivka, which is Ukraine's largest producer of nitrogen fertilizers, acids, salts and organic synthesis products, supplying the market with 3 % of world exports of ammonia, carbamide, polymer materials, and products. «Stirol» is connected to the most powerful ammonia pipeline that passes through Ukraine. For example, even in peacetime there were a number of accidents that caused discharge of harmful substances. On August 6, 2013 during the overhaul, ammonia discharged from the ammonia reservoir and liquid ammonia started leaking from the pipeline. Five people were killed in the accident and about twenty people were injured. All of them were exposed to ammonia vapor and received burns of the respiratory tract. On May 26, 2013, there was a fire at the plant, which destroyed 100 m² of the floor and damaged one compressor. The fire was extinguished only after 1.5 hours. On May 8, 2014 «Stirol» concern stopped its production¹⁴². The production of ammonia and its derivatives (carbamide, ammonium nitrate and carbamide-ammonium mixture) was suspended. The ammonia storage is emptied out and there is no ammonia at «Stirol».

¹⁴¹ The Avdiivka Coke and Chemical Plant hit by shelling. — Metinvest. — February 23, 2015. <http://akhz.metinvestholding.com/ua/press/news/show/6858>
The Coke and Chemical Plant in Avdiivka on fire for five hours after militants shell. — TSN. — February 11, 2015. <http://tsn.ua/ato/v-avdiyivci-cherez-obstril-boyovikiv-p-yat-godin-goriv-koksokhimichnyi-zavod-408527.html>
The Avdiivka Coke and Chemical Plant owned by Rinat Akhmetov under shelling. — Espresso TV. — July 22, 2014. http://espresso.tv/news/2014/07/22/pid_obstril_potrapyv_avdiyivskyy_koksokhimichnyy_zavod_rinata_akhmetova
The Avdiivka Coke and Chemical Plant hit by shelling again. — Vseukrainskyi vyrobnycho-praktychnyi zhurnal «Promyslova bezpeka». — December 1, 2014.

¹⁴² Ammonia discharge at the chemical plant owned by Firtash in Horlivka killed five people. Dzerkalo Tyzhnia. 06.08.2013. http://dt.ua/UKRAINE/na-zavodi-firtasha-u-gorlivci-stavsya-vikid-amiaku-zaginuli-5-osib-126273_.html
At least five people killed in the accident at the plant owned by Firtash. Ukrainska Pravda. 06.08.2013. <http://www.pravda.com.ua/news/2013/08/6/6995573/>
Fire at the «Stirol» ammonia plant in the Donetsk region destroyed 100 m² of the floor and one compressor. Dzerkalo Tyzhnya. 26.05.2013. http://dt.ua/UKRAINE/na-amiachnomu-zavodi-firtasha-v-gorlivci-stalasya-pozhezha-122522_.html
«Stirol» owned by Firtash suspends production due to the situation in the Donetsk region. Ukrainska Pravda. 8.05.2014. <http://www.epravda.com.ua/news/2014/05/8/449342/>

In Lysychansk on July 18, 2014 the shelling started a fire at Lysychansk oil refinery plant (Fig. 39). The shells hit the raw materials area, fuel oil storage, and TPS. It took a lot of time to put out the fire at the fuel oil storage due to the lack of emergency rescue equipment which was removed from the plant's territory by the militants of the so-called Luhansk People's Republic (LPR).



Fig. 39. Fire at the Lysychansk Oil Refinery Plant

As the locals reported to the media, the oil sludge tank with 50,000 ton capacity, two tanks with 20 tons of gasoline and the sulfur warehouse were burning at the plant. The fire broke out after the shelling from «Grad» rocket launcher¹⁴³.

Risks associated with accidents and fires at industrial plants with increased environmental hazards deserve special attention, as during hostilities the possibilities to rectify the consequences are minimized and there is no control over the situation; such accidents increase the potential negative impact on the environment.

¹⁴³ Fuel oil storage on fire at the Lysychansk ORP - no equipment to put out the fire. — 5 kanal. — July 18, 2014 <http://www.5.ua/ato-na-shodi/na-lysyhanskomu-npz-horyt-skhovyshche-mazutu-hasyty-nema-chym-56965.html>

The Lysychank oil refinery plant on fire after the shelling. — TSN. — July 18, 2014. <http://tsn.ua/ukrayina/u-lisichansku-pislya-obstrilu-gorit-naftopererobnyy-zavod-359651.html>

3.4. THE IMPACT OF THE HOSTILITIES ON THE NATURE RESERVE FUND OF UKRAINE IN EASTERN UKRAINE

The priority areas for the biodiversity protection are land areas and objects of the nature reserve fund, thus we consider it appropriate to examine various factors that influenced their functioning under ATO.

As of January 1, 2015 the nature reserve fund of the Luhansk region consisted of 189 sites with a total area of 935,53 km². The nature reserve fund of the Donetsk region included 117 territories and sites with a total area of 918,31 km².¹⁴⁴

More than half of protected sites of the Luhansk region and about a third of the sites of the Donetsk region (by their number) are or temporarily have been in the area of the hostilities. They include all the nature reserves in the region, namely «Luhanskyi» and «Ukrainskyi Stepovy» as well as such national nature parks as «Sviati Hory» and «Meotyda».

Information about the situation with the protected sites in the area of the hostilities is quite scarce and not sufficiently covered by the media. The main reason for this is that the issue of protected areas is not a high-profile one¹⁴⁵. Searching online information about the consequences of the war for the protected areas, we find only one reference, mentioning the fact that Donetsk Botanical garden greenhouses will not survive the winter without heating and reports that «the Nazis destroyed «Donetskyi Kriazh» reserve (actually it burned down as a result of the Ukrainian side being shelled from Russia) in «Novorossia reports»¹⁴⁶.

We found at least 33 territories of the NRF which were negatively affected by the hostilities. The summary of current information on the status of the damaged protected areas, primary examples of the impact of the major negative factors and the sources of information on the damage done to the protected sites are presented below.

Fires in the protected areas of NRF (both forest and steppe) caused by shelling and other factors related to the hostilities. This is the most common reason among all the detected ones. Thus, according to the remote sensing data (imposing of the outlines of the protected areas on Landsat 8 Global Fires I real-time satellite images and ERS data from Terra MODIS), the following areas have been damaged by fire: the part of the Luhansk «Provalskyi Step» nature reserve, «Trokhizbenskyi Step», «Donetskyi Kriazh» and «Zuievskyi» regional landscape parks, «Svyati Hory» national nature park, and such sanctuaries as «Alioshkin Buhor», «Balka Ploska», «Bilorichenskyi», «Volnukhynskiy», «Eremusovy Skhyl», «Znamenskyi Yar», «Naholnyi Kriazh», «Naholchanskyi», «Novozvanivskyi», «Obushok», «Pishchanyi», «Urochysche Murzyne», and «Balka Skeleva».

¹⁴⁴ Pryrodno-zapovidnyi... 2013, Donbas zapovidnyi... 2008

¹⁴⁵ Public assessment of environmental policy - 2012

¹⁴⁶ <http://www.novorossinform.org/news/id/19085>

Shelling and explosions of shells, causing mechanical damage to the landscapes, flora and fauna, and infiltration of chemical products into the air and soil as a result of the explosive reaction. Such effects may also be detected similarly to fires, with the use of ERS. The following areas have been detected as damaged by shelling: «Svyati Hory» NPP, the parts of «Kalmiuske» and «Kreidiana Flora» Ukrainian steppe reserve, «Donetskyi Kriazh» and «Slavianskyi Kurort» regional landscape parks, as well as «Luhanskyi», «Prystenske», «Kreidiane», «Bilohorivskyy» and «Perevalskyi» sanctuaries.

Construction of fortifications, resulting in destruction and transformation of biotopes that need wood of the forest reserves occurs in the territory of a number of protected areas, including «Krediana Flora» reserve and «Kramatorskyi» RLP that belong to the liberated territory now. In addition, the fortifications have also been far outside the area of hostilities — in the Kharkiv region, in «Dvorichanskyi» national nature park, bordering with the Russian Federation.

Uncontrolled use of natural resources of NRF, including the seizure of land areas and hunting. Such processes take place as a result of the absence of state control. Such activities were detected at «Iziumska Luka» RLP, where hunting towers are built. According to the reports by the press service of the prosecutor's office in the Donetsk region, in the town of Kramatorsk (Donetsk region) the inter-district prosecutor's office on supervision over the observance of laws in the field of environment conducted the compliance assessment of the requirements of the Land Code of Ukraine and the Law «On Nature Reserve Fund of Ukraine» in «Kramatorsky» regional landscape park. On the area of 100 hectares unidentified persons without special authorization for the use of natural resources and in the absence of the relevant decision of the executive powers initiated farming activity in the territory of 100 hectares, causing the state damages amounting to almost 1 million UAH¹⁴⁷.

Shutdown of the activity of NRF institutions in the territory of ATO. Thus, the central administration office of the Luhansk nature reserve has been destroyed; administration offices of «Meotyda» NPP, «Provalskyi Step» and «Khomutovskyy Step» reserves are seized by militants; in «Donetskyi Kriazh», «Zuivskyi» and «Kleban Byk» RLP they just have ceased to function. The personnel, findings, documents and archives of the conservation institutions have been lost.

There is also some unverified information about the burial of those killed during the fighting in the territory of «Donetskyi Kriazh» RLP. If such information is confirmed, over some period of time the products of decomposition will end up in the local rivers as taking into account composite terrain and rocky soil of the area such burials are shallow.

Due to the cold winter and heat outage in the city of Donetsk, the collection of plants from Donetsk Botanical garden greenhouse was put in danger¹⁴⁸.

¹⁴⁷ <http://novosti.dn.ua/details/234387/>

¹⁴⁸ <http://govorit.donetsk.ua/botanicheskii-sad-prosit-pomoshchi.html>

3.5. MINERAL WEALTH AND THE AREA OF THE HOSTILITIES IN EASTERN UKRAINE

Environmental safety during the exploitation of gob piles in peacetime is reduced to three main areas: correct formation, prevention of spontaneous combustion and neutralization of water under gob piles. These engineering requirements cannot be met during hostilities, power outage, shortage of diesel for the transport used on gob piles and delivery of the inert material. All the above mentioned factors lead to spontaneous heating and combustion of rock in a gob pile. Similarly, neutralization of acidified water under gob piles and its pumping is not carried out.

Another important issue is the fact it is prohibited to use flammable substances in gob piles. In the context of fighting, gob piles being the highest points of the terrain are often used as firing points from which shelling is carried out and which are also shelled. They are also utilized for storage of POL and explosives. This factor significantly increases the risk of spontaneous combustion of a gob pile. In addition, the destructive power of shells, thermobaric projectiles in particular, leads to thinning of the rock mass, oxygen access and spontaneous ignition.

Terricones are converted into weapons dump sites with unknown chemical «stuffing», whose danger is twofold:

- uncontrolled disassembly of rocks of terricones for banking and planning of the earth's surface leads to military pollution in clean territories;
- penetration into under-terricone water and pollution of natural waters. The risk increases with the acidity and migration of warm waters during burning of a terricone.

Combustion causes two major problems:

- emissions of pollutants into the atmosphere, which is especially dangerous with high levels of mercury and arsenic in rock as well as products of organic synthesis and phosphorus that missiles, shells and bombs may contain.
- contamination of subsoil water and groundwater from well fields in areas of sanitary protection with salts of heavy metals, products of organic synthesis, nitroglycerin, and nitrocellulose that missiles and shells may contain; the danger extends beyond the sanitary protection area of well fields in the areas of decentralized water supply and in the garden cooperatives that are often located near terricones. This aspect is particularly important for the Luhansk region, where groundwater is the main source of drinking water.

If prevention and elimination of spontaneous combustion in terricones in peacetime was a proven algorithm with a known set of tools and antipyrogens, the presence of military substances presents a completely new challenge.

Another issue is related to radioactivity in terricones which might be both natural and caused by weapons. Typically, a radiological situation is determined

by exposure of the environment to technologically-enhanced natural sources and also by radioactive contamination by uranium and thorium series radionuclides.

In Luhansk, we found three mines, whose activities significantly affected the overall radiological situation — «Luhanska», «Proletarska» and H. H. Kapustin mine. Their exploitation led to reclamation (conservation) of radiation hazardous objects and decontamination of polluted land. As we have noted above currently there is no information about their condition. The worst situation with the safety of IRS is also in the coal industry and often the problems with gob piles arise because of the lost IRS. Before the hostilities broke out, the articles of radiation accidents in Donbas were transferred to Dnipropetrovsk Integrated Plant of «Radon» USC which is no longer an option for Donbas now. At the same time, Ukraine has lost a state-owned enterprise «Spetsstentr» Vuhleizotop». Decontamination of gob piles with military radioactivity has not been developed. Such danger still exists because tank shell caps contain depleted uranium. It is clear that in wartime during the rock shipment processes equivalent dose rate (EDR) measurements of external γ -radiation are not performed.

Similar environmental problems are typical for other storages of coal mining waste, such as tailing ponds and sludge depositary of coal-preparation plants. Existing methods of demineralization (electrodialysis, evaporation, and osmosis) are extremely energy-intensive and require a deep level of the previous lighting of mine waters (up to 3–5 mg/L), thus, they are rarely used in Donbas. Damage caused to power supply of demineralizing plants, chemical storages, underwater pipelines, destruction of dams of hydraulic structures and damage of waterproofing of hydraulic structures followed by filtration are especially hazardous during the hostilities. The Ukrainian scientific center of technical environment in Donetsk, the leading center in this field, is lost for Ukraine now.

Ukraine has also lost a leading research institution on coal environment, namely Makiivka State Research Institute of Safety in the Mining Industry (MakNDI), which was involved in preparation of regulatory documents, expert environmental assessment of mine liquidation, scientific substantiation of safety rules in coal mines and mining plants, including their observance in gob piles. The exploitation of rocks with high background levels of gamma radiation for the elimination of mine shafts and rock dumping was carried out only under authorization of MakNDI. Moreover, this problem will affect not only Donetsk, but also the Lviv-Volyn coal basin.

The shortage of Ukrainian research institutions contributes to the situation when militants of the so-called Donetsk People's Republic (DNR) use the environmental issue of power supply in mines to their advantage. Such is the case with Horkyi mine in Donetsk, which was financed from the state budget of Ukraine and is characterized by fully depreciated drainage equipment. In

October 2014 the chairman of the independent Union of Miners, M. Volynets, made some apocalyptic statements about radioactive contamination of Donbas, the Sea of Azov and the Rostov Region due to the raising of radioactive waters of «Yunkom» Yenakiieve mine which was affected by nuclear explosion in 1979. The Ukrainian side has not disavowed his statements.

Another extremely important aspect regarding terricones is their ownership and financial issues related to it. When mines become part of the liquidation fund in the balance sheet, only the transfer of the land is registered, but the very terricones are not included on the list. Moreover, a terricone, in fact, can be a technogenic mineral deposit as showed by the units of JSC «Nadra Ukrainy» which conducted a geochemical and radiometric study of terricones within the state title 481. However, the regulatory framework on technogenic deposits in Ukraine has been destroyed

Given that coal is usually enriched in uncommon and rare earth elements, especially in Donbas area, Ukraine is going to lose potential revenue unless it solves the issue of restoration of eligibility of technogenic deposits and inclusion of terricones of the liquidated mines in the balance sheet.

A very important aspect of environmental safety is associated with the potential disposal of toxic waste from the Russian Federation in sludge depositaries and terricones, especially in the mines of liquidation fund.

Open borders and free traffic pose a real danger of such processes taking place. Therefore, close contacts between the Ministry of Environment and law enforcement agencies are vital.

Summarizing, we can state that technical solutions and resources to eliminate environmental problems of coal mining are present only in the civil sector. Absolutely unknown chemicals that are used in the defence sector by both sides, not only make it impossible to eliminate the consequences of their use, but also prevent monitoring of the environmental elements. Russia uses Donbas as a testing ground for such new weapons as TOC-1 «Buratino», 3PK C-300B, PC3B 9K58 «Smerch», PC3B 9K57 «Uragan», T-90 and T-72B3 tanks¹⁴⁹.

The structure of the Ministry of Environment of Ukraine does not envisage a unit which would be responsible for the situation and would establish cooperation with the Ministry of Defence of Ukraine. Resource materials of the Ministry of Defence of Ukraine on environmental issues are also targeted exclusively for peacetime period and relate mainly to POL. It should be noted that the armed forces of Ukraine were deployed in Iraq and it is likely that they have certain experience which can be used for new research findings.

¹⁴⁹ <http://www.pravda.com.ua/news/2015/01/17/7055377/>

CHAPTER 4.

ASSESSMENT METHODS OF DAMAGE CAUSED TO THE ENVIRONMENT AS A RESULT OF HOSTILITIES

Despite the existence of a list of important legal instruments to protect the environment, it still remains the silent victim of armed conflicts around the world¹⁵⁰. The United Nations Environment Programme (UNEP) has carried out more than 20 post-conflict economic assessments since 1999, which determined the consequences of war for the environment. The first post-conflict economic study included assessment of the countries affected by the first Gulf War.

In this section of the handbook we tried to analyze international studies into environmental damage from military conflicts, conducted by the Regional Environmental Center for Central and Eastern Europe, the UN and the World Bank in the former Yugoslavia, the Republic of Rwanda, the Gaza Strip, Lebanon, the Republic of Sudan and partially recognized Republic of Kosovo. Special attention in the analysis was also dedicated to the economic assessment of environmental damage based on the reports from Lebanon and partially the Gaza Strip; the assessment methods of environmental damage under national law were also covered¹⁵¹.

4.1. POST-CONFLICT ENVIRONMENTAL ASSESSMENT BASED ON INTERNATIONAL PRACTICE

Fortunately, only in some cases armed conflicts led to environmental disasters. However, the fact that there were no disastrous consequences does not rule out their long-lasting effects. Though environmental impacts are very diverse, it is still possible to single out some common features. Common negative environmental impacts were as follows:

¹⁵⁰ Protecting of Environment during Armed Conflicts. An Inventory and Analysis of Environment Law. — UNEP, 2009. http://postconflict.unep.ch/publications/int_law.pdf

¹⁵¹ Palestinian National Early Recovery and Reconstruction Plan for Gaza 2009-2010. <http://www.undp.ps/en/focusareas/crisis/paeremar09.pdf>

High Overall Pollution Level

There are various factors causing pollution. For example, in the former Yugoslavia and Kosovo it was primarily caused by the bombing of industrial plants, resulting in the discharge of hazardous substances into water bodies and the atmosphere¹⁵². In the Gaza Strip a high level of pollution was associated with an enormous amount of newly-generated waste and bombing of wastewater treatment facilities, leading to the discharge of untreated wastewater into the Mediterranean Sea¹⁵³.

Affected Aquatic Ecosystems (Rivers, Seas, Groundwater)

In general, the adverse effect on aquatic ecosystems was noticed in all the countries surveyed. In the former Yugoslavia and Kosovo, the most affected aquatic ecosystem was the Danube; in the Gaza Strip and Lebanon — the Mediterranean Sea; in Rwanda — the ecosystem of wetlands. The Gaza Strip and Lebanon also witnessed large-scale destruction of wastewater facilities and centralized water supply. The aquatic ecosystems were polluted as a result of bombing of bridges, and oil leaking from gas stations, power plants, and industrial plants.

In Yugoslavia after the bombing of a vinyl-chloride monomer plant more than 1,000 tons of ethylene dichloride and more than 1,000 tons of the solution, 33 % of which contained hydrogen chloride, were discharged directly into the Danube. In addition, more than 3,000 tons of sodium hydroxide and dozens of tons of chlorine contaminated the environment. The Danube was also contaminated by polychlorinated biphenol, ammonia, heavy metals, and radioactive substances. Cross-border pollution reached Romania and Bulgaria¹⁵⁴.

In the Gaza Strip due to the destruction of wastewater treatment facilities 100,000 m³ of wastewater reached surrounding agricultural land. It led to high pollution levels of offshore areas and the coast, excessive E.coli levels, and release of several hundreds of organochlorine pesticides, including DDT, as well as phosphates, pyrethroids and other nitrogen-containing compounds, triazines, triazoles, and strobilurins¹⁵⁵.

The damage caused to the electric power station in Lebanon, Jiyeh, led to massive oil spills. At the moment when the bombing occurred, there were 44,000

¹⁵² Assessment of the Environmental Impact of Military Activities during the Yugoslavia Conflict. Preliminary findings. — The regional Environmental Center for Central and Eastern Europe, 1999. <http://www.monde-diplomatique.fr/cahier/kosovo/ecologie-rapport>

¹⁵³ Detailed Infrastructure Damage Assessment. Gaza — 2014. UNDP. <http://www.ps.undp.org/content/dam/papp/docs/Publications/UNDP-papp-research-damageassessment2014.pdf>

¹⁵⁴ Assessment of the Environmental Impact of Military Activities during the Yugoslavia Conflict. Preliminary findings. — The regional Environmental Center for Central and Eastern Europe, 1999. <http://www.monde-diplomatique.fr/cahier/kosovo/ecologie-rapport>

¹⁵⁵ Environmental Assessment of the Gaza Strip following the escalation of hostilities in December 2008 — January 2009. — UNEP, 2009. http://www.unep.org/PDF/dmb/UNEP_Gaza_EA.pdf

thousand tons of oil at the station, some of which burned, and some (12,000–15,000 tons) flowed into the Mediterranean Sea. Consequently, the coastal biota, birds, marine mammals, reptiles, fish, and objects of the Nature Reserve Fund (NRF) were affected¹⁵⁶. According to the UNDP report, the oil spills will have serious effects on the marine biodiversity in the next 10–50 years and disastrous consequences for the littoral zone in the next 1–10¹⁵⁷.

As a result of the bombing of the petrochemical complex in Pančevo, Kosovo, 2,100 tons of ethylene dichloride and 8 tons of metallic mercury soaked through the surface soil and the wastewater outlet. 50–100 kg of mercury were discovered on the floor of the plant. 460 tons of vinyl chloride monomers got burned, releasing dioxins, phosgenes, and polycyclic aromatic organic compounds. A total of 80,000 tons of oil and oil products burned. In the same city 250 tons of liquid ammonia flowed into an open outlet from the fertilizer production plant, causing fish kill in the Danube. The bombing of the car factory in Kragujevac caused contamination of water and soil with chlorinated biphenyls¹⁵⁸.

In Rwanda, wetlands were intensively exploited during the military conflict, seriously threatening major ecosystem services, including freshwater replenishment. More than 60 % of Rwanda's wetlands are converted into agricultural land or sites for peat extraction¹⁵⁹.

Contamination of Drinking Water

Problems with drinking water were chronic in all countries except the former Yugoslavia. Military conflicts only reinforced the shortage of clean, safe water, particularly in Rwanda, where only 71 % of the population had access to the water. For example, in the Gaza Strip a large amount of drinking water for a long time was contaminated with nitrates, therefore there were numerous cases of cyanosis (blue baby syndrome) in children and infants in the country as a result of the presence of nitrates in their bodies¹⁶⁰. In Lebanon, there were outbreaks of severe diarrhea among the population after another bombing of water purification systems.

¹⁵⁶ Republic of Lebanon. Economic Assessment of Environmental Degradation Due to July 2006 Hostilities. - October, 2007. - The World Bank. <https://openknowledge.worldbank.org/bitstream/handle/10986/7619/397870LB.pdf?sequence=1>

¹⁵⁷ UNDP (United Nations Development Program), 2007. Lebanon Rapid Environmental Assessment for Greening Recovery, Reconstruction and Reform 2006. Beirut, Lebanon.

¹⁵⁸ The Kosovo Conflict. Consequences for the Environment and Human Settlements. UNEP, UNCHS, 1999. <http://postconflict.unep.ch/publications/finalreport.pdf>

¹⁵⁹ Summary Report. Rwanda: From Post-Conflict to Environmentally Sustainable Development. UNEP. http://www.zaragoza.es/contenidos/medioambiente/onu/issue07/1117_eng_ch9.pdf

¹⁶⁰ Emergency Water and Sanitation Hygiene (EWASH) — 2009. A brief outline of the sewage infrastructure and public health risks in the Gaza Strip for the World Health Organization. <http://www.ochaopt.org/cluster/admin/output/files/SewageInfrastructureGazaMarch2009WASHCluster-20090416-114157.pdf>

Soil Damage and Contamination Leading to Contaminated Food

This problem attracted particular attention in the analytical reports on the former Yugoslavia and the Gaza Strip. Explosions of shells caused great damage. Restoration of natural topsoil will take many years. Nature needs 1,500 to 7,400 years to restore a destroyed 20 cm humus layer. In 100 years only 0.5–2 cm will be restored¹⁶¹. In the former Yugoslavia, agricultural production was halted in an area of 2.5 million hectares due to the contamination. In Rwanda, unexploded ordnance contaminated 900,000 m² of soil, what makes 3.5 % of the country's territory¹⁶².

Air Pollution Caused by Fires at Chemical Plants, Landfills, and Forests

The abovementioned negative consequences were observed in the former Yugoslavia and Kosovo (plants), the Gaza Strip (polygons), and Lebanon (forests). One of the greatest dangers of air pollution is the speed with which it affects large territories.

In general, the condition of the atmosphere largely depends on the exploding shells and emissions from chemical plants, although the effects of such an influence are temporary. A long-term indirect effects are, for example, the increasing amounts of dust as a result of remedial construction or reduced vehicle speed in areas with damaged road networks.

In Lebanon, forest fire emissions caused high levels of air pollution. Most of these emissions have only short-term effect that virtually disappears after the rain. Such effect is difficult to assess in financial terms. What we know for sure is that solids are the most residual air pollutants, given the ongoing reconstruction of areas. Solids are internationally recognized as the major air pollutants in terms of their negative impact on people because of their cumulative capacity and ability to reach the lower respiratory tract. These particles precipitate at a slow pace and can travel long distances¹⁶³. The assessment of emissions from forest fires was performed using special emission factors established by USEPA¹⁶⁴. This method was used by EPL in their studies on forest fires.

The damage done to the petrochemical plant in Yugoslavia caused emissions of such combustion products as phosgene and vinyl chloride, which eventually

¹⁶¹ V. Janjic, 1999: NATO air strikes — environmental consequences.<http://www.knjizevnarec.co.yu/eko/index.html>

¹⁶² Summary Report. Rwanda: From Post-Conflict to Environmentally Sustainable Development. UNEP. http://www.zaragoza.es/contenidos/medioambiente/onu/issue07/1117_eng_ch9.pdf

¹⁶³ Republic of Lebanon. Economic Assessment of Environmental Degradation Due to July 2006 Hostilities. — October, 2007. — The World Bank. <https://openknowledge.worldbank.org/bitstream/handle/10986/7619/397870LB.pdf?sequence=1>

¹⁶⁴ United States Environmental Protection Agency

led to acid rain and secondary contamination of soil. In addition, numerous flights of military aircraft caused depletion of the ozone layer¹⁶⁵.

Fires at landfills in the Gaza Strip caused significant pollution of air and soil. The garbage in landfills was not pressed and sometimes reached a height of 20 m above the ground¹⁶⁶.

A Large Amount of Waste, Including Military Waste (Unexploded Ordnance and Disposed Equipment), Medical Waste, Municipal Solid Waste, and Debris From Demolished Buildings

The problem with waste was typical for all countries, but while in the former Yugoslavia disposed equipment prevailed, the Arab and African countries had the problem with unexploded ordnance and MSW. A significant share of waste accounted for the debris from demolition or partial destruction of the buildings. Usually such waste is quite inert and does not pose a large threat to the environment, but in the Gaza Strip and Lebanon a high level of waste containing asbestos was recorded, which is carcinogenic.

In Lebanon, 864 sites with approximately 1 million of unexploded cluster ordnance on the ground surface, polluting the area of about 34 million m² were found¹⁶⁷.

There was an interesting case in Sudan, concerning the effects of disposed equipment. During the military conflict an excavator, which was used on the 40 km channel north of Padak, got damaged. After that it was left to rust away, but it eventually became a nesting site for eagles and a shelter for several hives. UNEP experts examined the excavator and its surroundings, and concluded that its direct environmental impact was negligible¹⁶⁸.

Destruction of Natural Landscapes

The problem of the destruction of natural landscapes was emphasized in the environmental assessment in all countries. In the Gaza Strip, the greatest harm was caused by the movement of heavy military equipment. In Lebanon, the destruction of landscapes was the result of the quarries exploitation. In Kosovo

¹⁶⁵ Assessment of the Environmental Impact of Military Activities during the Yugoslavia Conflict. Preliminary findings. — The regional Environmental Center for Central and Eastern Europe, 1999. <http://www.monde-diplomatique.fr/cahier/kosovo/ecologie-rapport>

¹⁶⁶ Environmental Assessment of the Gaza Strip following the escalation of hostilities in December 2008 — January 2009. — UNEP, 2009. http://www.unep.org/PDF/dmb/UNEP_Gaza_EA.pdf

¹⁶⁷ E-mine: Electronic Mine Information Network. March 2007. Mine Action Co-ordination Centre South Lebanon: Unexploded Ordnance Fact Sheet Online. <http://www.mineaction.org/overview.asp?o=540>

¹⁶⁸ Sudan. Post-Conflict Environmental Assessment. UNEP, 2007. http://postconflict.unep.ch/publications/UNEP_Sudan.pdf

and Sudan, the harm was done due to the presence of shell holes. Landscapes in Rwanda and Sudan were heavily affected by mass migration. Construction of new settlements destroys forests. In particular, due to deforestation a desert border in Sudan moved 50–200 km further. Overall, two thirds of forests were destroyed in North Sudan and 40 % in South Sudan; the changes are still taking effect¹⁶⁹.

In Lebanon, additional pressure was exerted on quarries during the military conflicts. Exploitation of around 200 quarries led to the destruction of natural vegetation, air pollution by dust and general road deterioration. Moreover, the fires destroyed natural forests. In total, there were 48 forest fires in southern Lebanon. NASA satellite imagery was used for their detection. According to different data, from 1,800 to 2,338 hectares of forests burned as a result¹⁷⁰.

For comparison, about 3,000 fires occurred in the summer of 2014 in eastern Ukraine. UNDP reports that the impact of 48 fires in Lebanon was classified as severe, with significant long-term effects for approximately 10–20 years (an average regeneration period for trees in Lebanon). Total forestry losses amounted to \$ 15,900,091.

Impacts on Biodiversity

The destruction of natural ecosystems undoubtedly had negative consequences for biodiversity. In Sudan, the wildlife was forced out to the most remote parts of NRF. In some cases, for example, in southern Sudan, uncontrolled hunting reduced wildlife populations, led to the destruction of many local large-sized species such as elephant, rhino, buffalo, giraffe, zebra, and eland¹⁷¹. Also direct impacts on the species have been recorded as a result of water pollution in the former Yugoslavia. For example, fish kill due to contamination of the Danube is likely to lead to the extinction of such fish species in the territory as fringe sturgeon, European sturgeon, little chop, large chip, and mudminnow¹⁷².

In other cases the effect was indirect, mainly through the destruction of habitats. In particular, in Kosovo, great damage was done to orchid habitats¹⁷³.

¹⁶⁹ Sudan. Post-Conflict Environmental Assessment. UNEP, 2007.http://postconflict.unep.ch/publications/UNEP_Sudan.pdf

¹⁷⁰ Republic of Lebanon. Economic Assessment of Environmental Degradation Due to July 2006 Hostilities. — October, 2007. — The World Bank.<https://openknowledge.worldbank.org/bitstream/handle/10986/7619/397870LB.pdf?sequence=1>

¹⁷¹ Sudan. Post-Conflict Environmental Assessment. UNEP, 2007.http://postconflict.unep.ch/publications/UNEP_Sudan.pdf

¹⁷² Assessment of the Environmental Impact of Military Activities during the Yugoslavia Conflict. Preliminary findings. — The regional Environmental Center for Central and Eastern Europe, 1999. <http://www.monde-diplomatique.fr/cahier/kosovo/ecologie-rapport>

¹⁷³ The Kosovo Conflict. Consequences for the Environment and Human Settlements. UNEP, UNCHS, 1999. <http://postconflict.unep.ch/publications/finalreport.pdf>

In the former Yugoslavia the destruction of natural areas endangered 20 plant species¹⁷⁴.

Harm to Human Health, Including Long-Term Effects of Toxic, Carcinogenic, and Radioactive Substances

Large-scale harm to human health was characteristic of the former Yugoslavia, the Gaza Strip, Lebanon, and Kosovo. In particular, in the Gaza Strip the major causes of health problems were fires at landfills and the presence of nitrates in drinking water, which led to the development of methemoglobinemia. Gas emissions caused by burning debris contributed to respiratory irritation and their long-lasting effect led to the development of symptoms of asthma, chronic illnesses, and cancer¹⁷⁵. In Lebanon, public health deteriorated due to the great amount of untreated wastewater. In Kosovo, many people discussed the use of weapons with depleted uranium during the military conflict, however field and analytical activities of UNEP found no reliable proof of such a case¹⁷⁶. In the former Yugoslavia, there were some forecasts for chronic diseases of the nervous system and liver due to the presence of carcinogens¹⁷⁷.

Inhalation of air containing a large amount of suspended solids may have such health effects as increased mortality rates from heart and respiratory diseases, reduced lung function in children and adults with development of obstructive airway disease, and increased daily prevalence of respiratory symptoms in children and adults.

In Lebanon, to evaluate the damages caused by shell bursts to health and lives of people the method of DALYs (Disability Adjusted Life Years) was applied. It helps count the number of lost years of a healthy life. This methodology was developed by WHO, the World Bank, and international experts.

Emergence of the Environmental Refugees Problem

This problem concerned the former Yugoslavia, Sudan, and Rwanda. In particular, in the latter two countries it became large-scale. African immigrants migrated in millions, fleeing not only from military aggression, but also from droughts, floods,

¹⁷⁴ Assessment of the Environmental Impact of Military Activities during the Yugoslavia Conflict. Preliminary findings. — The regional Environmental Center for Central and Eastern Europe, 1999. <http://www.monde-diplomatique.fr/cahier/kosovo/ecologie-rapport>

¹⁷⁵ Emergency Water and Sanitation Hygiene (EWASH) — 2009. A brief outline of the sewage infrastructure and public health risks in the Gaza Strip for the World Health Organization. <http://www.ochaopt.org/cluster/admin/output/files/SewageInfrastructureGazaMarch2009WASHCluster-20090416-114157.pdf>

¹⁷⁶ The Kosovo Conflict. Consequences for the Environment and Human Settlements. UNEP, UNCHS, 1999. <http://postconflict.unep.ch/publications/finalreport.pdf>

¹⁷⁷ Assessment of the Environmental Impact of Military Activities during the Yugoslavia Conflict. Preliminary findings. — The regional Environmental Center for Central and Eastern Europe, 1999. <http://www.monde-diplomatique.fr/cahier/kosovo/ecologie-rapport>

and landslides. Massive displacement of people due to the military conflict and an unfavorable environmental situation resulted in the major devastating effects to the environment in Rwanda. Displacement of around three million people and building of settlements in new areas led to irreversible losses, including reducing areas of national parks, forests and other vegetation. The problem exacerbated due to 54,000 refugees from the Democratic Republic of Congo and the Republic of Burundi¹⁷⁸.

Sudan, with five million of displaced people and refugees from other countries, ranked first in the world in terms of mass displacement. This led to significant deforestation in the areas of new settlements, which caused the degradation of soil, depletion of underground water sources, and contamination of surface and groundwater¹⁷⁹.

Weak Government Stand in Resolving of Environmental Issues

Such characteristic feature was clearly stressed in the report on the environmental situation in the former Yugoslavia. However, in Rwanda, after the military conflict environmental issues received a priority during the reconstruction of damaged areas. Despite some difficulties, an effective system of resource management was created, integrated environmental vision was effectively promoted and the access to environmental information was improved.

The methods of economic assesment, most commonly applied in the Gaza Strip and Lebanon reports^{180,181}:

- Evaluation of waste extraction, transportation, and disposal (Lebanon, the Gaza Strip);
- The cost of cleaning and remediation of contaminated soils (the Gaza Strip);
- The cost of recovery of information system and environment monitoring system; (the Gaza Strip);
- The cost of recovery of any affected recreational area contaminated as a result of spills of oil, chemicals, untreated wasterwater, and solid waste (Lebanon, the Gaza Strip);
- Potential loss of revenue for the NRF objects, fisheries, and hotels (Lebanon);
- The cost of the destroyed forests and forest restoration (Lebanon);
- Biodiversity losses (Lebanon).

¹⁷⁸ Sudan. Post-Conflict Environmental Assessment. UNEP, 2007. http://postconflict.unep.ch/publications/UNEP_Sudan.pdf

¹⁷⁹ Sudan. Post-Conflict Environmental Assessment. UNEP, 2007. http://postconflict.unep.ch/publications/UNEP_Sudan.pdf

¹⁸⁰ Republic of Lebanon. Economic Assessment of Environmental Degradation Due to July 2006 Hostilities. — October, 2007. — The World Bank. <https://openknowledge.worldbank.org/bitstream/handle/10986/7619/397870LB.pdf?sequence=1>

¹⁸¹ Environmental Assessment of the Gaza Strip following the escalation of hostilities in December 2008 — January 2009. — UNEP, 2009. http://www.unep.org/PDF/dmb/UNEP_Gaza_EA.pdf

For example, let us consider valuation for disposal of debris left after the destruction of buildings in the Gaza Strip. Total construction waste on site amounted to 600,000 tons. With the density of 1.2t/m³ such waste requires 500,000 m³ of area. With the allowable disposal height of five meters, the disposal area will cover 100,000 m² and 25% of such area will be needed for the sanitary zone, which gives the total result of 125,000 m² area for waste disposal. On the basis of the data, it was calculated that the cost of removal and disposal of debris after the building destruction and asbestos waste in particular, amounts to \$ 17,49 million. This number includes the direct cost of waste loading and transportation (6 million), the cost of insurance because of the presence of asbestos fibers (1.2 million), the cost of environmental impact assessment (4.04 million), and opportunity cost of land, with an area of 125,000 m², which will be used for waste disposal (6.25 million.)¹⁸².

Another example concerns economic costs due to the biodiversity damage in Lebanon. Estimated losses included the cost of releasing of the species from the affected wildlife, their transportation to treatment facilities and the cost of treatment and rehabilitation¹⁸³.

Most indirect economic calculations are based on the «willingness to pay» approach (WTP) or «willingness to accept» (WTA). WTP is the maximum amount of money that an individual is willing to pay in order to avoid something undesirable, for example, to pay for conservation of species (to avoid its loss) or waste disposal (to avoid landfill appearance). WTA, on the other hand, is the maximum amount of money that an individual is ready to receive to put up with some negative phenomenon, e.g. pollution.

For example, the cost of saving of the same species in some countries may vary due to a different economic situation since such a method of cost valuation is based upon the willingness of local people to pay for the species preservation. Therefore, in economically developed countries, the cost will be higher than in underdeveloped.

The downside of economic valuation lies in the fact that it is impossible to evaluate consequences by their value. In particular, extinct organisms or entire populations of some species cannot be evaluated. We evaluate only those influences that we can see and which we know about. And even when it is possible to notice such consequences, the evaluation makes up only 35–40 % of the real consequences.

¹⁸² Environmental Assessment of the Gaza Strip following the escalation of hostilities in December 2008 — January 2009. — UNEP, 2009. http://www.unep.org/PDF/dmb/UNEP_Gaza_EA.pdf

¹⁸³ Republic of Lebanon. Economic Assessment of Environmental Degradation Due to July 2006 Hostilities. — October, 2007. — The World Bank. <https://openknowledge.worldbank.org/bitstream/handle/10986/7619/397870LB.pdf?sequence=1>

4.2. Methodology of Evaluation of Damage Caused to the Environmental Objects as a Result of the Hostilities in Eastern Ukraine

EPL studied the areas of the Donetsk region affected by the hostilities and made assessment of damage caused to the land resources.

Using satellite imagery we were able to identify the size of the shell holes and assess the extent of the soil destruction caused by the hostilities in eastern Ukraine, namely in the territories of Amvrosiivka and Shakhtarsk districts of the Donetsk region.

The Amvrosiivka district is located in southern part of the Donetsk Ridge, 82 km from Donetsk, bordering the Shakhtarsk district in the north and the Rostov region in the south-east. The border line extends to 73 km. The Shakhtarsk district is located 170 km from Mariupol sea port; prevailing soils are ordinary chernozem.

The study found 1,137 shell holes in the territory of the Amvrosiivka district, covering a total area of 21,138 m² and 9,987 shell holes with a total area 161,914 m² in the Shakhtarsk district, with their approximate size similar to the one applied in the study by EPL. The shell holes were formed as a result of the use of shrapnel and high-explosive mines, «Grad» multiple rocket launchers, shells of field guns and self-propelled howitzers as well as self-propelled missiles of the «Uragan» rocket launcher system.

The study by EPL in the Donetsk region has shown that as a result of the hostilities soils are contaminated with such heavy metals as lead, strontium, titanium, vanadium, cadmium, manganese, and nickel. To exclude natural distribution of these metals background samples have been analyzed.

Using the method of damage evaluation in accordance with the national law, we estimated that the amount of damage caused by contamination of land resources in the Amvrosiivka and Shakhtarsk districts in the area of 18.3 hectares where shells exploded, amounts to more than nine million UAH.

Regulatory monetary value of land areas of the examined districts was employed for valuation alongside the information obtained from the State Agency of Land Resources of Ukraine.

If we replicate damage assessment on all the shell holes that were formed as a result of shell bursts in the Donetsk and Luhansk regions, the damage to land resources and costs of reclamation of affected land will reach billions of hryvnias.

The process of natural restoration of land resources with heavy metals from contamination will take hundreds of years. Reclamation of contaminated and disturbed lands is possible only in peaceful environment. EPL hopes that such conditions will arise in the near future. Indeed, the subjective motivation of the situation or ambitions of one or more people may result in severe and unpredictable consequences for the future generations.

CONCLUSIONS

The current situation in eastern Ukraine calls for immediate actions in terms of prevention of man-made disasters caused by the war, publicizing the level of hazards, locating each of the disasters and developing the detailed plan of actions for their mitigation.

The reports by the UNEP and the World Bank on the environmental standards in the post-war period in Lebanon, the Gaza Strip, Sudan, former Yugoslavia, and Kosovo clearly reveal the devastating impact of the war on the environment. Qualitative changes and calculable losses are of immense proportions.

Lack of control of the environment in the war zone in Donetsk and Luhansk regions, absence of regulatory authorities and permanent shootings and bombardments do not allow unbiased assessment at the state level of environmental damage caused during the period of armed conflict.

Since September 2014, EPL has been conducting the research on the impact of military operations in eastern Ukraine on the environment:

- The appeal to fellow environmental lawyers from Russia and all over the world has been lodged jointly by practicing lawyers and ecologists with the aim of condemning the devastating impact of the aggression on Ukraine and its environment.
- The research based on the data from Earth's remote sensing MODIS (NASA) has been conducted. It covered all cases of fires in vegetation and settlements during the period from June to September 2014. According to the research, there were 3000 cases of fire in the war zone in eastern Ukraine, which is 20 times as much as in the similar period in 2013.
- The study based on the data received from automated environmental monitoring system in Luhansk region has been conducted. The information about the composition of the air had been recorded by the station until it was destroyed under fire. It was observed that fire in Shchastia town in Luhansk region caused concentration growth of the following substances in the air: sulphur oxide, nitrogen and carbon.
- The overall area of the territories under fire in ATO zone during the period from June to September 2014 has been calculated, which amounted to 297 006 hectares, 17 % of the overall area of woods, steppes and fields in ATO zone.
- It has been researched that around 1000 hectares within the territory of Krasnyi Lyman forestry farm in Donetsk region has been damaged during summer

- fire by launch vehicles. The territory of the forestry is the part of the national nature park «Sviati Hory», which is the only national park in eastern Ukraine.
- The method of making water filters from improvised means for the population in eastern Ukraine has been devised and circulated via social networks, as water chlorination stations were destroyed during fire.
 - The evidence of destruction of nature reserves in the war zone in eastern Ukraine has been provided. Total losses amounted to 14 bln UAH.
 - The map of nature reserves areas damaged during the war in eastern Ukraine has been drawn.
 - A study of hazardous waste in eastern Ukraine has been carried out.
 - Extremely hazardous waste amount to 1,8 thousand tonnes on the territory of Donetsk region and 14,2 thousand tonnes in Luhansk region.
 - The most valuable nature reserves in Donetsk region, which were damaged during hostilities, have been under study, with national park «Sviati Hory», regional landscape park «Slovianskyi Kurort» and reserve «Kreidiana Flora» located on the outskirts of Slovyansk town, among them. The scale of damage has been researched and soil samples in the area of fire and water samples from the Siverskyi Donets have been taken for analysis.
 - The lawyers and ecologists from EPL together with the journalists from «Channel 5» and «New Channel» visited the branch of Ukrainian Steppe Reserve «Kreidiana Flora», which was damaged in fighting for the bridge near Zakitne village (Krasnyi Lyman, Donetsk region).
 - Soil and water in Donetsk region have been studied. According to the study, soil is heavily polluted with strontium, titanium, vanadium and cadmium due to shells bursts in the war zone.
 - The problem of water resources in the war zone in eastern Ukraine has been discussed with leading experts during the round table «The Foundations of Acquis Communautaire as the Prerequisite for Improving Water Resources in Ukraine», which was arranged and held by EPL in Kyiv, October 23, 2014.
 - The round table «Military Actions in Eastern Ukraine: Hazards and Consequences for the Environment and Health» was held in Kyiv, January 22, 2015.
 - The detailed plan of primary actions for central executive bodies has been devised to provide civil defence and environmental security during military operations in eastern Ukraine in cases of damage to chemical plants, ignition of toxic chemicals, potable water and soil pollution.

We hope that the results of our studies and calculations will serve as a tool in making managerial decisions at the national and international levels and act as a driving force in attracting the attention of the world community to establishing peace for the sake of life in terms of environmental protection.

RECOMMENDATIONS OF EPL TO CEB (CENTRAL EXECUTIVE BODIES)

The current situation in eastern Ukraine calls for immediate actions from all central executive bodies, public institutions and international organizations for the purpose of consolidating efforts and taking adequate measures aimed at preserving lives and health of people and nature in eastern Ukraine.

With the view of taking measures to immediately detect man-made environmental disasters in the war zone in eastern Ukraine, to publicize the level of hazards, to locate each of the disasters and to develop the detailed plan of actions for their mitigation, EPL together with the participants of the round table discussion offered suggestions and recommendations to the central executive bodies, public institutions, international organizations, which follow below.

To the Cabinet of Ministers of Ukraine:

- To create information analysis centre for collecting information about the environment in the hostilities area in eastern Ukraine, to pass the new law, to provide financial and technical support.
- To involve research and analytical institutes in the sphere of environment in solving environmental problems in the hostilities area in eastern Ukraine.
- To evacuate civil population from dangerous areas in the military conflict zone in eastern Ukraine.
- To provide depositories for nuclear and chemical hazards.
- To ensure the collaboration of the Ministry of Environment and Natural Resources of Ukraine, the Ministry of Defence of Ukraine, the Ministry of Health Care of Ukraine, the State Emergency Service of Ukraine, the State Environmental Inspection of Ukraine, the State Sanitation and Epidemiological Department of Ukraine in providing anthropogenic and environmental safety. Life and conservation of the environment can be ensured on condition of adequate constructive well-coordinated activity of the above-mentioned bodies.

To the Ministry of Environment and Natural Resources of Ukraine (hereinafter the Ministry of Environment of Ukraine)

- To ensure effective monitoring in the hostilities area in eastern Ukraine (radiological and chemical studies).
- To conduct environmental and social audit of the territories, towns and villages, of potentially dangerous units after the end of military actions in eastern Ukraine.
- To establish the Department in the Ministry of Environment of Ukraine responsible for publicizing via the site the information about the state of the environment in eastern Ukraine.
- To create the task force for the development of information and analysis system based on advanced GIS.
- To update the system of the state and departmental environmental monitoring involving GIS and ensure its implementation.

To the Ministry of Education and Science of Ukraine

To provide environmental education and public education in terms of civil defence of population in ATO zone in order to ensure environmental safety.

To the Ministry of Defence of Ukraine

Taking into account the consequences of environmental hazards, to consider the possibility of increase in the number of departments of environmental safety according to the type of performed tasks and to re-establish the Central Military Environmental Laboratory in the Ministry of Defence of Ukraine.

To the State Environmental Inspection of Ukraine

To ensure environmental supervision of the state of water resources, soil, air, sites for storing dangerous chemicals and waste in ATO zone on the basis of available equipment and mobile units of the State Environmental Inspection of Ukraine.

To the State Emergency Service of Ukraine

- Together with economic agents, located on the territories with hazardous matter and waste in ATO zone, to put hazardous production out of use in ATO zone and to ensure evacuation of hazardous matter and waste from ATO zone.
- To develop the rapid warning system for population and its evacuation from ATO zone. To ensure complete termination of military operation during evacuation.
- To provide guidelines for population under military actions.
- To oblige local self-government bodies and public utility companies to ensure provision of information to population about the availability of civil defence shelters in eastern Ukraine. To locate the information on stands in Public utilities service providers' offices and residential buildings.

To the Ministry of Health Care of Ukraine

- To measure background radiation and test drinking water on the territory of military operations in eastern Ukraine.
- To publicize the results on the site of the Ministry of Health Care of Ukraine.

To the Verkhovna Rada of Ukraine:

To develop and approve a new doctrine of environmental safety of Ukraine.

To public institutions:

- To create the portal for recording environmental damage in the war zone in eastern Ukraine.
- To actively publicize their own studies results among the public authorities which pursue the state policy in terms of environmental protection.
- To ensure collection, analysis and publicizing of information about the state of the environment in the war zone in eastern Ukraine at the level of regions and territorial communities.
- To demand from public authorities weekly information update about the state of the environment on the occupied territories.
- To prepare information for the occupied territories and preventive measures on using drinking water.
- To engage public television in solving environmental problems in eastern Ukraine.
- To draw the map of environmentally dangerous territories for «environmental migrants.»

To international organizations:

- To exploit the information about the state of the environment in the war zone in eastern Ukraine as the supplementary argument of influence for international and interstate organizations in order to attract the attention to the issues of promotion of the peace process.
- To publicize information and analysis data on the state of the environment in the war zone in eastern Ukraine in UN, EC etc.
- To provide financial aid for joint projects of central executive bodies and public institutions with the purpose of ensuring permanent supervision of the state of the environment in the war zone in eastern Ukraine.
- To provide assistance with the equipment (quick test) for monitoring of the environment, drinking water in the war zone in eastern Ukraine (dose meters — for radiation tests, nitrate meters, conduct meters — for drinking and surface water).
- To create the international mission for assessment of environmental damage.

In addition to this, EPL has offered detailed suggestions for the Ministry of Environment of Ukraine in the field of environmental protection with the purpose of ensuring environmental safety in eastern Ukraine, which follow below.

I. SECTION: INFORMATION AND ANALYSIS

1. To charge one of the departments of the Ministry of Environment of Ukraine with collecting and analyzing information about the state of the environment and suggesting emergency measures for environmental safety in the war zone in eastern Ukraine.
2. The above mentioned department shall collect the information about the following objects:
 - Sewage treatment facilities damaged in the military conflict zone in eastern Ukraine (names of the enterprises, legal and physical addresses, causes of damage, consequences for the sewage treatment facilities, the name of the water body into which sewage is discharged, the period of electricity cut-off — if occurred).
 - Environmentally hazardous enterprises in the military conflict zone in eastern Ukraine (names of the enterprises, legal and physical addresses, the names and quantity of chemicals (hazardous, highly explosive, highly inflammable), the amount of hazardous waste; evidence of chemicals/waste ignition — if occurred, with the quantity of chemicals indicated).
 - Flooded mines in the military conflict zone in eastern Ukraine (names of the enterprises, legal and physical addresses, approximate volume of mine water which flooded the mine (m³), the results of the previous radiation research of mine water, the amount of rock (metric tons).
 - Mines in the military conflict zone in eastern Ukraine (names of the enterprises, legal and physical addresses, operating/non-operating/damaged due to military operations in the military conflict zone, the volume of mine water on the surface, pumping capacity (m³/hour), the results of the radiation research of mine water, the amount of rock (metric tons), the results of radiation research of the rock).
 - Products and oil pipelines on the territory of the military conflict zone in eastern Ukraine (the diagram of products and oil pipelines, its length in the zone (m), evidence of damage).
 - The objects of nature reserves on the territory of the military conflict zone in eastern Ukraine (names, legal address, evidence of damage, damaged area (ha)).
 - Forestry farms on the territory of the military conflict zone in eastern Ukraine (names, legal address, evidence of damage, damaged area (ha)).

- The damaged objects of infrastructure in the military conflict zone in eastern Ukraine, which directly affect the environment (names, legal and physical addresses, evidence of damage, potential environmental hazards).
- 3. The Department of the Ministry of Environment of Ukraine shall regularly (on a daily basis) collect information about the state of the environment in the military conflict zone in eastern Ukraine and release it (on a weekly basis).
- 4. To create a task force for developing information and analysis system based on GIS to monitor the state of the environment in the military conflict zone in eastern Ukraine.
- 5. To develop information and analysis system based on GIS to monitor the state of the environment in the military conflict zone in eastern Ukraine and to input the information stated in paragraph 2 to this system.
- 6. To create a webpage on the website of the Ministry of Environment of Ukraine on the coverage of the state of the environment in the military conflict zone in eastern Ukraine with the application of information and analysis system.
- 7. To ensure the coverage of information about the state of the environment in the military conflict zone in eastern Ukraine on the website of the Ministry of Environment of Ukraine.

II. SECTION: LEGISLATIVE INITIATIVE

1. The Ministry of Environment of Ukraine shall induce the Cabinet of Ministers of Ukraine to introduce amendments to Article 8 of the Resolution of the Cabinet of Ministers of Ukraine of 30.03.1998 regarding inclusion the State Environmental Inspection of Ukraine into the list of parties responsible for environmental monitoring.
2. For the afore-mentioned reasons the Ministry of Environment of Ukraine shall amend «The Regulations on Information Exchange between the Bodies of the Ministry of Environment of Ukraine and Other Parties that Monitor the Environment in Carrying out Monitoring Observations of the State of the Environment (statutory document 211.0.1.10–02)».
3. To draft the Resolution of the Cabinet of Ministers of Ukraine on collaboration among the parties that monitor the state of the environment in the military conflict zone in eastern Ukraine and submit it to the Cabinet of Ministers of Ukraine.

III. SECTION. MONITORING THE STATE OF THE ENVIRONMENT IN THE MILITARY CONFLICT ZONE IN EASTERN UKRAINE

1. To ensure cooperation among the parties monitoring the state of the environment in the military conflict zone in eastern Ukraine.
2. To create the task force from the representatives of the monitoring parties according to the Resolution of the Cabinet of Ministers of Ukraine № 391 of 30.30.1998 to arrange and conduct the monitoring in the hostilities zone in eastern Ukraine.
3. The task force responsible for monitoring the environment in the military conflict zone in eastern Ukraine shall:
 - analyze the information about the state of the environment, collected by the Information and Analysis Department of the Ministry of Environment of Ukraine.
 - collect and analyze the afore-mentioned information from the monitoring parties about the state of the environment and damaged infrastructure in the military conflict zone in eastern Ukraine.
 - set the priorities for monitoring the state of the environment in the military conflict zone in eastern Ukraine.
 - assign each party the areas of responsibility for monitoring the state of the environment in the military conflict zone in eastern Ukraine.
 - develop the procedure for monitoring the state of the environment in the military conflict zone in eastern Ukraine by the parties.
4. The Ministry of Environment of Ukraine shall coordinate the work of the task force and the monitoring of the state of the environment in the military conflict zone in eastern Ukraine by the parties.
5. The Ministry of Environment of Ukraine shall set up the schedule for the visits to the east of the parties monitoring the state of the environment to conduct chemical and radiation researches.
6. The Ministry of Environment of Ukraine shall ensure the collection of monitoring results from the parties; the monitoring results shall be introduced into the information and analysis system and made public on the website.
7. The Ministry of Environment of Ukraine shall ensure the coordination of the state and departmental monitoring on the liberated territories.
8. The Ministry of Environment of Ukraine shall appeal to OSCE for cooperation in arranging visits to the east for monitoring of the state of the environment.

IV. SECTION: ENVIRONMENTAL AND PUBLIC EDUCATION

1. To cover the information about the state of the environment in the military conflict zone in eastern Ukraine on the websites of the Ministry of Environment of Ukraine and the monitoring parties.
2. The Ministry of Environment of Ukraine together with the monitoring parties shall publish information leaflets on:
 - the highly hazardous environmental zones in the military conflict area in eastern Ukraine supplemented with cartographical data.
 - flooded mines, chemicals ignition, dangerous waste, damage of sewage treatment facilities in the military conflict zone in eastern Ukraine, which are hazardous to the environment and health.
 - the state of the environment according to the data of Information and Analysis Department and the monitoring results.
3. Together with the Ministry of Health Care of Ukraine and the State Emergency Service of Ukraine to develop regulations on life safety under conditions of chemical poisoning and water pollution for the population in the military conflict zone in eastern Ukraine.
4. The Ministry of Environment of Ukraine with the assistance of the Ministry of Defence of Ukraine, OSCE representatives and volunteers shall forward information materials to the military conflict zone in eastern Ukraine.
5. Together with the Ministry of Health Care of Ukraine and the State Emergency Service of Ukraine to ensure measurement of background radiation in the military conflict zone in eastern Ukraine and on the liberated territories and to make the information public on the website.

ВОЄННІ ДІЇ НА СХОДІ УКРАЇНИ — ЦИВІЛІЗАЦІЙНІ ВИКЛИКИ ЛЮДСТВУ

Посібник

За загальною редакцією *Олени Кравченко*

Технічний редактор — *Василина Модна*

Дизайн — *Олена Жінчина*

Підписано до друку 16.06.2015 р. Формат 66*96/16.
Гарнітура Minion Pro. Папір офсетний. Офсетний друк.
Ум. друк. арк. 9,1. Обл.-вид. арк. 8,1
Наклад 100 прим. Зам. №1817

Друк «Компанія “Манускрипт”»
вул. Руська, 16/3, м. Львів, 79008
тел./факс: (032) 235-52-20, тел./факс: (032) 235-51-40.

Свідоцтво про внесення суб'єкта видавничої справи
до державного реєстру видавців, виготівників і розповсюджувачів
видавничої продукції серія ДК № 3628 від 19. 11. 2009 р.

