

ACQUIRING PRACTICE IN ENVIRONMENTAL AND SOCIAL IMPACT
ASSESSMENT: CASE STUDY OF LVIV CITY DUMPSITE, UKRAINE

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Abstract. Municipal Solid Waste Management (MSWM) is a new and fast-growing business area that is becoming widespread in Ukraine. The fire accident at Lviv city landfill “Hrybovychi” forced the local governments to initiate work on its closure and reclamation. The Environmental Impact Assessment (EIA) of the planned activity is the first mandatory step in this direction. The complex nature of EIA procedures requires a similarly integrated approach to identify hazards and develop a shared vision of existing risks. This is demonstrated by the analysis of two published EIA reports on remediation of “Hrybovychi” dump and the dangers that were not identified.

Threats of additional groundwater pollution, causes of fire and consequences of negative impact on adjacent areas, the possibility of re-ignition of the landfill, the spreading of micro-particles (PM_{2,5}), and formation of toxic compounds classified as persistent organic pollutants (POPs) together with their long-distance migration – these and other dangers were not identified and were not discussed with public organizations. The article aims at showing a scientific approach to identifying environmental hazards in combination with the social component – assessments of problematic activities for public health, which are often ignored in post-Soviet countries.

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Current and best practices of the Baltic Sea countries in this field are presented by an international team of university scientists. Analysis of critical observations and making recommendations for preventing, minimizing, and mitigating the adverse effects of an accident can help to improve the peer review and development of similar EIA projects.

Keywords: Municipal Solid Waste (MSW), landfill gases, pollutant emissions, environmental impact assessment (EIA), persistent organic pollutants (POPs), leachate, heavy metals.

1. Introduction

Municipal Solid Waste Management (MSWM) is a key environmental concern across Europe. The situation in Ukraine has already proven to be critical in many cities and regions due to a lack of proper waste management infrastructure, adequate policy, business approaches, qualified public awareness and response. Under the EU–Ukraine Association Agreement, Ukraine is implementing the EU Directives on Waste (EU Directive 2011/92 / EU) in domestic law that improve the waste management system and help in the transition to a circular economy (Asters, 2018). The Ukrainian Government has approved the National Waste Management Strategy (Zakon, 2017). Law of Ukraine “On Environmental Impact Assessment” (Law of Ukraine, 2017) got in force, aiming to identify environmental risks before the instalment or reconstruction of landfills that could pollute the environment (Redcliffe Partners, 2017).

The World Bank (WB) and other well-known donor organizations have published several reviews on MSWM in Ukraine to attract external financing (WB 2016, Information 2018, Redcliffe Partners 2017, EBRD 2017, Invest Ukraine, Deloitte 2012). These publications reflect the growing interest of foreign investors in the Ukrainian waste management sector and, consequently, the importance of Environmental and Social Impact Assessment (ESIA) procedures for doing business in Ukraine.

The European Bank for Reconstruction and Development (EBRD) within the framework of its investment program “Green Cities” (EBRD, 2019) provided financial support for the modernization of solid waste infrastructure in the cities of Lviv, Kyiv, Mariupol and Khmelnytsky. The € 1.1 billion program helps the participating cities to develop and implement a Green City Action Plan, the ultimate goal of which is the introduction of low-carbon technologies and climate change mitigation. (EBRD, 2018, 2019; Usov, 2018). The Lviv unsanitary dump “Hrybovychi” is one of the hundreds of the most environmentally hazardous sites in Ukraine (Trofimov, 2014; Khromyak, 2016). The dump

is the third-largest in Europe, covering an area of 38.8 hectares; the actual waste area occupies 26.5 hectares with an average hip of 60–70 m, where 12–15 million tons of wastes are concentrated. Geographically, the dump is located at a distance of 80 km from the border with the EU and receives 658 thousand tons of solid waste annually (Ministry of Regional Development, 2020). The rehabilitation of the Lviv landfill is the first of four projects implemented under the EBRD program and the first project in Ukraine implemented in the context of the National Solid Waste Management Strategy.

A comprehensive landfill reclamation business model combines strategic planning with investment as well as related international technical assistance. (DLF, 2017, Lviv Solid Waste, 2020) Ukraine has gained experience that is worthy of generalization and comprehensive discussion, given the further positive dynamics of international investment projects. The authors consider it expedient to discuss the mechanism of EIA implementation on the example of reclamation of the Lviv landfill in view to improve the organizational management of such projects and the possibility of their successful replication.

ESIA is a new tool in Ukrainian practice, which involves studying the technical and environmental context of the project to combine the views and priorities of stakeholders. It provides for the planning of mitigation measures and a monitoring plan to overcome the negative environmental and social consequences and to formulate institutional responsibilities for the implementation of these measures. The global practice of MSWM gives priority to the social sphere of activity, taking into account the political and business interests of stakeholders. In contrast, EIA in Ukraine focuses mainly on technical issues, and social content is often underestimated. These considerations were taken into account by the scientific community from Ukraine together with colleagues from the Baltic Sea Region (BSR).

The problem at this stage for Ukraine is the imperfection of the implementation of this tool and the lack of awareness of stakeholders with the existing practice of EU countries in the provision of environmental services and social protection. This approach is reflected even in the abbreviation (EIA), where the component of social protection is absent. Public access to information on the impact of landfills on the environment is insufficient, so activists do not have strong arguments against the position of stakeholders (opponents) from business and local authorities. One of the concerns is that stakeholders still do not recognize the fundamental difference between a dump and a landfill – an

engineering structure where waste is separated from the underlying soil by a protective bed. According to the Lviv Oblast Prosecutor's Office (Vasylenko, 2012), no landfill in the region can be considered a "sanitary landfill" since they do not employ any measures to protect nature or human beings.

This paper aimed at discussing critical observations that are important to the scientific community and providing recommendations to prevent, minimize, mitigate or offset adverse impacts on nature and the social environment, as well as improving the environmental performance of such projects.

2. Materials and Methods

The study was conducted as part of a group discussion on ways to improve the implementation of the EIA mechanism in Ukraine, initiated by the National Ecological Center of Ukraine (NECU) with the participation of international experts from the BSR, Ukraine, Georgia and Armenia the participants of international LASUWAMA (Strengthening BSR Universities Network on Landscape Sustainability and Waste Management) project supported by Swedish Institute (SI, Dnr. 23722/2018). The project had a focus on MSWM and the restoration of anthropogenically changed landscapes. This format of the discussion was implemented during the Winter Session of the Carpathian School (KSH-2020), an educational project for masters, graduate students, community activists and local governments in Kosiv, Ivano-Frankivsk region.

Key points on the assessment of the dangers of in-depth land reclamation (ILR) and ways to rehabilitate the Lviv landfill were also the topic of discussion at the online session of the International Carpathian School (ICS-2021). Technological aspects of EIA were taken from the materials of two published EIA reports for the Lviv landfill (Pugach, 2018; Kovalev, 2018) and the EBRD regulations on technical documentation and access to information policy (EBRD Access to Information Policy, April 2019).

The analysis of the above-mentioned EIA reports is based mainly on materials (Pugach, 2018). In our opinion, it was performed more thoroughly (370 pages). The alternative report of 72 pages (Kovalev, 2018) reveals the essence of the planned activity, but does not take into account the ultimate goal set by the investor: "introduction of low-carbon technologies and climate change mitigation". The main emphasis in the "landfill" reclamation is defined as "the construction of a safety dam with an exit and a safety shaft; access road construction; and arrangement of the filtrate drainage

system to eliminate its impact on the environment" (ibid, p. 70). The report also ignores the issues of landfill gas management that caused the fire accident in 2016.

The current state of MSWM in Ukraine is considered in the views of foreign donors, such as the World Bank, EBRD and GIZ. Sources of scientific information were professional articles published in international journals and experience gained through multilateral research projects implemented in Ukraine with the support of the governments of Switzerland, Canada, Sweden and the EU.

3. Results and Discussion

Lviv dumpsite "Hrybovychi" is one of the hundreds of the most environmentally dangerous objects in Ukraine (Trofimov, 2014; Khromyak, 2016). The placement of the dumpsite during the Soviet era did not take into account geological, hydrogeological conditions and geographical location. There was not any preparation of the territory, in particular, waterproofing of the waste storage site. According to the design standards, the period of operation of the landfill was expected until 1984. However, further operation of the site was extended until 2016. Both municipal and toxic industrial wastes were disposed at the landfill until 1990. The estimated amount of such waste is about 2 million tons (Puhach, 2018). The lack of geomembrane and mechanism of leachate treatment leads to a major exceed of the maximum permitted level of harmful substances (Pavlyuk, 2010).

Pollutants are migrating with the leachate into the Malekhivka and the Poltava rivers that belong to the catchment area of the Western Bug transboundary river which flows through the territory of Ukraine, Belarus and Poland, approaches the Vistula Basin and enters the Baltic Sea (Fig. 1).

The Lviv City Council, together with representatives of the EBRD, announced the start of an information campaign on dump reconstruction in early December 2019. Unfortunately, technical approaches and potential risks of planning activities have limited access for the scientific community.

The Government of Ukraine has started developing a National Framework Strategy for Adaptation to Climate Change. But this work has only recently begun, and at this stage, the climate change mitigation is not reflected in the EIA Law, which is, in our view, a weakness of the law. Undoubtedly, climate change mitigation and adaptation measures should be part of the EAI, as required by EBRD regulations (EBRD, 2020).

The EIA requires a description of the status of the dumpsite and planning rehabilitation technologies including geology and geomorphology of the lay; detection of structural defects such as damaged landfill gas collection systems and fire safety; lack of landfill bottom liners,

the problem with leachate ponds, and the planning activities to be solved. A review of scientific literature and technical documentation has identified several risks needed to be considered within EIA. They are grouped below.



Fig. 1. The Western Bug River Basin (<http://esnuir.eenu.edu.ua/handle/123456789/12934>)



Fig. 2. Avalanche cone of the landfill body displacement (about 100,000 m³), 2016 (Puhach, 2018)

Engineering concerns

There are several shortcomings in decisions to stabilize the body of the landfill and landslide (Pugach, 2018).

Leachate

The landfill has not been equipped with an impermeable bottom since its establishment in 1957. A fire at a landfill in 2016 worsened its status due to an unpredictable landslide in a nearby ravine (Fig.2). This fact poses a significant risk of pollution of the geological environment, in particular aquifers. The danger is associated with an increase in the catchment area (26.5 ha) and the volume of filtrate, which is formed due to precipitation from the additional area and the further spread of the filtrate. The average rainfall in Lviv is 760 mm (Fig. 3).

A recent study has proven that landfill leachate is a significant source of pollutants as a consequence of the leaching of hazardous substances (Vaverková, 2019). An uncontrolled release of leachate can occur through the shifted part of the dumpsite that filled the ravine.

According to the engineering-geological survey (LLC Girhimprom Institute, 2013), the loamy layer under the main area of the landfill is thin enough. Groundwater pollution processes, as well as the effects of this pollution on surface water, are underestimated in the EIA project. The set of described geological factors defers problems with groundwater pollution. However, such contamination is inevitable, and the planned remediation measures for the landfill may only mitigate but not eliminate it. The processes of groundwater

pollution and the effects of pollution on surface water remain underestimated, threatening the deepening of the environmental crisis around it.

The multifunctional final cover layer of the dumpsite body with a protective geomembrane screen preventing the infiltration of rains. However, these measures in no way minimize the impact of the already formed leachate and pollution of the geological environment, in particular, its further migration in groundwater and impact on surface water. Therefore, the claim that there is no impact of the dumpsite on the geological environment is not objective (Puhach, 2016). To assess the impact of the leachate on Quaternary sediments and the Upper Cretaceous aquifer, a specialized survey and testing are required. The leakage of leachate or contaminants to the fractured marl zone may have extremely large-scale consequences, the localization of which will require special ecological and hydrogeological measures.

The level of occurrence of the Upper Cretaceous aquifer is recorded at a depth of 42 m at the top of the dumpsite, and the nature of its piezometric surface indicates radial flow from the dumpsite. Therefore, the flow of pollution to the aquifer will lead to its radial distribution in a dissolved form, including in the direction of settlements of Velyki Hrybovychi, Dublyany and Malekhiv. Their inhabitants are still using water from wells for garden irrigation. Given these risks, it is recommended to develop and implement a system of hydrogeological monitoring of the impact zone for preventing long-term negative effects of a dumpsite and preventing further emergencies.

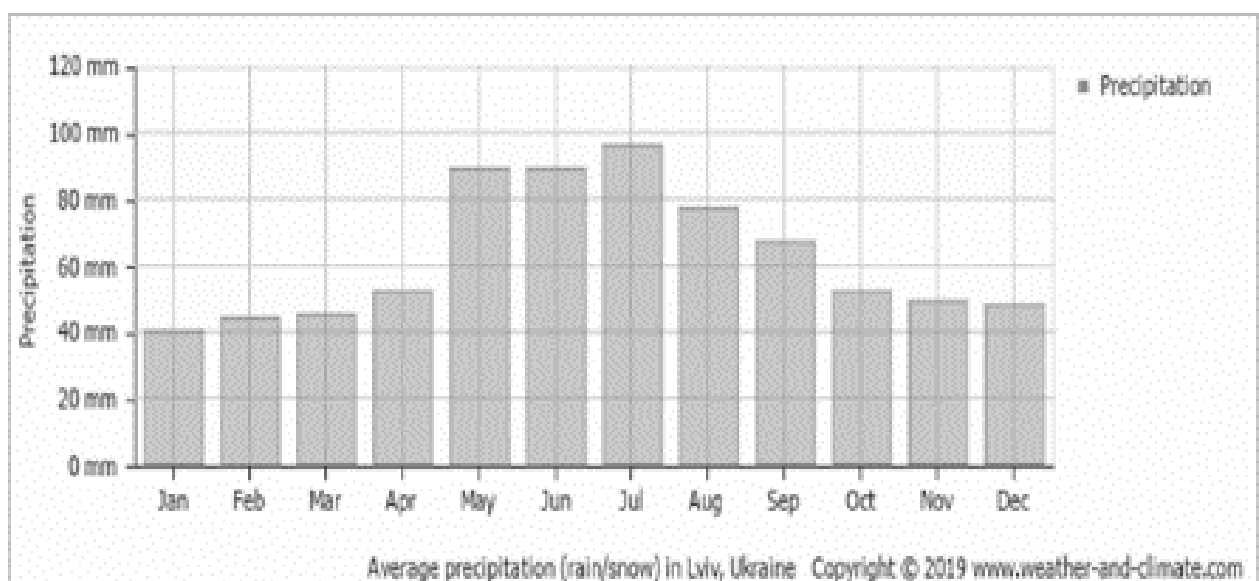


Fig. 3. Average precipitation in Lviv

(<https://weather-and-climate.com/average-monthly-precipitation-Rainfall, Lviv, Ukraine>)

Fires and hazard emission

The gas utilization system, which consisted of 160 wells, was destroyed during the 2016 fire. Currently, gas wells and gas collectors are mainly covered with a five-meter layer of waste (Pugach, 2018). The lack of a gas collection system at the landfill significantly increases the risk of spontaneous combustion. The unauthorized burning of landfill gases is mentioned in the Report. To control this danger, the authors plan to purchase firefighting equipment, conduct detailed training of workers, restrict access to the work area and provide workers with appropriate protective equipment (including detectors of harmful gas concentrations, etc. (Pugach, p. 49). The authors should have considered the potential possibility of spontaneous fires during the active phase of reclamation and anticipate the possible consequences.

Waste fires are increasingly claiming the danger of losing the balance of natural geoecosystems due to the lack of effective defoamers. The rapid growth of flammable organic waste in solid waste in combination with the tendency to increase the average daily temperatures forms a high level of fire danger of the landfill and a high probability of formation and spread of toxic compounds over long distances in Ukraine and abroad.

Deep landfill fires do not “burn” in the accepted sense. These fires are a form of combustion known as pyrolysis, where the thermal reaction takes place in an environment with limited oxygen content. The process of oxidation of organic residues (combustible material) is very slow and takes place at low temperatures. As the waste heats up, it begins to sublimate. Residual fuel in the form of coked carbon can remain hot in the absence of oxygen for many years (Foss-Smith, 2010), which is dangerous.

In the case of the Hrybovychi landfill, up to 65 meters high, the fire could move vertically upwards, forming dangerous gaps on the surface. A better understanding of internal “underground” fires can help to form practical recommendations for the efficient management of solid waste and reduce environmental and social risks in the process of reclamation of the facility.

Smouldering is a slow, low-temperature, form of flame-free combustion of organic materials, supported by the heat generated when oxygen directly attacks the surface of the condensed phase (Rein, 2009). The fundamental difference between smouldering and flame is that in the first stage, the oxidation and heat recovery reaction takes place first on the solid surface of the fuel or porous matrix, and in the second stage on the gas

phase surrounding the fuel (Rein, 2009). The problem of smouldering is related to the transboundary transport of air contaminated with fine dust, solid particles with a diameter of fewer than 10 μm (PM_{10}), which can be a significant health hazard in adjacent regions. Air pollution can travel long distances to regions with air currents. Studies have shown that particles smaller than 2.5 μm ($\text{PM}_{2.5}$) can migrate on an intercontinental scale (Shuchang Liu, 2020).

An analysis of world fire statistics (CTIF Report, 2019) shows that landfill fires in Ukraine are quite common. In 2017, landfills accounted for 10.4 % of fires, a total of 104 cases, which creates a corresponding number of emergencies of a complex nature. It is believed that fires have a high environmental risk (Sarapina, 2017), and cause serious human losses and significant negative consequences for the environment as sources of POPs (Weichenthal, 2015, 2019, Vaverkova, 2019). Such compounds are subject to the Stockholm Convention on Persistent Organic Pollutants, POPs (Stockholm Convention, 2004), to which Ukraine is a party.

The nature of landfill spontaneous combustion is often not obvious and needs to be understood. Some landfill gases (arsine, phosphine) are characterized by spontaneous combustion. The formation of phosphine (PH_3), which can cause a landfill fire, was studied by Roels, 2004 and George, 2004. Hazard factors depend on the type of combustible waste, the geographical location of the landfill and the type of fire (Raúl, 2018). In general, landfill fires occur at low temperatures and in an anaerobic environment. Hydrocarbons, chlorinated materials and pesticides form various toxic gases, such as dioxins and furans (Escobar-Arnanz, 2018), multinuclear aromatic hydrocarbons, aerosols (Purser, 2016), (Rovira, 2018) and other harmful compounds (Nadal, 2016). Smoke generated during a landfill fire contains hazardous toxic gases such as CO , H_2S , CH_4 , CS_2 , etc., as well as carcinogenic compounds. The formation of unpleasant odors and smoke irritates the inhabitants of the surrounding settlements and can even endanger human health, especially among vulnerable groups such as the elderly, children, pregnant women and/or people with pre-existing chronic respiratory diseases (Vaverková, 2019).

Aderemi and co-authors (Aderemi, 2012) have broadened our understanding of landfill fires and described their potential impact on public health using the study of the unsanitary landfill in Lagos, Nigeria. Sarapina (2016) investigated the problem of solid waste incineration and proposed an assessment of the most dangerous components of flue gases depending on the amount of incinerated

waste. Many practical recommendations are offered to minimize such risks. Depending on the type of landfill and the type of fire, landfill fires can create unique challenges for landfill maintenance/waste management and fire service.

There is a need to study the factors that can lead to the spontaneous combustion of solid waste if they persist for a long time. A better understanding of these factors can help establish practical guidelines for the efficient management of solid waste and reduce the environmental and social costs of spontaneous combustion of fires. Its importance can be seen from the fact that millions of euros are lost every year in Sweden due to wildfires.

Covering

Laying and terracing the body of the landfill, as well as drilling 96 holes for the system of greenhouse gases provided by the project activities, create a risk of failures of equipment and operators in vertical cavities, which could be formed due to a large-scale fire in 2016.

A top cover of the landfill is a necessary condition for its reclamation. Final capping regulates mass transfer between the atmosphere and waste disposal by controlling water input and avoiding/minimizing the dispersion of gas emissions (Cossu, et al. 2018). As a minimum, it should contain a sealing layer (cap), a surface water drainage system and cover soils (Staub, et al. 2011). There was no information on where the provider suggests getting material for covering the dumpsite with the area of 384 00 m², and thickness of 0.3 m of mineral soil, 3.0 m of fertile soil, 0.3 m of rubble and 0.25 m of sand (Puhach, 2018). Our draft calculation shows the need for construction materials is around 369.183 m³. This will require about 12 300 trucks (MAN Scania, 30 m³) for transportation that may cause a substantial risk to the ecosystem due to digging and moving such amount of soil, local traffic and road safety.

A similar problem with lacking locally available cover material was encountered when closing the landfill on Saaremaa Island, Estonia. Due to geographic location, clay or any other material with low permeability was not available locally and to transport it from the mainland was extremely expensive (Pehme, et al, 2014). In the current situation, the best solution was to extract cover material from the same landfill using technology known as Landfill Mining (LFM). Instead of covering the landfill with an impermeable cover layer, a concept of semi-permeable methane degradation layer was used (Pehme, et al, 2018). Investigation showed that the excavated fine fraction (< 40 mm) has appropriate

properties including hydro-physical properties and organic content, for the methane degradation layer.



Fig. 4. Grybovychi landfill. Illegal soil mining (<https://zaxid.net/news/>)

Biocover was constructed by a 1.2 m excavated fine fraction and a 0.5 m mineral gas distribution layer between waste and biocover. Such construction enables to effective distribution of the gas evenly into the top layer, where methane is degraded (Pehme, 2018). On top of biocover, species of trees that are tolerant to gases, unusual pH and unfavourable moisture conditions were planted. The final result of the landfill remediation was a recreation area with ski trails and picnic areas. Further monitoring proved the sustainability of using excavated fine fractions as the main material for biocover (Pehme, 2018). Ongoing research about the efficiency of methane degradation layers that are made of the fine fraction of waste is monitored on the operating landfill (Sholokhova, 2019). However, this type of biocover is effective only for landfills with low-level CH₄ emissions therefore, in the case of the Lviv landfill additional measures such as biogas collection systems should be in place.

Organizational and Economic issues

Land ownership is one of the main constraints in Ukraine. By law, the right to make decisions rests with the landowner, the Malekhiv Village Council. A community of 2.300 people will be eligible to decide the fate of an entity that receives waste from 800.000 people.

The EIA will be mandatory for a broad range of business activities and facilities which are grouped by the Law into the categories that include household or other waste with the volume of 100 tons per day or more (Redcliffe Partners, 2017). A failure to comply with the legislation on EIAs can result in the temporary suspension or termination of business activities. Such suspension or termination can be made based on a court

decision upon the submission of a competent state body, or any other party, whose rights or interests are violated. These risks have not been discussed yet.

MSWM is a challenge for the cities' authorities in developing countries mainly due to the increasing generation of waste and the burden posed on the municipal budget because of the high costs associated with its management (Guerrero, 2013). The authors pointed out the complexity and the lack of understanding of the diversity of factors that affect the different stages of waste management and establishing links necessary to ensure the functioning of the entire waste management system.

Financing

To ensure the implementation of the project in accordance with the requirements of the financial institution, there is a practice to develop and submit an Environmental and Social Action Plan (ESAP), which contains details of the terms of the agreement between financial institutions and the client to the stakeholder group. The ESAP should set out in detail the terms of the agreement between the financial institutions and the client to ensure that the project is implemented under the financial institution's requirements.

The financial and economic analysis of the planned activities was not made public. This did not allow identifying the most effective technical solutions to recognize investment needs and demonstrate the financial viability of the project. The procurement strategy within the planned activities has not been made public and is not transparent. At the same time, the project activity envisages financing of the planned activities for two years, and the formation and approval of the budget of Ukraine take place annually. The dangers of project implementation due to insufficient funding in the face of inflation and budget deficits were not discussed.

Social aspects

A new concept of Enhanced Landfill Mining (ELFM) is used, which targets the integrated valorisation of materials and energy from past, present and future landfills while meeting the most stringent ecological and social criteria (Hogland, 2010, Burlakovs, 2016). ELFM is considered as a prospect to the circular economy and payback source to waste management operations. However, the LFM technology is currently subject to criticism by both environmentalists and landfill operators and service suppliers (Vaverková, 2019).

Landfill remediation and life cycle assessment involve monitoring its technical condition and the dynamics of the spread of pollution in the surrounding area. This should be a major issue for local communities, which unfortunately do not have the relevant knowledge and relevant information. Unlike the EIA standards according to the policies of international financial institutions, the national regulatory framework does not require the EIA procedure to study the socio-economic conditions of local communities near the project. It also does not obligate to identify social risks and impacts, develop a social risk and impact management system, a grievance mechanism and comments on the project. Accordingly, at the national level, there is no practice of including social criteria in the project cycle.

The ESIA standards consider the impact on the local, regional or national economy, landowners, and land users. They provide justification of the impact of possible labour inflows and their interaction with the local population, the attitude of stakeholders and vulnerable groups to the project. Last, not least, they identify labour relations and working conditions, health and safety of workers and the population, respect for human rights, gender equality, issues of cultural heritage preservation, etc. These issues are monitored following certain requirements for project implementation, which disclose in detail the criteria to be met by the project and, in particular, reflected in the EIA Report.

Access to information

The Aarhus Convention (1994) offers the right of everyone to receive environmental information that is held by public authorities. It includes information on the state of the environment, on policies of the local authorities, the taken measures, and also on the state of the environment if it can affect human health and safety. To a large extent, this state of affairs is conditioned by underdeveloped instruments for implementing international legislation to which Ukraine is a party. The social and environmental aspects of waste management are part of the concept of sustainable development, which is currently at the stage of the distribution of powers between central and local governments (Bondarenko et al., 2019).

From the BSR countries experience, the effective tools for managing community-owned territories depend to a large extent on the degree of willingness to adopt and support new technologies by society. The impact of territorial communities on responsible decision-making processes in Ukraine is often ignored by authorities or business entities. Unfortunately, the facts of non-

compliance with the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention) are not unique in Ukraine.

The UNECE Protocol to the Aarhus Convention on Pollutant Release and Transfer Registers (PRTR) is a publicly accessible database or inventory on chemicals or pollutants released to air, water and soil, and transferred off-site for treatment. It brings together information about the chemicals that are being released, where, how much, and by whom. It is remarkable that the PRTR was originally signed in Kyiv in 2003, but adopted only in 2016. The term of 13 years from signing to getting it in force gives an understanding of the pace of social transformations in Ukraine.

The Stockholm Convention (2004) was the next international document adopted officially by Ukraine in 2007. This document recognized the importance of the private sector and non-governmental organizations to contribute their efforts to reduce emissions and discharges of POPs. It contains two special articles on information exchange (Article 9) and public information, awareness and education (Article 10) that requested governments to provide all available information on POPs to the public, taking into account paragraph 5 of Article 9.

The EIA procedure provides for informing the public at the stages of publishing the notice of planned activities and the EIA Report, as well as the opportunity to provide suggestions and comments on the planned activities at these stages. However, there is no legal framework for systemic public involvement, as provided for by international bank policies, in particular through the development and implementation of stakeholder engagement plans stated at EBRD Performance Requirement 10 (PR 10 EBRD).

The Stakeholder Engagement Plan (SEP) is a document that identifies the stakeholders of the project and determines how their involvement will be achieved. A mandatory component of the plan is a mechanism for receiving appeals and complaints from all stakeholders at all stages of project implementation to take into account and implement decisions to prevent, minimize impacts or compensate them. Stakeholders are individuals or groups who are interested in implementing a project during any phase of the life cycle. Stakeholder engagement covers contact information, communication and dialogue between Project developers and stakeholders through consultation and disclosure.

Disclosure involves the creation of a non-technical summary, the purpose of which is to provide information to anyone who may be interested in the project. As the name implies, the document should be

written in a non-technical language to ensure that the results of the EIA can be understood by the majority of the population.

In the case of the EIA procedure for the Hrybovychi landfill, the public and industry experts were unable to provide suggestions and comments due to the lack of public access to the original draft report on landfill reclamation developed by the French company Egis in 2017. Instead, two above mentioned EIA reports from different developers with different names and contents were published in the Unified Register of EIA without any explanation to the public. The authorized central body (Ministry of Environment) issued two permits for the implementation of activities for each of the reports - Conclusions from the EIA – and this was done in one day (January 14, 2019). Thus, systematic public information was not provided, which significantly limited its participation in the decision-making process for one of the most resonant environmental issues in the country.

Public and employee health care

Many studies that address the potential toxicity of solid waste site emissions look at the biological effects of landfill leachate on selected species of animals and plants in the laboratory. New ecological test methods have demonstrated that a mixture of hazardous chemicals getting into the soil from landfills can cause genetic changes that are associated with adverse effects on the reproductive system (Roelofs et al., 2012) Besides, an epidemiologic study of the human birth rate near landfills in Wales found an increase in the rate of birth defects after the opening or expansion of sites (Palmer et al., 2005). A study of dioxin contamination after an accidental fire at a municipal landfill in Greece found unacceptably high levels of dioxins in food products, primarily meat, milk and olives from an area near the landfill (Vassiliadou, 2009). Some food samples exceeded the limits specified by the EU, while all food samples had contamination higher than the usual levels of contamination inherent in Greek food.

The Stockholm Convention on POPs aims to protect human health and the environment by taking the necessary measures to minimize or prevent releases. Unfortunately, it is poorly implemented in Ukraine (Mykhaylenko, 2016). Studies of Lviv, Khmelnytsky and Ternopil landfills have shown that in the area of their influence there is an increased radiation background, soils are contaminated with heavy metals, the air is saturated with aerosols from the processes of debris destruction (Popovych, 2012, 2014). The uncontrolled discharge of waste is a serious threat to the environment due to the migration of landfill gases and filtrate from

their storage sites. Landfill sites present a high level of risk to public health, both because of chemical contamination of the territory and the transmission of infectious agents by rodents, insects and stray animals.

Landfills emit toxic gases such as formaldehyde, hydrogen cyanide, hydrogen sulphide, nitrogen oxides and many others (OEPA, 2006). Smoke might not be visible since compacted waste acts as a good particulate filter, but fugitive gases can percolate towards the surface. A special problem with smoke, which is mainly unburned carbon, is the particles of activated carbon, which are an adsorbent with an extraordinary ability to absorb the “most dangerous” pollutants. Very small particles, (PM_{2.5}) are capable of remaining in the air for days, and together with adsorbed contaminants pass directly into the bloodstream once inhaled.

Data analysis of morbidity in Zhovkva district, Lviv region, found no indicators that could be associated with the negative impact of MSW dumpsite “Hrybovychi” on public health for the years 2014–2016 (Puhach, 2018). This applies, in particular, to infectious and parasitic diseases transmitted through water. The nearby villages use water directly from the Lviv water supply system at preferential tariffs, which eliminates the situation with the above-mentioned diseases. The data on prevalence and morbidity among the population in the Zhovkva district of the Lviv region during 2014–2016 indicate that the overall incidence rate in the district is not too high if compare with indicators in the Lviv region. As for the fixation of tumour cases, experts believe that such negative statistics should appear in about 10 years. However, diseases of the blood, hematopoietic organs, circulatory system, respiratory system, disorders of the psyche and behaviour are already exceeding the regional average (Puhach, 2018). Table 1 provides statistics on respiratory morbidity in the population of the Zhovkva district with a population of 110 400 people (2016), which show increased values compared to similar indicators in the Lviv region.

Table 1

**Prevalence and morbidity rate
of the population in Zhovkva district, Lviv region
in 2014–2020 (Puhach, 2018).**

Area	Morbidity rate, the value per 1000 people		
	2014	2015	2016
	Respiratory diseases		
Zhovkva district	453.24	417.71	441.48
All over the Lviv region	398.61	395.02	409.24

No emissions of substances from the planned landfill remediation measures that could have a carcinogenic effect have been identified. However, the dangers of cancer and other negative consequences for public health due to the unintentional formation of POPs in the fire were not taken into account. However, studies in Sweden, Canada, the United States, Mexico and other countries have shown that eating food even with very low levels of POPs causes an imbalance in the immune system in adults, and children have serious problems with coordination and mental activity (Aleshina, 2014).

The issues of observance of norms and standards of professional safety obviously require special attention during the implementation of project activities, especially taking into account the risks of emergencies, preparedness and response to them.

For projects financed by banks, in addition to compliance with national legislation, it is also mandatory to comply with international standards and best international practices of professional safety during construction and in other industries (EBRD PR 2 Labor and working conditions, PR 4 Health, Safety and Security).

4. Conclusions

Adoption and implementation of the Law of Ukraine “On Environmental Impact Assessment” and relevant by-laws of the Cabinet of Ministers of Ukraine aimed at its implementation have to significantly improve the image of Ukraine in the transition to the European requirements and standards in environmental protection, outlined in EU Directive 2011/92 / EU.

Strengths of the EIA Law include consideration of technical issues, including early consideration of alternatives to planned activities, the possibility of comments and suggestions on the EIA project from the public and free access to environmental assessment materials. Such characteristics of the Law are provided by the EU legislature and have the prospect of adapting Ukrainian legislation to the EU norms. At the same time, the practice of using EIA in Ukraine still has a number of shortcomings that should be noted by legislators, practitioners and the scientific community.

The complex nature of EIA procedures requires a similarly integrated approach to identifying risks and developing a common vision of existing threats. This is demonstrated by the studies of risks that were not identified in the process of developing the EIA for the reclamation of the dumpsite “Hrybovychi”. Lack of substantiated risks of groundwater contamination, ways of origin and negative impact of fires on adjacent territories, possibility

of re-ignition of the dumpsite, spreading of micro-particles and toxic compounds over long distances and other dangers were not recognised and discussed with public organizations and other stakeholders.

The reasons for such omissions are the lack of the institute of experts, which has not yet been implemented in Ukraine, although provided for in Article 10 of the Law. Another issue is the lack of scientific and methodological support for environmental impact assessment of certain economic activities, the development of which is hampered by the current Law. Thus, the issue of verification of the reliability and completeness of the environmental impact assessment rests with the authorized state bodies (central or territorial), which do not have sufficient expert qualifications for such actions. The consequence of the current shortcomings of national legislation on environmental impact assessment is the lack of consideration of certain types of impact of planned activities or their insufficient assessment, which, in particular, is based on the analysis of reports on EIA reclamation of landfill “Hrybovychi”. Measures to mitigate the effects of climate change and adapt to climate change should be part of the EIA.

The global practice of assessing the impact of environmentally hazardous activities, in particular the reclamation of landfills, gives significant priority to social influences in decision-making, but they remain significantly underestimated while implementing projects in Ukraine.

The EBRD's environmental and social policy requirements require EBRD clients to conduct comprehensive activities and consultations, proportionate to the nature and scale of the funded project, taking into account the interests of stakeholders and its potential environmental or social development, risks and consequences. However, in the case described by the authors, the project sponsors (EBRD) do not always properly require local authorities to comply with standards for the development and disclosure of public documents such as the ESIA, the ESMP, the ESAP, and the SEP plans.

The quality of prepared EIA projects and the transparency of contractor selection are not always properly framed due to the lack of clearly defined evaluation criteria and the lack of a mechanism to involve scientific experts in the field in such evaluations. Access to wider public information and consultations conducted during the preparation of the EIA project under international standards were limited to the necessary EIA report, plans and makeshift citizen participation in the decision-making process.

Active access to available information and public involvement in discussion on MSWM is assured not only by Aarhus Convention but also by the Laws of Ukraine “On Environmental Impact Assessment”, “On Housing and Communal Services” and “On Waste”. Learning of public opinion and creating conditions for favourable public attitudes is necessary for the sustainable MSWM and establishing effective management decisions, implementing of which should reduce environmental and social impact, improve living conditions and quality of life.

In the context of decentralization reform, the involvement of local communities in the decision-making process in the field of MSWM, including the reclamation of landfills, of which there are thousands in Ukraine, is particularly relevant considering the impact of communities on financing such projects, including co-financing from local budgets. Extensive coverage of the problems and consequences of landfill remediation among local communities, involvement of experts, as well as adherence to high standards of environmental and social policy of leading banks, will increase the sustainability of such projects and improve national practices in the face of imperfect legislation.

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