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Environmental Impact Assessment and Legal Protection of Rights Affected by Transboundary Environmental Offences in Tailings and Mining Waste Management

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Abstract: The study aimed to analyse the legal mechanisms that ensure the protection of the rights and legitimate interests of citizens in the event of transboundary environmental offences related to the operation of tailings and waste dumps. The research included a study of the legislation of Kyrgyzstan, Kazakhstan, Uzbekistan, as well as Germany and France, to identify the strengths and weaknesses of their legal systems in environmental safety and protection of the rights of affected citizens. Despite the constitutional right to a clean environment, Kyrgyz citizens remain insufficiently protected in the transboundary context due to weak law enforcement and minimal integration of international norms.

Keywords: compulsory insurance; international cooperation; international obligations; natural resources; public participation; risk management

1. Introduction

The environmental risks associated with mining operations are particularly relevant in the context of transboundary impacts. Tailings ponds and mine dumps resulting from mining operations can become a source of major environmental disasters, the consequences of which extend beyond national borders. In the countries of Central Asia, this problem requires comprehensive legal regulation, including mechanisms not only at the national but also at the international level. Key aspects requiring attention are enforcement mechanisms, compulsory insurance of environmental risks, and coordination of efforts at the level of interstate cooperation to prevent transboundary environmental incidents.

An important component of effective regulation is the improvement of national legislation. A. Akhmatova and M. Joldoshbek kyzy¹⁾ analysed general issues of law enforcement in the field of environmental security in Kyrgyzstan. They stressed the need to improve the legislative norms governing environmental protection within the country and pointed out the importance of creating mechanisms to prevent environmental offences. At the same time, A. Akhmatova and M. Joldoshbek kyzy did not address transboundary aspects of environmental offences, which limits their relevance in the context of international interactions and transboundary risks. Corporate liability for environmental offences plays an important role in incident prevention²⁾. Issues of liability

of mining companies were raised by D. Bekezhanov et al.³⁾, who analysed in detail the existing legal liability mechanisms in Kyrgyzstan. The authors emphasised the need for stricter measures to hold companies liable for environmental damage. However, D. Bekezhanov et al. addressed the national level and did not address transboundary environmental offences, which limits their applicability to international regulation.

The integration of international standards into national legal systems is also an important aspect of enhancing environmental protection. N.R. Mallaev⁴⁾ analysed legislative initiatives in the field of environmental management and their compliance with international norms. The author emphasised the importance of adapting international standards to improve environmental security in Kyrgyzstan. However, a shortcoming of the study is the omission of analysing the practical aspects of the implementation of these international standards. Monitoring of facilities with high environmental risk, such as tailings ponds and mining dumps, is an important element in preventing environmental disasters. A.Kh. Khamit et al.⁵⁾ analysed the need for stricter control over the operation of such facilities. They emphasised the importance of regular monitoring to prevent possible accidents and disasters. At the same time, their study does not cover transboundary aspects of monitoring, which limits their relevance for the development of international legal mechanisms.

In addition, international cooperation is an important element in preventing transboundary environmental disasters. D.L. Baydeldynov and P. Tifine⁶⁾ emphasised the need to create transboundary agreements between Kyrgyzstan and neighbouring countries to regulate environmental risks. They emphasised the importance of such agreements to reduce the risks of transboundary incidents. However, their work lacks a detailed analysis of the legal mechanisms for the implementation of such agreements, which limits their practical significance. One of the effective measures to prevent environmental disasters can be compulsory insurance of environmental risks. The issues of insurance were raised by D.R. Ziganshina⁷⁾, who emphasised the need to introduce compulsory insurance for enterprises with a high level of risk. This would increase the level of protection of the population in case of environmental disasters. However, the study does not consider the difficulties associated with the introduction of such mechanisms in the absence of a clear legislative framework to control insurance and compliance with its mandatory norms.

Legal liability for environmental offences requires significant improvement, especially in the context of transboundary risks. A.Zh. Nurutdinova and S.D. Bekisheva⁸⁾ analysed the existing mechanisms of liability for environmental pollution in Kyrgyzstan, identifying gaps in law enforcement. They noted that the system is not strict enough to hold enterprises liable for environmental damage, which weakens its effectiveness. However, A.Zh. Nurutdinova and S.D. Bekisheva did not address the practical issues of how existing mechanisms could be strengthened through cooperation with international institutions and the use of best practices from other countries (e.g., France and Germany). International agreements play a key role in the issues of environmental protection and prevention of transboundary environmental disasters⁹⁾⁻¹¹⁾. This topic has addressed legislative support for environmental security, with a particular focus on the need to adapt international standards into national legal systems. K.A. Dehkanova¹²⁾ emphasised the significance of such changes for increasing the level of environmental protection in Kyrgyzstan. She emphasised the integration of international norms to strengthen national regulatory mechanisms. However, the study did not include detailed analyses of specific transboundary environmental risks, which limits their value in addressing transboundary incidents.

Thus, studies by various authors show that, despite the existence of significant developments in the field of legal regulation of environmental safety in Kyrgyzstan, important aspects related to transboundary environmental risks remain insufficiently studied. The study aimed to analyse the legal mechanisms for protecting citizens from transboundary environmental incidents in Kyrgyzstan to identify key gaps in the legislation. The main objectives of

the study included examining law enforcement mechanisms, compulsory environmental risk insurance, monitoring of high-risk sites and international cooperation to prevent transboundary environmental disasters.

The scientific novelty of the study lies in the comprehensive legal analysis of gaps in the legal regulation of transboundary environmental offenses in the Kyrgyz Republic in the context of comparison with the legal systems of the European Union, in particular Germany and France. For the first time, the study emphasizes the lack of effective law enforcement mechanisms, mandatory environmental risk insurance, and effective norms of international cooperation in the field of prevention of transboundary environmental incidents.

2. Materials and Methods

The legal acts of Kyrgyzstan, legislation of Central Asian countries such as Kazakhstan and Uzbekistan, as well as documents of the European Union (EU), Germany and France were studied in the course of the research. The legislative framework of the Kyrgyz Republic was scrutinised in the context of the regulation of mining waste management and transboundary environmental offences. The main laws considered in the study were Law of the Kyrgyz Republic No. 53 “On Environmental Protection”¹³⁾, which regulates general aspects of environmental safety, and Law of the Kyrgyz Republic No. 89 “On Production Wastes and Consumption”¹⁴⁾, which establishes waste management procedures. Water Code of the Kyrgyz Republic¹⁵⁾, which addresses the protection of water resources, was important to analyse concerning the threat of transboundary pollution. The Procedure for Production and Consumption Waste Management in the Kyrgyz Republic¹⁶⁾ provided specific requirements for the management of tailings and mine dumps. These acts have been compared with international standards to assess their compliance and effectiveness.

Legislation from Central Asian countries, including Kazakhstan and Uzbekistan, was also analysed. In Kazakhstan, legal documents such as the Environmental Code of the Republic of Kazakhstan¹⁷⁾, which regulates mining waste management, and the Code of the Republic of Kazakhstan No. 125-VI “On Subsoil and Subsoil Use”¹⁸⁾, which establishes legal norms for the use of natural resources and waste management, including tailings ponds, were examined. In Uzbekistan, attention has focused on the Law of the Republic of Uzbekistan No. 754-XII “On Nature Protection”¹⁹⁾ and the Law of the Republic of Uzbekistan No. 2018-XII “On Subsoil”²⁰⁾, which regulate environmental safety and waste management. These acts served as important examples for comparison with Kyrgyz legislation.

Table 1 presents an overview of the key legal instruments from Kyrgyzstan, Kazakhstan, and Uzbekistan, as well as

from selected European Union member states Germany and France whose legal frameworks are often used as benchmarks for environmental governance. In addition, core international conventions governing transboundary environmental protection and hazardous waste management, including the Basel Convention and the Espoo Convention, were included to evaluate the extent of their integration into national legislation. This selection enabled a structured comparison of regulatory approaches, institutional responsibilities, and the degree of alignment

with international legal standards.

The study also examined the legal regulations of some EU countries, in particular Germany and France. In Germany, an important regulation to analyse was the Act to Promote the Circular Economy and Ensure the Environmentally Sound Management of Waste²¹⁾, which regulates the control of industrial emissions and waste management at industrial facilities, including tailings dams. In France, a key document was the Environment Code²²⁾, which sets

Table 1: Legal framework overview of transboundary environmental regulation

Title of Legal Act	Country / Jurisdiction	Year of Adoption	Type of Legal Act	Regulator / Executive Body
Law of the Kyrgyz Republic No. 53 "On Environmental Protection"	Kyrgyzstan	1999	Law	Ministry of Natural Resources of the Kyrgyz Republic
Law of the Kyrgyz Republic No. 89 "On Production and Consumption Waste"	Kyrgyzstan	2001	Law	Ministry of Economy of the Kyrgyz Republic
Water Code of the Kyrgyz Republic	Kyrgyzstan	2005	Code	State Water Agency of the Kyrgyz Republic
Procedure for Production and Consumption Waste Management in the Kyrgyz Republic	Kyrgyzstan	2004	Regulation / Administrative Act	Ministry of Economy of the Kyrgyz Republic
Environmental Code of the Republic of Kazakhstan	Kazakhstan	2007	Law	Ministry of Ecology of the Republic of Kazakhstan
Code of the Republic of Kazakhstan No. 125-VI "On Subsoil and Subsoil Use"	Kazakhstan	2017	Code	Ministry of Industry of the Republic of Kazakhstan
Law of the Republic of Uzbekistan No. 754-XII "On Nature Protection"	Uzbekistan	1992	Law	State Committee for Nature Protection of the Republic of Uzbekistan
Law of the Republic of Uzbekistan No. 2018-XII "On Subsoil"	Uzbekistan	1994	Law	State Committee for Nature Protection of the Republic of Uzbekistan
Circular Economy Act of Germany	Germany	2012	Law	Federal Ministry for the Environment of Germany
Environmental Code of France	France	2010	Code	Ministry of Ecology of France
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	International	1989 (in force 1992)	Convention	Secretariat of the Basel Convention (UNEP)
Convention on Environmental Impact Assessment (EIA) in a Transboundary Context (Espoo Convention)	International	1991 (in force 1997)	Convention	Secretariat of the Espoo Convention (UNECE)

Source: compiled by the authors

strict standards for hazardous waste management and regulates liability for environmental offences affecting water and land resources. These national acts determined how individual EU countries are implementing the Union's directives at the national level.

International instruments such as the Basel Convention "On the Control of Transboundary Movements of Hazardous Wastes and Their Disposal"²³⁾ are essential in regulating transboundary aspects of environmental offences by controlling the movement and disposal of hazardous wastes, which is directly related to tailings management. The Convention on Environmental Impact Assessment in a Transboundary Context²⁴⁾ establishes international procedures aimed at preventing transboundary pollution from industrial activities through coordinated environmental assessments. These international agreements establish a legal framework for cooperation between countries on environmental safety and the protection of the rights of affected parties.

3. Results

Transboundary environmental offences are a serious problem when activities in one country cause pollution of natural resources and damage beyond its borders. In the scientific literature, such violations are defined as actions or omissions that cause negative environmental impacts in other states²⁵⁾. In the context of tailing ponds and waste heaps, these are significant sources of threat, especially in the event of accidents, leaks or destruction of facilities.

One of the key aspects of transboundary offences is the impact of pollutants that spread through water resources and soils, affecting the environmental security of neighbouring countries. Tailings dams are storage sites for mining waste that contain toxic substances such as heavy metals and chemicals. When such sites are destroyed, contamination can spread rapidly, making them potentially hazardous to the transboundary ecosystem. Mining dumps, although not direct sources of pollution, can, through chemical reactions, release toxic compounds that are leached by rainwater, contaminating nearby water resources. Examples of transboundary incidents include the collapse of the "Kazzinc" tailings dam in Kazakhstan in 1998, which resulted in heavy metal pollution of the Irtysh River, affecting neighbouring countries, for example, China¹⁾. Another well-known case was the accident at Romania's Bahia Mare mine in 2000, when a cyanide leak led to the contamination of transboundary rivers, affecting the territory of Hungary, Serbia and Bulgaria²⁶⁾. These cases emphasise the need to develop stricter control measures and better coordination between states to prevent such disasters.

Furthermore, the overall trend of offences in the region reflects the deteriorating environmental situation caused by insufficient control over industrial facilities and their

waste, as well as weak international cooperation in environmental protection. The increase in the number of incidents shown in Figure 1 highlights the need for stricter international control mechanisms, improved national legislation and greater accountability of mining companies to prevent further environmental degradation in Central Asia.

Based on this, the protection of the rights and legitimate interests of citizens affected by transboundary environmental offences is one of the key issues in Kyrgyzstan. The right to a clean environment, enshrined in the Constitution of the Kyrgyz Republic²⁷⁾ (Article 48), remains poorly protected in practice. This is especially true in cases of transboundary pollution, such as leaks from tailing ponds, which may affect neighbouring countries. Kyrgyz legislation lacks clear mechanisms to ensure the protection of this right in transboundary contexts⁸⁾. Citizens affected by such incidents are often unable to file a lawsuit or receive compensation for the damage they have suffered.

Transboundary environmental offences in the field of tailings and mining waste management pose a serious environmental threat, as pollution caused in one country by the improper handling of mining waste can spread across borders, damaging the environment, human health, and the economies of neighboring countries. Such offences usually involve violations in waste storage, particularly in tailings ponds that store toxic mining waste such as heavy metals, chemicals and other hazardous compounds. When these tailings ponds collapse due to accidents, leaks, or aging infrastructure, they can cause hazardous substances to spread to neighboring countries, contaminating water, soil, and even the atmosphere, damaging ecosystems and human health.

Transboundary environmental offences occur when pollution caused by unauthorised or improper waste management practices spreads across national borders, violating the environmental and legal rights of neighbouring countries. This can happen through the destruction of tailings ponds, the leakage of chemicals or heavy metals into rivers and soil, ultimately leading to the contamination of water resources or soil in neighboring countries. The duration of such violations can be significant. They can last for years, as pollution from tailings ponds is often chronic and its effects can be observed for decades after the pollution occurred. The severity of offences can range from local environmental problems to global disasters that cause serious damage to the environment and human health.

An example of a transboundary environmental offence is the collapse of the KazZinc tailings pond in Kazakhstan in 1998, when the accident resulted in the contamination of the Irtysh River with heavy metals, affecting ecosystems in neighbouring countries, including China. Another serious incident occurred in 2000 in Romania, when a

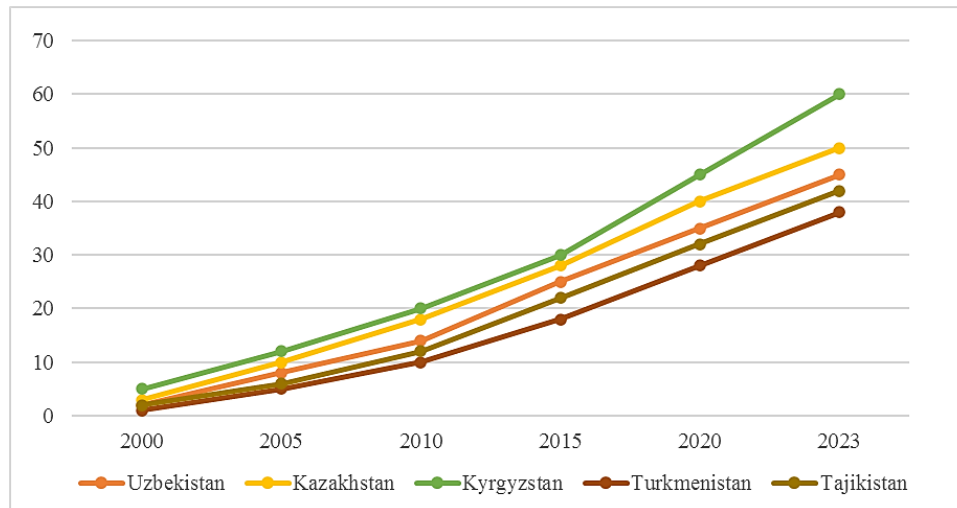


Fig. 1: Dynamics of transboundary environmental offences in Central Asian countries (2000-2023).

Source: compiled by the authors based on the National Statistical Committee of the Kyrgyz Republic²⁸⁾.

cyanide spill at a mine in Bucharest contaminated several rivers flowing through Hungary, Serbia, and Bulgaria, causing an environmental disaster in those countries^{28);29)}. These cases demonstrate the high severity of transboundary environmental offences and their ability to cause catastrophic consequences for numerous countries, which is a result of imperfect legal and technical mechanisms for waste control. Such events underscore the need for clear rules for tailings management and more effective international cooperation to prevent such disasters.

Transboundary environmental offences can cause significant damage to the states affected by the pollution. The spread of pollution through rivers and water resources is the main way in which toxic waste spreads beyond national borders, posing a threat to the health of people living near such water bodies, as well as to agricultural land and wildlife. This is even more important for countries that share common water resources, as in the case of the Naryn and Chu rivers, which flow through several Central Asian states.

These incidents show how important legislative and technical measures are to prevent such accidents. They also highlight the need for stricter control over the activities of companies working with potentially hazardous waste, such as mining companies, and the creation of mechanisms for rapid response to emergencies. Despite this, a number of countries, including Kyrgyzstan, Kazakhstan, and Uzbekistan, still have significant gaps in their legal regulations, in particular the lack of clear procedures for assessing transboundary impacts and the absence of effective mechanisms for compensating for damage caused by such pollution.

Therefore, transboundary environmental offences resulting from the activities of tailings ponds and mining

waste pose a serious threat not only to the environmental security of individual countries, but also to neighbouring states. They demonstrate the importance of establishing international standards and mechanisms for the prevention, control, and compensation of damage from transboundary pollution.

Transboundary environmental offences related to the operation of tailings and waste dumps represent one of the most acute threats to ecological security in Central Asia²⁹⁾⁻³²⁾. Such facilities, often containing toxic substances like heavy metals and cyanides, pose a high risk of accidental leaks and structural failures. When containment is breached, pollutants can rapidly spread through transboundary rivers and soils, impacting ecosystems and populations beyond national borders. In Kyrgyzstan, tailings facilities are frequently located near international water bodies such as the Naryn and Chu rivers. However, national legislation lacks provisions for mandatory transboundary risk assessments or coordinated emergency responses. The absence of compulsory monitoring and risk management plans further increases the likelihood of undetected degradation and delayed response, thereby exposing neighbouring countries to significant environmental harm. These risks underscore the urgent need for legal reforms and enhanced international coordination to ensure the safe operation of hazardous industrial waste facilities.

Limited access to justice is also an issue. Citizens face difficulties in trying to obtain a fair trial in cases related to transboundary environmental incidents^{33);34)}. The lack of specialised courts and the absence of mechanisms for cross-border cooperation between the judiciaries of Kyrgyzstan and neighbouring states limit the ability of citizens to defend their rights in court⁶⁾. This complicates the prosecution of those responsible for environmental offences. In addition, Kyrgyz legislation lacks effective

mechanisms to compensate for damage to the health and property of citizens in cases of transboundary environmental incidents. The absence of compensation funds for such situations deprives victims of the opportunity to restore their rights. Strengthening the legal framework and establishing compensation mechanisms could significantly improve the protection of citizens' rights in cases of transboundary pollution.

Article 7 of the Law of the Kyrgyz Republic No. 89 "On Production Wastes and Consumption"¹⁴⁾ requires enterprises to develop waste management projects, but this law lacks provisions for mandatory transboundary impact assessment of industrial waste. Consequently, the rights of citizens and legal entities in neighbouring countries whose water or land resources may be contaminated by toxic waste remain unprotected. Rights such as access to clean water and a safe environment are enshrined in Article 2 of the Convention on Environmental Impact Assessment in a Transboundary Context²⁴⁾, which requires participating countries to prevent transboundary environmental impacts of projects. Article 5 of the Convention on Environmental Impact Assessment in a Transboundary Context²⁴⁾ also provides for a procedure for public consultations to protect the interests of citizens, but Kyrgyz legislation does not provide for public participation of neighbouring countries in assessing the impact of large mining projects.

Water resources, which are vital for the population, are often subject to transboundary pollution^{35);36)}. According to Article 42 of the Water Code of the Kyrgyz Republic¹⁵⁾, water bodies must be protected from pollution and discharges of harmful substances. However, if pollution spreads to water resources of neighbouring countries, such as the Naryn or Chu Rivers, the rights of citizens of these countries to access clean water, as enshrined in Article 1 of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, could be violated. The Convention requires countries sharing transboundary water bodies to cooperate in the prevention, control and reduction of transboundary water pollution. The legislation of the Kyrgyz Republic lacks clear mechanisms to implement these requirements, leaving the rights of citizens of neighbouring countries vulnerable to pollution³⁷⁾.

The Procedure for Production and Consumption Waste Management in the Kyrgyz Republic¹⁶⁾ requires enterprises to monitor the condition of tailings and dumps and to take measures to prevent accidents. According to Article 9 of this regulation, enterprises are obliged to regularly check the technical condition of facilities and ensure their safety to minimise the risks of accidental releases of waste. However, the regulation does not contain mandatory provisions on international cooperation in transboundary environmental incidents. This may result in a situation where, in the event of an accident at the tailings dam resulting in the leakage of toxic substances outside

Kyrgyzstan, the rights of citizens of neighbouring States to a safe environment, enshrined in Article 1 of the Convention On Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters³⁸⁾, article 5 of the Convention on Environmental Impact Assessment in a Transboundary Context²⁴⁾ and article 3 of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal²³⁾ will remain unprotected. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal²³⁾ also enshrines the right of affected states to receive information on movements of hazardous wastes across their borders, but this provision is not reflected in the national legislation of Kyrgyzstan.

The lack of integration of international obligations has a direct impact on the rights of affected parties. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal²³⁾ in Article 4 requires countries to take measures to prevent and minimise the transboundary movement of hazardous wastes, but Kyrgyzstan's national laws do not contain specific rules to address these risks in the context of tailings facilities. If waste stored at these facilities were to reach water bodies across borders, citizens of neighbouring countries would be deprived of the opportunity to protect their rights to a clean environment, which are enshrined in article 3 of the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters³⁸⁾, as well as in article 9 of the same convention, which provides for access to justice in environmental matters. These international instruments also enshrine the right of victims to participate in environmental decision-making processes.

The Convention on Environmental Impact Assessment in a Transboundary Context²⁴⁾, which in Article 2 obliges countries to conduct EIAs for projects that potentially affect the environmental safety of neighbouring states, has also not been fully implemented in the Kyrgyz Republic. As a result, projects related to the operation of tailings dumps or mining dumps do not undergo an adequate risk assessment for transboundary areas. This violates the rights of citizens to participate in decision-making concerning their environmental safety, as well as the right to access information about potential threats, which are enshrined in Article 6 of the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters³⁸⁾. The absence of such control violates the rights of citizens to a healthy environment and well-being, which are also protected by international acts, such as the Convention on Biological Diversity³⁹⁾ (Article 8).

Another key issue that remains unresolved in the context of the protection of rights and legitimate interests is the lack of a specialised body or supervisory system that would

control issues of transboundary environmental offences in Kyrgyzstan. At the moment, national bodies, such as the State Agency for Environmental Protection and Forestry under the Government of the Kyrgyz Republic, focus mainly on domestic aspects of environmental protection. However, an adequate response to transboundary incidents related to tailings and mining dumps requires the establishment of a specialised structure or an interstate body to monitor and prevent such situations. In addition, the management of transboundary environmental offences is often complicated by the lack of technical capacity and resources in Kyrgyzstan to conduct rapid transboundary impact assessments. For instance, when toxic substances leak from a tailings dam, state authorities face the problem of a lack of equipment to measure pollution levels in transboundary waters and soils³⁾. This creates significant delays in decision-making and coordination with neighbouring countries such as Kazakhstan and Uzbekistan. Improving technical capacity and attracting international support in the form of expert advice and equipment could significantly improve Kyrgyzstan's ability to respond to transboundary environmental incidents^{40);41)}.

On the other hand, private companies, especially mining companies, are crucial in preventing transboundary environmental offences related to tailings and mine dumps⁴²⁾. The activities of such companies are regulated by the legislation of the Kyrgyz Republic, but the legal norms related to the prevention of transboundary incidents are not sufficiently detailed and require improvement. Thus, according to Article 53 of Law of the Kyrgyz Republic No. 160 "On Subsoil"⁴³⁾, companies are obliged to take measures to prevent negative EIA. However, the law lacks specific requirements regarding the management of transboundary environmental risks. For example, the norms on the development of accident prevention plans for tailings dams that could minimise transboundary pollution are not specified. In addition, the law does not provide for mandatory updating of such plans, which leads to a decrease in the readiness of enterprises to promptly respond to environmental incidents. This is particularly relevant for facilities located near transboundary water resources.

One of the important shortcomings in the current legislation is the lack of mandatory requirements for insurance of environmental risks. Law of the Kyrgyz Republic No. 53 "On Environmental Protection"¹³⁾ mentions the obligation of enterprises to prevent negative impacts on nature but does not provide specific measures for compulsory insurance of liability for environmental offences. Mandatory insurance for mining companies would be a key step in increasing their liability for potential transboundary environmental offences⁴⁴⁾. It would also enable compensation for affected states and citizens in the event of an incident. In EU countries,

insurance requirements for environmental risks are regulated by the Directive of the European Parliament and the Council "On Environmental Liability with Regard to the Prevention and Remedying of Environmental Damage"⁴⁵⁾, which requires companies whose activities involve potentially hazardous facilities to have insurance policies covering the costs of environmental remediation after incidents. These insurance policies include transboundary environmental impacts, allowing for prompt compensation to affected citizens and states.

In addition, the current system of state control over the activities of private companies needs to be strengthened. Article 20 of Law of the Kyrgyz Republic No. 53 "On Environmental Protection"¹³⁾ requires State oversight of environmental compliance, but the practical implementation of these provisions remains weak. The lack of regular monitoring of facilities such as tailings dams results in accidents being detected after significant consequences when transboundary pollution becomes irreversible. This emphasises the need to establish a system of regular monitoring of environmental risks in real time, which should be carried out not only by state authorities but also by the companies themselves. At the same time, monitoring data should be shared with supervisory authorities and neighbouring countries, which is particularly important in the context of transboundary water bodies⁴⁶⁾.

Legislation in Central Asian countries, in particular Kazakhstan and Uzbekistan, take a different approach to mining waste management and environmental protection, particularly in the context of transboundary environmental offences that may violate the rights of citizens of neighbouring countries to a clean environment and water. In Kazakhstan, for instance, environmental safety is regulated through several key legal acts, such as the Law of the Kyrgyz Republic No. 53 "On Environmental Protection"¹³⁾ and Code of the Republic of Kazakhstan No. 125-VI "On Subsoil and Subsoil Use"¹⁸⁾. Following Environmental Code of the Republic of Kazakhstan¹⁷⁾, enterprises are obliged to minimise the negative impact on the environment and comply with the requirements for safe waste management, including tailings. A peculiarity of Kazakhstani legislation is the mandatory transboundary impact assessment stipulated in Article 57 of this law. Unlike Kyrgyz legislation, where the requirements for TSIA are less well developed, Kazakhstan regulates this process in detail, paying more attention to the implications for neighbouring states. This helps to protect citizens' rights to a clean environment, as enshrined in international instruments such as the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters³⁸⁾. However, despite this obligation, Article 26 of the Kazakh law, as in Kyrgyzstan, leaves unregulated the issues of compensation for damage in case of transboundary pollution, which

limits the access of affected citizens to fair compensation. Tailings dam safety in Kazakhstan is regulated through established requirements for monitoring and prevention of accidents. Article 60 of the Code of the Republic of Kazakhstan No. 125-VI "On Subsoil and Subsoil Use"¹⁸⁾ stipulates obligations for regular monitoring of the condition of facilities, which creates a basis for the protection of citizens' rights to a safe environment. In contrast to Kyrgyz legislation, where monitoring requirements are also present in the Procedure for Production and Consumption Waste Management in the Kyrgyz Republic¹⁶⁾, Kazakhstan's norms are more focused on transboundary impact assessment. This contributes to better protection of the rights of citizens of neighbouring countries, but there remains the problem of insufficient integration of international obligations, such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal²³⁾, which limits the possibilities to prevent transboundary environmental offences.

In Uzbekistan, environmental protection issues are regulated by the Law of the Republic of Uzbekistan No. 754-XII "On Nature Protection"¹⁹⁾ and Law of the Republic of Uzbekistan No. 2018-XII "On Subsoil"²⁰⁾. Article 3 of the Law of the Republic of Uzbekistan No. 754-XII¹⁹⁾ sets out the state's obligations to prevent transboundary pollution, which demonstrates the legislator's clearer intention to protect the rights of citizens of neighbouring countries. However, specific mechanisms for implementing these obligations, such as the EIA in a transboundary context, still need to be further developed. Unlike Kazakhstan, which has more detailed procedures for transboundary impact assessment, Uzbek legislation lacks clear instructions for implementing these norms⁵⁾. This creates legal gaps in the protection of citizens' rights to a clean environment, especially in the case of major accidents related to tailings dams.

The obligations of enterprises to prevent pollution and ensure environmental safety in Uzbekistan are regulated by regulations that require the use of safe technologies. Article 19 of the Law of the Republic of Uzbekistan No. 2018-XII "On Subsoil"²⁰⁾ requires enterprises to implement environmentally sound practices to minimise EIA. While this provision is aimed at minimising environmental damage within the country, it is not sufficiently detailed in terms of interaction with neighbouring states. The rights of citizens of neighbouring countries to access clean water and a safe environment, despite being enshrined in Article 6 of the Constitution of the Republic of Uzbekistan⁴⁷⁾, remain vulnerable in the event of transboundary environmental offences. As in Kazakhstan and Kyrgyzstan, there are no adequate mechanisms for compensation if transboundary pollution harms citizens of other states⁵⁾. The Environmental Code of the Republic of Kazakhstan¹⁷⁾ introduces more

comprehensive environmental protections, but, similar to the previous legal framework, it still lacks clear provisions for cross-border compensation mechanisms in cases of environmental damage caused by mining and waste facilities.

A new Law of the Republic of Uzbekistan No. LRU-1036 "On Environmental Expertise, Environmental Impact Assessment, and Strategic Environmental Assessment"⁴⁸⁾, was signed by the President of Uzbekistan on February 24, 2025. This law introduces significant changes to the regulatory framework for environmental protection in Uzbekistan, particularly enhancing the EIA process. While the law will come into effect in six months, its prospective impact could greatly strengthen the environmental governance structure by addressing current gaps in environmental expertise and assessment.

The experience of EU countries such as Germany and France are relevant for this study as it demonstrates how cross-border environmental offences are effectively regulated and the rights of citizens of neighbouring states to a clean environment are protected. In Germany, environmental protection and waste management are regulated by the Act to Promote the Circular Economy and Ensure the Environmentally Sound Management of Waste²¹⁾. According to Article 6 of this act, companies are obliged to minimise waste generation and reduce their negative impact on the environment. Mandatory transboundary impact assessment provided for in German legislation helps prevent pollution of natural resources in neighbouring countries and protects citizens' rights to clean water and a safe environment, as stipulated in the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters³⁸⁾ and Convention on Environmental Impact Assessment in a Transboundary Context²⁴⁾. Kyrgyzstan lacks similar mechanisms, which makes it difficult to protect the rights of citizens of other countries in the case of transboundary pollution caused by mining activities.

When a transboundary water resource is contaminated in Germany, as is the case with tailings dam accidents, the law requires a mandatory risk assessment and coordination with neighbouring states to prevent further pollution. Article 62 of the Act to Promote the Circular Economy and Ensure the Environmentally Sound Management of Waste²¹⁾ establishes general rules of liability for environmental offences, but, like Kyrgyz law, there are no detailed mechanisms for compensating damages to affected citizens of other states. This creates a gap in the protection of the rights of affected parties when transboundary pollution has a significant impact on the natural resources of neighbouring countries⁴⁹⁾.

French law also carefully regulates environmental issues through the Environment Code²²⁾. Article L512-1 of the French Environmental Code obliges enterprises to conduct

a mandatory EIA if their activities may affect neighbouring countries. These measures aim to protect the rights of citizens of other countries to clean water, healthy living conditions and a clean environment, which is also enshrined in international instruments of the Environment Code²²⁾. For example, when accidents occur at industrial facilities in France, such as the collapse of tailings dams, resulting in the pollution of transboundary water bodies, French law requires enterprises to notify neighbouring states and take measures to prevent further damage⁵⁰⁾. Unlike Kyrgyzstan, where such mechanisms are not developed, French law provides for mandatory coordination procedures with other states, which protects the rights of citizens of neighbouring countries.

France also strictly complies with the provisions of the Directive of the European Parliament and the Council "On the Management of Waste from Extractive Industries"⁵¹⁾. According to Article 11 of this Directive, companies are required to develop plans to prevent accidents and minimise their consequences. These plans ensure the protection of the rights of citizens of neighbouring countries to safe living conditions and environmental protection, especially in the case of transboundary incidents. Unlike Kyrgyzstan, where the legal framework for preventing tailings dam accidents is less detailed, the legislation of France and other EU countries provides specific measures to prevent negative environmental impacts⁵²⁾. However, EU directives, despite their high standards, can be difficult to apply when interacting with third countries such as Kyrgyzstan, which is also a limitation for more effective control of transboundary environmental risks.

An analysis of the legislative norms of Germany and France shows that their approaches to transboundary environmental offences and the protection of the rights of citizens of other countries differ significantly from those applied in Kyrgyzstan. For instance, the Procedure for Production and Consumption Waste Management in the Kyrgyz Republic¹⁶⁾ does not include provisions on the need to assess transboundary impacts, as is required in the EU. There are also no mandatory consultations with neighbouring states if a project may affect their natural resources. As a result, Kyrgyzstan runs the risk of failing to adequately protect the rights of citizens of neighbouring states to clean water and a safe environment in the event of transboundary pollution.⁵³⁾

To facilitate a systematic comparison of legal frameworks governing transboundary environmental risk management, Table 2 outlines the core regulatory elements relevant to mining waste and tailings management across five jurisdictions: Kazakhstan, Uzbekistan, Kyrgyzstan, Germany, and France. The table identifies key dimensions, including the existence and quality of EIA procedures, compensation mechanisms for transboundary damage,

cross-border consultation requirements, and the degree of integration of international environmental standards. By juxtaposing the regulatory approaches of Central Asian states with those of EU countries, the table highlights structural deficiencies in national legislation, particularly in Kyrgyzstan, and illustrates how stronger legal instruments and institutional practices contribute to enhanced environmental protection and regional cooperation.

In the current context of tailings and mining waste management, the issue of transboundary environmental offences is becoming strategically important. First, such offences pose risks that extend beyond the borders of a single state – toxic substances that accumulate in tailings ponds or mining waste can seep into the river basins, soils, and atmospheric air of neighbouring countries. This creates the potential for environmental damage that is international in nature. Second, responsibility for safe waste management rests not only with national institutions, but also with international legal frameworks and cooperation, as facilities located near borders or connected to transboundary waterways require coordinated action.

A comparative analysis of the national legislation of different countries allows us to assess how different legal systems respond to these challenges. In Kazakhstan, the legislative framework provides for a number of environmental requirements for waste management: for example, Law of the Kyrgyz Republic No. 89 "On Production and Consumption Waste"¹⁴⁾ prohibits the disposal of waste in natural resource areas or in areas of mineral extraction if there is a risk of pollution. In addition, the regulatory framework contains provisions on the international transport of waste and monitoring of the state of the environment during the operation of waste disposal sites.

At the same time, Kazakhstan highlights the problem of inherited Soviet tailings ponds, which creates even greater risks – for example, the lack of adequate closure and reclamation procedures that could mitigate transboundary environmental threats. In Uzbekistan, legislation also contains general principles for the protection of the natural environment and the substrate – Law of the Republic of Uzbekistan No. 754-XII "On Nature Protection"¹⁹⁾ defines the state's obligation to ensure environmental safety.

However, regulatory practice lacks detailed provisions on the specifics of tailings management, their transboundary risks, or compensation mechanisms in the event of pollution beyond the state's borders. This creates a legislative gap where such facilities can affect neighboring countries without a clear legal mechanism for response.

The situation is different in Germany: the Circular Economy Act adopted in 2012 establishes general principles for waste prevention, reuse, and environmentally sound waste management.

Table 2: The constituents of CNG

Aspects of comparison	Kazakhstan	Uzbekistan	Kyrgyzstan	Germany	France
EIA	Mandatory for projects near borders, but not sufficiently detailed	Obligatory under the Law of the Republic of Uzbekistan No. 754-XII “On Nature Protection”, but not sufficiently implemented	Not provided for in the legislation	Mandatory transboundary impact assessment	Mandatory transboundary impact assessment
Mechanisms of compensation for damage	There is no clear mechanism for compensating damage to neighbouring states	No detailed provisions on compensation for transboundary damage	There is no mechanism for compensation for transboundary damage	Compensation mechanisms are in place, but not sufficiently developed for third countries	Compensation mechanisms are in place but need to be improved in transboundary contexts
Mandatory cross-border consultations	Present as a general requirement, but needs to be improved	General provisions that need to be improved	No mandatory provisions	Mandatory cross-border consultations	Mandatory cross-border consultations
Regulation of tailings and waste heaps	Regulated by the Environmental Code of the Republic of Kazakhstan, but poorly addresses transboundary risks	Regulated by the Law of the Republic of Uzbekistan No. 2018-XII “On Subsoil”, but no transboundary aspect	Regulated by the Resolution, but no cross-border risk assessment	Strict requirements for tailings management	Strict regulations for tailings management facilities
Integration of international standards	Partial integration	Partial integration of international standards and further development required	Integration of international norms is minimal	Full integration of international norms	Full integration of international norms
Accident prevention and mitigation plans	Plans are partially in place but need to be finalised	Measures to prevent accidents are foreseen but not well-detailed	Partial accident prevention plans, need to be strengthened	Accident prevention plans are mandatory	Mandatory accident prevention plans

Source: compiled by the authors based on L. Lirëza and G. Koçi⁵³⁾, and X. Hu⁵⁴⁾.

The law stipulates that prevention, reuse, recycling, and environmentally acceptable disposal play a key role. Although direct conclusions about tailings storage facilities are not always visible in the text of the law, it creates a legal basis for a high level of control, technological responsibility, and, importantly, international cooperation. Within this approach, transboundary environmental risks are systematically recognized as the country implements effective management of waste that may have an impact beyond its national borders.

In France, the legal framework is also geared towards a high level of environmental control. French legislation also provides for consultations with neighbouring states in cases where activities may have a cross-border impact, i.e. it creates a management model that directly takes into account cross-border environmental risks.

Comparing these approaches, the importance of the issue of transboundary environmental offences becomes clear: countries with a high level of regulation (Germany,

France) have created a system that responds more adequately to risks that extend beyond national borders. In countries with economies in transition (Kazakhstan, Uzbekistan), legislation establishes basic environmental principles, but the absence of specialized regulations on tailings ponds, transboundary consultations, compensation mechanisms, or monitoring abroad creates significant gaps. To summarise, the study identified significant gaps in Kyrgyzstan’s legislation on transboundary environmental offences related to tailings and waste dumps. Although the rights of citizens to a clean environment are enshrined in the Constitution, in practice their protection, especially in the transboundary context, remains weak. The lack of clear mechanisms for compensation, effective legal instruments for filing claims and access to justice, as well as insufficient international cooperation, complicate the protection of citizens’ rights. Compared to the laws of EU countries such as Germany and France, Kyrgyz legislation requires further development and adaptation to international standards. Introducing a system of

transboundary consultations, improving access to justice and establishing compensation mechanisms could significantly increase the level of protection of citizens' rights and help prevent environmental disasters affecting not only Kyrgyzstan but also its neighbours.

4. Discussion

The study identified key problems related to the regulation of transboundary environmental offences in Kyrgyzstan. The focus was on legal gaps in the prevention of environmental incidents, protection of citizens' rights and international cooperation in transboundary risk management⁵⁵⁾⁻⁵⁷⁾. The results of the study confirmed the need to introduce more effective control and liability mechanisms and concluded that coordination with neighbouring states needs to be strengthened. These findings require more detailed examination in the context of existing scientific developments.

The analysis showed that Kyrgyzstan already has an important legal framework regulating environmental protection issues, such as Law of the Kyrgyz Republic No. 53 "On Environmental Protection"¹³⁾ and Law of the Kyrgyz Republic No. 160 "On Subsoil"⁴³⁾. These laws provide a framework for environmental management and a legal framework for environmental protection. This correlates with the results of O. Agboola et al.⁵⁸⁾ and J. L. Reynolds⁵⁹⁾, who note that the existence of such a legal framework contributes to improved environmental security in Central Asian countries, including Kazakhstan and Uzbekistan. However, the current results emphasise that more specific and clear enforcement mechanisms are needed to better manage transboundary environmental risks associated with tailings and mine dumps. This points to the need for further development of legislation to improve its effectiveness.

In addition, Kyrgyzstan lacks legal mechanisms to provide compensation to affected citizens in the event of transboundary environmental incidents. Although the Constitution of the Kyrgyz Republic²⁷⁾ enshrines the right of citizens to a clean environment, the lack of clear norms regulating compensation mechanisms makes the protection of this right weak. This is consistent with the findings of G. Grieco et al.⁶⁰⁾ and B. Čučković⁶¹⁾, who highlight similar problems in Central Asian countries, including Kazakhstan and Tajikistan. In EU countries, such as Germany and France, compensation mechanisms are clearly defined, allowing affected citizens to quickly obtain compensation. The comparison shows that Kyrgyzstan needs to develop clearer norms regarding compensation and protection of citizens' rights in case of transboundary environmental offences, which will ensure more effective protection of the legitimate interests of the population.

One of the key rights requiring special attention is the right

to a safe and clean environment, enshrined in the Constitution of the Kyrgyz Republic²⁷⁾. This right is protected at both the national and international levels, but the research shows that Kyrgyzstan lacks mechanisms for its effective protection in case of transboundary incidents. Comparison with the results of studies by I. Park et al.⁴²⁾, N.K. Singo and J. D. Kramers⁶²⁾ shows that Central Asian countries such as Kazakhstan and Uzbekistan also face similar problems, where the lack of specific legal mechanisms makes the protection of this right limited. However, in EU countries such as Germany and France, these mechanisms are more clearly regulated, allowing affected citizens to protect their interests through the judicial system or other legal procedures. The EU has directives that guarantee the right to redress and access to justice in environmental cases, which significantly strengthens the protection of civil rights^{50);63)}. In contrast, in Kyrgyzstan, citizens face problems in realising their right to redress in cases of transboundary environmental disasters. A comparison of these data highlights the need to develop a clearer legal framework in Kyrgyzstan to protect the legitimate interests of citizens, especially in the context of transboundary environmental incidents.

One of the emerging priorities in strengthening environmental governance in Kyrgyzstan is the development of electronic systems for environmental data exchange and open access to information. Currently, access to up-to-date information on environmental conditions – particularly concerning the technical status of tailings facilities, levels of water pollution, and potential threats to transboundary ecosystems – is limited. This lack of transparency hampers the realization of the public's right to environmental information, as guaranteed under the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention).

In this context, the establishment of open-access digital platforms – featuring real-time data visualization, interoperability with international databases (e.g., EIONET, UNEP Live, Earth Observations Data Sharing Principles), and remote public access – emerges as a vital step toward improving transparency and accountability in environmental monitoring. Such systems would not only inform citizens within Kyrgyzstan but also enhance cross-border collaboration, particularly with neighbouring countries that share water resources and transboundary pollution risks (e.g., Kazakhstan, Uzbekistan, Tajikistan). Relevant models can be drawn from the European Union, where initiatives like the Copernicus Programme and the INSPIRE Directive ensure the free flow of geospatial and environmental data across member states. The adoption of similar frameworks in Kyrgyzstan, adapted to national institutional and technical capacities, could significantly improve oversight of high-risk industrial sites, increase the accountability of private operators, and establish a legal

basis for early warning and rapid response in case of environmental emergencies.⁶⁴⁾

The lack of a mandatory insurance system for environmental risks in the Kyrgyz mining sector also creates significant risks in case of accidents. In contrast to Kyrgyzstan, EU countries such as Germany and France provide compulsory insurance that covers the costs of damages in case of accidents. A. Gómez-Arias et al.⁵²⁾, M.N. Ugwanga and N.A. Kgabi⁴⁴⁾ confirmed that such an insurance system significantly reduces environmental risks and improves the protection of the rights of citizens affected by transboundary incidents. The introduction of such a system in Kyrgyzstan could significantly increase the liability of enterprises and improve the protection of citizens' rights. This distinction points to the need to introduce such mechanisms in Kyrgyzstan to increase the responsibility of companies and protect the rights of citizens. Monitoring of facilities with high environmental risk, such as tailings dams, in Kyrgyzstan, is not carried out regularly, which increases the likelihood of accidents. This is consistent with the results of C. Hildmann et al.⁴⁹⁾, and F. F. Carmo et al.⁶⁵⁾, which emphasise the importance of regular inspections and independent audits of such facilities. EU countries, such as Germany and France, have long implemented continuous monitoring mechanisms, which allows them to promptly identify potential threats and prevent accidents. A comparison of data shows that Kyrgyzstan needs to introduce stricter monitoring procedures to improve environmental safety and prevent transboundary disasters.

Enforcement mechanisms in Kyrgyzstan in the context of transboundary environmental offences also remain inadequate. Although there are basic legal acts, such as Law of the Kyrgyz Republic No. 160 "On Subsoil"⁴³⁾, they do not provide clear mechanisms to hold perpetrators accountable for transboundary environmental incidents. This is consistent with the findings of C. Cacciuttolo and A. Marinovic⁶⁶⁾ and G.T. Nwaila et al.⁶⁷⁾, who also emphasise that in African countries (Niger, Senegal), as in Kyrgyzstan, Kazakhstan and Uzbekistan, environmental enforcement mechanisms remain underdeveloped and often fail to provide an adequate level of environmental protection and citizens' rights. In contrast, in EU countries such as Germany and France, enforcement is governed by clear norms and standards, which allows for effective prosecution of businesses and compensation for victims⁶⁸⁾⁻⁷⁰⁾.

Thus, although Kyrgyzstan already has a legal framework for regulating environmental issues, further reforms are needed to improve the effectiveness of this system. Introducing mandatory environmental risk insurance, improving monitoring of high-risk facilities, strengthening law enforcement mechanisms and developing international cooperation are key measures that will help to improve the level of environmental protection and citizens' rights.

Comparison with international practices shows that borrowing and adapting successful models of environmental risk management can significantly improve the situation in Kyrgyzstan and protect the rights of citizens in the event of transboundary environmental offences.

5. Conclusions

This study highlights the significant environmental risks posed by transboundary pollution from tailings and mining waste facilities in Central Asia, particularly in Kyrgyzstan, Kazakhstan, and Uzbekistan. The operation of these facilities, which often contain hazardous substances such as heavy metals and cyanides, poses a serious threat to the environment and the health of neighbouring countries. The collapse of tailings dams and accidental chemical leaks can lead to the rapid spread of contaminants through water bodies and soil, affecting ecosystems and populations across borders.

One of the key findings of this research is the inadequacy of current national legislation in Kyrgyzstan, Kazakhstan, and Uzbekistan to address the full scope of transboundary environmental risks. In Kyrgyzstan, the lack of provisions for mandatory transboundary risk assessments, the absence of clear mechanisms for international cooperation in case of environmental incidents, and limited access to justice for affected citizens remain major gaps. Despite some legal frameworks that regulate environmental protection, such as Kazakhstan's Environmental Code (2021) and Uzbekistan's newly signed law on Environmental Expertise, EIA, and SEA, these laws do not sufficiently address the need for compensation for cross-border environmental damage or establish clear guidelines for preventing transboundary pollution from mining activities. The study also emphasizes the importance of international legal instruments, such as the Basel Convention, Espoo Convention, and the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, which provide frameworks for preventing and managing transboundary environmental impacts. However, these international conventions have not been fully implemented into the national laws of Central Asian countries, resulting in inadequate protection for citizens and ecosystems in neighbouring states.

A key conclusion of the study is the lack of clear procedures for compensating citizens affected by transboundary environmental disasters within the Kyrgyz legal framework. The absence of mandatory insurance and insufficient compensation mechanisms create a legal gap, leaving affected individuals without adequate recourse for redress. In contrast, EU countries have established compulsory insurance and compensation systems as standard practices, offering a higher level of protection for

their citizens. The lack of similar provisions in Kyrgyzstan, Kazakhstan, and Uzbekistan results in inadequate protection for citizens in the event of transboundary environmental disasters.

Thus, the study results highlight the need to modernise the legislation of Kyrgyzstan and other Central Asian countries, introduce clear enforcement mechanisms, mandatory environmental risk insurance, regular monitoring of high-risk sites, and strengthen international cooperation to prevent transboundary environmental incidents. The study limitations are determined by the focus on the legal aspects, without looking in detail at institutional and organisational factors that may affect the implementation of environmental regulations and mechanisms in practice. In the future, it is important to expand the sample of countries studied to more comprehensively examine the factors that influence the implementation of legal mechanisms in this area.

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