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The Role of Liability Regime in Addressing Historical Contaminated Land Problems: A Comparative Perspective from England and China

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ABSTRACT: This article conducts a comparative analysis of contaminated land regimes in China and England, focusing on their development, liability attribution, key principles, administrative nature, and financial guarantees. Both regimes are risk-based and are supported by the Polluter Pays Principle and the Stewardship Principle. They have similar liability arrangements: attributing the liability firstly to the polluter and then to landowners/occupiers or the usufructuaries. Administrative authorities under both regimes hold pivotal roles in remediating land on certain occasions. However, the cost recovery mechanisms vary due to the different constitutional roles among enforcing authorities, courts, and liable parties in the two countries. Both regimes impose retrospective liability, yet England provides detailed rules regarding the hardship provision and exclusion tests, preventing the unfair allocation of liability more effectively. Experience from England highlights the limited role of legal regimes in managing historical pollution, emphasising the need for supplementary mechanisms. This is why financial support is critical for effective land remediation in both countries.

Keywords: Contaminated land; Soil pollution; The polluter pays principle; The stewardship principle; Retrospective liability; Cost recovery; Financial guarantee



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1. Introduction

Both land and soil are fundamental resources for humans. Soil provides habitat for wildlife, delivers 95% of global food supplies, and holds three times as much carbon as the atmosphere [1] (p. 1). Despite the importance of soil, it is considered a non-renewable resource, as it takes on average 100 years for 1 cm of topsoil to form. It should therefore be managed according to its importance and non-renewability [2] (p. 2). Land and soil are related concepts. In a legal context, land often refers to a designated piece of land [3], and soil is one of the essential components of land, the upper layer of the earth [4]. Therefore, soil contamination/pollution also indicates the pollution or contamination of land. In this article, the terms soil pollution and land contamination are used interchangeably [5] (p. 3) ¹.

With the rapid development of industrialisation and urbanisation, the pressure on land resources has never been more pronounced on a global scale [6] (p. 7). Both England and China bear significant legacies of soil and land contamination. England, as an early industrialised nation, has a substantial history of contaminated land, and land contamination has remained a persistent concern since the 1950s, with far-reaching impacts on public health, food safety, and housing availability [7] (p. 3). It was estimated that the cost of soil degradation reached £1.2 billion annually, with nearly 4 million hectares of soil at risk of compaction [8] in England and Wales [9] ². The deteriorating soil condition in England not only affects soil fertility but also poses threats to water resources and increases the likelihood of flooding events [1] (p. 3). As an emerging industrialised country, China is also grappling with the threat of contaminated land [10] (p. 556). According to the national survey on soil pollution in China, as much as 16.1 percent of the surveyed sites fail to meet soil environmental quality standards; among these sites, 11.2 percent exhibit minor pollution, 2.3 percent display light pollution, 1.5 percent show moderate pollution, and 1.1 percent are seriously polluted [11]. In response, both England and China have taken action to tackle the serious soil pollution. In England ³, this is primarily governed by Part 2A (P2A) of the Environmental Protection Act 1990 (EPA 1990). P2A was incorporated into the EPA 1990 through Section 57 of the Environment Act 1995 (EA 1995) and came into effect in 2000 [12]. In China, the Law on the Prevention and Control of Soil Pollution (hereinafter referred to as the SPL) was introduced in 2018 and became effective in 2019.

The aim of this article is to contribute to the current discussion of compensation for environmental damage⁴, by focusing on the liability regime for addressing soil pollution in England and China. More particularly, the jurisdictions address the challenges of contaminated land by assigning liabilities of soil pollution that share convergence but also exhibit some differences. This article aims to analyse and compare the legal frameworks in both countries to draw insights and lessons from each other. This article is constructed as follows: First, it provides an overview of the evolution of the contamination regime in England and China. Second, it presents the frameworks of the land contamination regime, examining its liability scope, liability distribution, the responsibility of public authorities, recovery mechanisms, and liability rules. Third, it compares the regimes in both jurisdictions, considering fundamental principles, the nature of the two regimes (administrative or civil), temporal dimensions, and financial guarantees. Finally, it concludes with remarks.

2. Historical Evolution of Legal Framework for Addressing Land Contamination in England and China

The introduction of policies addressing contaminated land and soil pollution in both England and China was, regrettably, delayed compared to the emergence of the serious problems they sought to tackle. The mounting pressure caused by these issues eventually led to the creation of specific laws and regulations. This section provides a brief overview of the evolution of legal regimes specially designed for addressing soil pollution in the two jurisdictions.

2.1. The Development of the Contaminated Land Regime in England

The issue of contaminated land in the UK first gained public attention in the late 1950s [13]. However, it took another 50 years or so for a dedicated legislative framework to be put in place in response to this concern. It was not until the 1970s, primarily driven by a housing shortage, that policymakers began to consider the development of contaminated land regime as a means to provide more housing for residents [13]⁵. This part interrogates the reasons for the slow evolution of P2A and the relations between P2A and other methods for land remediation.

2.1.1. The Postponed Registration System for Contaminated Land

One of the fundamental prerequisites for addressing the contaminated land issue is knowing the precise location and the extent of soil pollution. However, given the large amount of funding and the specific expertise required for such investigations, the government hesitated to undertake this project, mainly due to budget constraints [14]. Developers were also concerned that disclosing the existence of contaminated land would adversely affect land values, and their lobbying efforts exerted intensive pressure against establishing a registration system for contaminated land [13]. In May 1991, the Department of the Environment (DoE) and the Welsh Office issued a detailed draft regulations for the creation of public registers of contaminated land, emphasising that ‘it is better for everyone concerned to know what contamination may be present on a site, and for investigations to be made and if necessary for decontamination to be carried out on the basis of knowledge [13]. This document aimed to enable local authorities, landowners, potential buyers, and developers to get access to information about the expected contamination and thus to prepare for further development [15]. Finally, the registration system for contaminated land was launched, laying the foundation for the contaminated land regime.

2.1.2. Dependence on Statutory Nuisance and the Planning System

Prior to the implementation of P2A, the statutory nuisance mechanism and the planning system were mainly employed to address contaminated land problems.

The statutory nuisance mechanism lies at the intersection of private law nuisance and statutory regulations and has already been used to combat environmental problems [16] (p. 385). Pursuant to section 79 of EPA, the statutory nuisance could be applied to solve pollution caused by smoke, dust, light, litter, odour, and noise (including vibrations) [17]. Before the 1970s, the primary legal sources for addressing contaminated land problems relied on the concept of statutory nuisance under the Public Health Acts 1846–1936 and the Town & Country Planning Acts 1909–1947. These acts granted local authorities to take action in cases of statutory nuisance, which involved the removal of noxious materials in urban districts [18]. However, since public nuisance did not specifically address historical pollution problems and was not directly related to land contamination, it exerted limited function in addressing land contamination issues during that period.

In the late 1970s, the government of England began to consider the use of the planning system to tackle contaminated land problems [19]⁶. Given that land remediation is a prerequisite for land redevelopment, particularly for housing purposes, administrative authorities integrated land remediation into the planning system. The planning system became a more professional mechanism for dealing with contaminated land issues from 1980. In 1980, the Interdepartmental Committee for the Redevelopment of Contaminated Land (ICRCL) released ‘Guidance on the Redevelopment of Contaminated Land’, which served as a reference for local authorities and developers to formulate local plans [20]. The planning system primarily operates by granting development permissions through the planning authorities [21]. These authorities have the power to require developers to remediate contaminated land as a condition for granting permission [22]. Developers may be mandated to investigate and remediate the land to ensure that

potential development is conducted in an environmentally sound manner [23]. Through the redevelopment process, the contaminated land can be effectively addressed by developers. Despite its effectiveness, the reliance on the planning system hindered the need for the introduction of a formal legal framework [19] (p. 147).

Currently, the planning system still plays an important role in land remediation. It was reported that the planning system, emerging as one of the effective tools for administrative authorities, had addressed approximately 90% of contaminated land sites in England and Wales by 2009 [24] (p. 7).

2.1.3. Adoption of the Polluter Pays Principle and the Enactment of P2A

The enactment of P2A cannot be separated from the adoption of the Polluter Pays Principle in the UK. The Polluter Pays Principle indicates that those responsible for pollution should bear the costs of preventive and/or remedial measures [25,26]. This principle was initially recognised by the Organisation for Economic Co-operation and Development (OECD) and the European Union (EU) [26] (p. 33).

In the UK, the Department of the Environment (DoE) and the Wales Office released a consultation paper in 1986, introducing primary mechanisms for implementing the Polluter Pays Principle [13] ⁷. Although this marked a positive start, the principle was not fully integrated into law at that time. It was not until around 1989, during the formation of EPA 1990, that the pollution policy of the UK officially shifted towards a more stringent application of the Polluter Pays Principle [26] (p. 32). This recognition of the Polluter Pays Principle, as articulated in the consultation paper *Paying for Our Past* [27] (p. 30), became the cornerstone for the development of a new liability regime for contaminated land [28].

The report of *Paying for Our Past* published in 1994, outlined the framework for controlling contaminated land in England and Wales, from which the foundation of P2A began to take shape. P2A was subsequently incorporated into the EPA 1990 through the Environmental Act 1995 (EA 1995) [29]. P2A comprises 29 sections, from s.78A to s.78YC, primarily covering the responsibilities of enforcing authorities and liable persons concerning contaminated land. A comprehensive understanding of the P2A's operation can be gained through Contaminated Land Statutory Guidance (Guidance) accompanying this regime [30]. The initial version of Guidance was issued in 2000 by the Department of the Environment, Transport, and the Regions, and subsequently amended by the Department for Environment, Food and Rural Affairs (Defra) ⁸ in 2006 and 2012, respectively. The Guidance in 2012 encompasses eight parts, covering the objectives of P2A, the roles of enforcing authorities, risk assessment, definitions, determinations, remediation, liability for contaminated land, and the recovery of remediation costs [30], which provides detailed instruction on the implementation of P2A.

2.1.4. Relations between P2A and Other Mechanisms

Apart from P2A and the planning system, the voluntary remediation is also a solution for land remediation. Voluntary remediation narrowly refers to the actions taken by site owners, those accountable for the site, or polluters who voluntarily address existing land contamination [24] (p. 5) ⁹. In England, around 4% of contaminated land has been addressed by the voluntary remediation [24] (p. 6) ¹⁰.

The scopes and targets under the P2A, the planning system and voluntary remediation are different. P2A, pursuant to section 78A, is a risk-based regime that is concerned with significant environmental risk [17], which means only land that meets this 'significant risk' standard can be remediated through P2A. Different from this, the planning system does not use the phrase of 'contaminated land' but 'land affected by contamination' instead [31]. In this way, it covers all instances where the substances in, on or under the land might have threats to people, property, human activities and the environment, regardless of whether the land satisfies the 'significant risk' standard in P2A. Likewise, in order to achieve different conservation objectives ¹¹, the voluntary remediation operates in a broader sense, not limited to the 'significant risk' standard but all environmental issues.

Second, the remediation targets are different between P2A and the planning system. Under the P2A, the final remediation should satisfy the 'suitable for use' standard [32] (p. 17). Likely, as stated in Planning Policy Statement 23, as a minimum, redeveloped land under planning system should not be capable of being determined as contaminated land under P2A of the EPA, 1990 [31]. However, the remediation target of redevelopment depends on the potential use of the land. It can be designed based on higher standards for future use [33] (p. 132).

To summarise, the planning system is the dominant method for land remediation in England, while the voluntary remediation is the first choice for enforcing authorities [30] ¹². P2A, as a legal framework, serves as the last resort [34].

2.2. The Development of the Contaminated Land Regime in China

In China, the issue of contaminated land sites has primarily arisen due to inadequate industrial planning and insufficient pollution management [35] (p. 1). Despite the threats posed by land contamination to public health and economic development, the specific legislation for addressing soil pollution remained largely absent for an extended period in China. There were several reasons to explain this legislative delay. Firstly, soil pollution is a hidden problem by nature, making it challenging to detect. Secondly, China's primary focus had been on economic growth, which sometimes overshadowed environmental concerns, leading to a lack

of motivation among governments to address soil pollution [36]. Like the UK, the development of the contaminated land regime in China can also be divided into two phases taking the enactment of the specific legislation for combating soil pollution in 2018 as a division. Before the introduction of Soil Pollution Law, regulations related to soil pollution were scattered across a wide range of laws, regulations, and policies in China at both central and local levels [36].

2.2.1. Soil Pollution Policies Prior to 2018

The origins of soil pollution in China can be traced back to the late 1950s when industrialisation began [35] (p. 3). However, it was not until the late 1970s, coinciding with rapid industrial development, that severe pollution, including land contamination, became a worrisome issue [10]. Unlike air or water pollution, soil pollution is often invisible and concealed, and pollutants can persist in the soil for extended periods, making it a challenge to detect promptly [5] (pp. 9, 37, 43). Environmental laws in China had been developed in tandem with industrialisation. In 1978, environmental protection was enshrined in China's Constitutional law, asserting the State's responsibility to protect the environment, natural resources, and prevent pollution and other public hazards [37]. In 1979, the first comprehensive Environmental Protection Law (for Trial Implementation) was introduced. Articles 10 and 22 of the EPL 1979 emphasised the government's duty to combat soil pollution, explicitly stating that the government should take responsibility for improving soil quality and preventing soil erosion and pollution [38]. The State's environmental protection obligations continued to feature in subsequent environmental protection laws, including the Environmental Protection Law of 1989 [39]¹³ and 2014 [40]¹⁴. However, these obligations remained general and vague, posing challenges for effectively addressing soil pollution.

In addition to the comprehensive EPL, soil pollution was also addressed in laws pertaining to land utilisation and management, as well as agriculture. For example, Article 35 of the Land Administration Law mandated that governments at all levels should take measures to prevent soil pollution [41]. Article 2 of the Rules on Land Reclamation required operators to undertake reclamation measures during construction activities to restore contaminated land to a usable condition [42]. The Agriculture Law contained provisions related to soil protection, including the proper use of agricultural pesticides and fertilisers during farming activities and restrictions on the production of agricultural chemical products [43].

Furthermore, some local governments also issued regulations for managing solid waste and contaminated sites. For instance, Article 47(2) of the Chongqing Municipal Environmental Protection Regulation stipulated that operators must remove toxic and harmful substances and remediate contaminated lands before changing their production or relocating [44]. While these laws and regulations established basic obligations for addressing soil protection, particularly assigning responsibilities to governments, they were not specifically tailored to address soil pollution and often lacked the specific requirements necessary for effective enforcement.

In 2006, the director of the Ministry of Environmental Protection (formerly MEP, now the Ministry of Ecology and Environment, MEE since 2018) raised concerns about the worsening soil pollution situation in China at a conference, highlighting that soil pollution had intensified, threatening food safety and causing direct economic losses of more than 20 billion yuan each year [45]. The first nationwide survey on soil pollution in China was conducted between April 2005 and December 2013, jointly carried out by the MEP and the Ministry of Land Resources (formerly MLR, now the Ministry of Natural Resources after 2018) [10]. Initially budgeted for approximately 1 billion yuan, the survey was expected to be completed within 3.5 years but ended up taking around 8 years [45]. This survey illustrated the severity of soil pollution in China, with 16.1% of land was found to be polluted [10]. The survey directly contributed to the enactment of the Soil Pollution Law in 2018.

2.2.2. The Enactment of Soil Pollution Law in 2018

For a long period, soil pollution in China was addressed by a scatter of policies and rules at both national and local levels and the absence of the specific legislation was regarded as one of the most important reasons behind the deteriorating soil condition in China. As a response to the worsening soil condition and the increasing demand, the draft of the SPL was formulated in 2013 and was prepared for submission for consideration in line with the Legislative Planning of the Twelfth National People's Congress Standing Committee [46]. The SPL was officially adopted during the 5th meeting of the Standing Committee of the 13th National People's Congress on August 31, 2018, and it came into effect on January 1, 2019. The SPL represents China's comprehensive law specifically designed to address soil pollution, marking a significant milestone in China's environmental legal framework [36]. It comprises seven chapters, encompassing fundamental principles, general terminology and standards, and responsibilities pertaining to prevention, protection, and management. Additionally, it distinguishes between land designated for agricultural use and construction use, addressing contamination issues accordingly. The SPL also outlines provisions for supervision and legal liabilities related to soil pollution.

3. Liability Regime for Contaminated Land in England and China

The distribution of liability of contaminated land among different parties plays a key role in the legal regimes in both England and China. To have a better understanding of the liability regimes for contaminated land in two jurisdictions, this section provides a summary of key aspects of both regimes, including their scope, liability distribution, and mechanisms for recovering costs.

3.1. Scope of Liability Regimes

P2A is a risk-based regime that focuses on significant environmental risk. Under section 78B, local authorities are responsible to identify contaminated land [17]. As provided in section 78A, land that is polluted has to meet certain risk standards to be identified as contaminated land [17]. This means that only harm reaching the “significant” level will be considered for remediation through P2A. Contaminated land is defined in section 78A(2) as land where “significant harm is being caused or there is a significant possibility of such harm being caused; or significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused” [17]. Under section 78A(4), ‘harm’ encompasses both the actual and potential damage to living organisms, ecological systems, and the property of individuals [17]. Therefore, in practice, a wide range of conditions may not constitute significant harm and thus cannot be regulated by P2A [17]. Remediation under section 78A(7) includes assessing the condition of the contaminated land in question and taking actions to prevent harm or restore it [17].

The SPL in China also operates as a risk-based system, while it does not emphasise that harm should reach the ‘significant’ standard as P2A does. Soil pollution under the SPL is defined as changes in soil characteristics (biological, chemical, or physical) caused by human activities, which subsequently affect soil functions, public health, and the environment, highlighting the adverse effects on human health and the environment [47]. From the definition of soil pollution itself, it appears that the SPL only regulates actual harm rather than potential harm. However, in several articles, the SPL authorises the government to take measures to prevent potential harm. For example, pursuant to article 44, local governments should take emergency response measures if the emergency might cause soil pollution [48]. This means the SPL also regulates both potential and actual soil pollution.

Compared to P2A, the soil pollution liability regime under the SPL is a more nuanced regime because it differentiates between categories of land (construction land and agricultural land) and prescribes distinct requirements for remediation based on varying levels of risk. Chapter 4 of the SPL, titled ‘Risk Management and Control and Remediation’, distinguishes between risk assessment, management, and remediation for agricultural and construction land use. In contrast, P2A does not differentiate between different land uses and regulate them accordingly. These differences between the SPL and P2A can be explained by two reasons.

Firstly, without considering the cost of enforcement, an ideal contaminated land regime should address different kinds of contaminated land based on the features of land pollution accordingly. Land usage types exert different influence on the environment and pose distinct threats for soil pollution. In industrial and urban areas, both in China and England, soil contamination is more likely caused by the industrial activities and the disposal of waste materials. Conversely, agricultural lands are susceptible to pollution risks associated with the excessive use of pesticides and fertilisers. Agricultural pollution tends to be diffuse, making it challenging to detect compared to industrial land pollution, which is typically more concentrated and readily identifiable [36]. For this reason, the nature of soil pollution differs between agricultural and industrial land. This divergence in pollution characteristics underscores the need for tailored approaches and regulatory mechanisms to address these distinct pollution types effectively. The SPL was introduced around 20 years after P2A, and this category-based management strategy demonstrates the strength of the SPL as a new regime.

Second, this can be explained by the land use difference in China and England. China has a diverse range of land uses, with more than 20% classified as developed, including cities, towns, villages, industrial areas, and mining lands [49]. This diversity of land uses reflects China’s rapid urbanisation and industrialisation. In contrast, England has a lower proportion of developed land (8.7%), with a significant portion being agricultural (63.1%), forestry open land and water (20.1%) [50]. The diversity in land use in China necessitates a strategy that considers the specific risks and challenges associated with different types of land use.

It is worth noting that both jurisdictions are concerned with the effects of soil pollution on water. In the definition of contaminated land in P2A, harm includes harm or threats to water, and this implies that assessments and remediation should consider the impact on controlled waters [51]. Similarly, the SPL requires risk assessment reports to include assessments of groundwater pollution. For example, Article 36 of the SPL outlines requirements for survey reports. If pollution exceeds the standards for the management and control of soil pollution risk, the survey must encompass an examination of whether groundwater has been polluted [48]. Regardless of whether pollution affects agricultural or construction land, based on article 57 and 64, the remediation plan for soil pollution should include measures to address groundwater pollution [48].

3.2. Responsible Persons/Parties

According to section 78F of P2A, the ‘appropriate person’ refers to the individuals or entities responsible for remediating contaminated land. P2A identifies two categories of appropriate persons: ‘Class A’ persons and ‘Class B’ persons, as described in the Statutory Guidance [30]. ‘Class A’ persons pursuant to section 78F(2) refer to the polluters, i.e., individuals or entities that caused or knowingly permitted the presence of contaminated substances on the land [17]. Based on section 78F (3), the remediation responsibility of ‘Class A’ persons is directly related to the pollution they caused or knowingly permitted, based on the extent referable to substances which he caused or knowingly permitted to be present in, on or under the contaminated land [17]. ‘Class B’ persons pursuant to section 78F (4), on the other hand, refer to the landowners or occupiers, who become responsible for remediation of contaminated land when ‘Class A’ persons, i.e. polluters, cannot be found after reasonable inquiry [17].

Section 78F of P2A provides:

“(1) This section has effect for the purpose of determining who is the appropriate person to bear responsibility for any particular thing which the enforcing authority determines is to be done by way of remediation in any particular case.

(2) Subject to the following provisions of this section, any person, or any of the persons, who caused or knowingly permitted the substances, or any of the substances, by reason of which the contaminated land in question is such land to be in, on or under that land is an appropriate person.

...

(4) If no person has, after reasonable inquiry, been found who is by virtue of subsection (2) above an appropriate person to bear responsibility for the things which are to be done by way of remediation, the owner or occupier for the time being of the contaminated land in question is an appropriate person.”

Pursuant to section 78J, there are certain limitations on requiring ‘Class B’ persons to undertake remedial measures to tackle pollution of controlled waters [17]. Nevertheless, accordingly to section 78K, ‘Class B’ persons are generally responsible for remediating the contaminated land while they own or occupy it [17]. Under the same section, it is important to note that the appropriate person is not only responsible for substances present in, on, or under the land that they directly caused or knowingly permitted but also for substances that have escaped directly or indirectly from the land they polluted [17]. In such cases, landowners or occupiers of the contaminated land where the substances have migrated to are not considered appropriate persons. If no ‘Class A’ or ‘Class B’ persons can be identified in relation to a significant contaminant linkage [17], it may be treated as an ‘orphan site’, meaning there is no liability party for that contaminated land [37]. According to section 78M, failure to comply with the obligations specified in a remediation notice, without reasonable excuse, can result in an individual being charged with an offence and facing fines [17]. Under this section, if proceedings for an offence are not effective, authorities can initiate legal proceedings to compel compliance with the remediation notice [17].

Similar to the liability arrangement in England, there are two categories of liable parties in the Soil Pollution Law of China: the polluter and the usufructuary. The relevant provision, Article 45 of the SPL, outlines the responsibilities of these parties:

“A person responsible for soil pollution shall be obligated to conduct the management and control of soil pollution risk and remediation. If the person responsible for soil pollution cannot be ascertained, the land usufructuary shall conduct the management and control of soil pollution risk and remediation.”

It is important to note that the SPL initially did not provide a clear definition of ‘the person responsible for soil pollution’. However, this definition was later clarified in the *Interim Measures for Identifying the Person Responsible for Soil Pollution in Construction Land* [52] and the *Interim Measures for Identifying Persons Responsible for Agricultural Land Soil Pollution* [53]. The Interim Measures define the person responsible for soil pollution as the individual or entity responsible for activities that result in soil pollution, such as discharging, dumping, stockpiling, landfilling, leaking, scattering, seepage, loss, or scattering of pollutants or other toxic and harmful substances on agricultural or construction land [52,53]. Some scholars have criticised the term ‘the person responsible for soil pollution’ for its ambiguity and suggested replacing with the more direct term of ‘polluter’ [54].

Another responsible person prescribed in the SPL is the usufructuary of the contaminated land. Making the landowner, occupier, or usufructuary liable for soil pollution or land contamination is a common approach in many jurisdictions [55]¹⁵. This practice is often grounded in the complex nature of soil pollution, where identifying the original polluter and establishing causation can be challenging, especially when the polluting activities are historical. Moreover, the original polluter may no longer exist due to dissolution, bankruptcy, or changes in identity, making them incapable of bearing the costs of pollution remediation. Holding the landowner, occupier, or usufructuary responsible is seen as an efficient way to address pollution promptly.

In China, the SPL assigns liability to the usufructuary rather than the landowner. This approach can be attributed to China’s unique land ownership structure, as land is either owned by the State in urban districts or collectively owned by peasants in rural and suburban areas, unless otherwise provided by the State¹⁶. Consequently, assigning liability to the landowner would burden public authorities with the responsibility and cost of remediation. This could result in significant financial and administrative burdens for public authorities, which the usufructuary-based liability approach aims to avoid [36].

3.3. Remedial Action Undertaken by Public Authorities and Cost Recovery Mechanism

In England, according to section 78N, the enforcing authority under section 78A(9) holds the power to implement remedial measures when there is an imminent danger [17]. Additionally, they can carry out remediation work at the expense of the appropriate person if such an agreement is in place [17]. If the appropriate person fails to comply with the remediation notice or if no appropriate person is identified after a reasonable inquiry, the public authority can step in to remediate the land [17]. Subsequently, pursuant to section 78P, the enforcing authority has the right to recover the reasonable costs from the appropriate person [17].

When determining whether to recover costs from the appropriate person, the enforcing authority could exercise discretion in accordance with the EPA 1990 and the Statutory Guidance. The decision-making process for cost recovery adheres to the principles of fairness and the Polluter Pays Principle, and the latter dictates that costs should primarily be borne by the polluter whenever feasible [30]. When assessing whether to reduce costs, a consistent approach is applied to all types of commercial or industrial enterprises classified as appropriate persons, including public corporations, limited companies (both public and private),

partnerships (whether limited or not), and individuals operating as sole traders [30]. For small or medium-sized enterprises, the enforcing authority considers the impact of full cost recovery on their financial stability and the local economy [30]. When the appropriate person is a charity, trustee, or social housing landlord, and cost recovery could affect the activities of these entities, the authority contemplates the option to waive or reduce the costs [30]. According to section 78P(2) of P2A, the authority could take into account the economic situation of the appropriate person for the recovery of remedial cost [17]. If recovering the costs would cause hardship of the liable person, the authority has the option to waive or reduce the fees [17]. This sometimes results in contamination costs being covered by public funds, which are ultimately funded by taxpayers.

Pursuant to section 78P, the enforcing authority initiates the recovery process by serving a charging notice on the appropriate person and providing a copy to any affected parties [17]. This notice specifies the amount of remediation cost, any applicable interest rates, and outlines the right to appeal [17]. Regarding the measures of cost recovery, article 25 of the Regulatory Enforcement and Sanctions Act 2008 empowers the enforcing authority to take enforcement actions to ensure the pursuit of remedies if the appropriate person fails to pay for the cost [56]. These actions, pursuant to article 46 may encompass fixed monetary penalties¹⁷, discretionary requirements¹⁸, stop notices prohibiting certain activities [56], or in extreme cases, asset seizure and imprisonment [57]¹⁹. Alternatively, the enforcing authority can pursue a liability order from the court, applying to a magistrates court for this purpose [58–61]²⁰. Once the court confirms the payable amount and issues the liability order, the authority can proceed with cost recovery by seizing and selling the assets of the liable party [62].

According to the SPL in China, public authorities are expected to take remedial measures for soil remediation in four scenarios. The first scenario arises from article 44, when emergent incidents occur and pose the risk of soil pollution [48]. Even though there is no dispute with regard to the liability for soil pollution, the investigation and risk assessment procedures necessary for preventive and remedial actions still take time and meanwhile soil conditions may continue to deteriorate. The second scenario unfolds when either the polluter or the land usufructuary fails to perform their duties. Competent authorities²¹, either directly or through a third party can take essential preventive and remedial measures on behalf of the liable parties. Ultimately, pursuant article 94, all costs incurred are borne by the responsible parties [48]. Third, pursuant to article 68, in situations where the government reclaims the usufruct on the land, and the polluter is the former land usufructuary, the local authorities are tasked with controlling soil pollution risks and remediating the land [48]. Fourth, although not explicitly prescribed in the SPL, it can be inferred that public authorities should intervene when both the polluter and the usufructuary cannot be identified. According to Article 71 of the SPL, remediation of contaminated land can be conducted under the soil pollution funds [48]. Typically, this implies that public authorities should assume liability when both parties are unidentifiable.

Different from the P2A in England, the SPL does not provide specific guidelines on how public authorities can recover costs from responsible parties. Insights can be drawn from the Civil Code of China, particularly concerning environmental pollution and ecological damage. Article 1235 stipulates that in cases of ecological and environmental damage due to violations of state regulations, state-authorized agencies have the right to claim compensation from the tortfeasor [63]²² for losses and expenses related to damage prevention, pollution clean-up, and ecological environment restoration²³. These state-authorized agencies, typically at the provincial or municipal (prefecture) level, are responsible for compensation for ecological and environmental damage within their respective administrative regions [64]²⁴.

Traditionally, the entitlement to recover costs is governed by administrative law, which includes recovery from both the polluter and the usufructuary. According to article 12 of the Administrative Compulsion Law, ‘performance on behalf of the party concerned’ is an administrative enforcement mechanism [65]. Pursuant to article 50, this occurs when a party fails to fulfil obligations from an administrative authority and continues to disobey, potentially endangering traffic safety or causing environmental pollution, or natural resource damage [65]. In such cases, based on article 51, the administrative authority may execute the obligation on behalf of the party or authorise a third party to do so, with the costs borne by the party in question [65]. However, the specific methods for claiming costs when remediation is carried out under Administrative Compulsion Law remain unclear in Chinese legal system. In practice, the costs could be recovered through four approaches: first, issuing an administrative order to the concerned party to pay the costs; second, requiring enforcement through the courts if the party fails to comply even after reminders; third, initiating legal proceedings before civil courts; and fourth, file a lawsuit by a third party if the remedial action is carried out by a third party [66].

3.4. Liability Rules and Defences

Though not clearly indicated in P2A, the liability framework under P2A is widely recognised as strict and retrospective liability, of which the condition does not require proof of fault [67,68]²⁵. Pursuant to section 78J, P2A provides three defences that the appropriate person can be exempted from liability. The first exemption pertains to damage resulting from water pollution originating from an abandoned mine [69]²⁶. The second exemption under section 78K absolves the landowner or occupier if the liability arises from the escape of contaminants from another piece of land [17]. The third provision prescribed in section 78X, excludes individuals who are ‘acting in a relevant capacity’, as defined in section 78X(4) of P2A, such as insolvency practitioners [17].

The Contaminated Land Statutory Guidance, additionally, prescribes some specific scenarios to exclude a person who would otherwise be considered the appropriate person from liability. Exclusion tests for ‘Class A’ persons include:

- A. Individuals who merely provide assistance to the actual polluter without directly causing or allowing pollution. For instance, those who offer financial support, grant land tenancies, license occupation to the actual polluter, or provide advisory or service-oriented (legal, financial, or technical) assistance are not classified as polluters under P2A [30].
- B. Individuals who have already fulfilled their responsibility for remediation [30] (pp. 50–51).
- C. Situations where a polluter (seller) transfers land with known pollution information to another person (buyer) within the liability group. In this case, the buyer assumes liability for remediation as the current landowner or occupier [30] (pp. 51–52).
- D. Scenarios primarily related to pollution sources. Persons who should be excluded include those who caused a substance that led to contaminant linkage through its interaction with another substance introduced to the land by someone else [30] (p. 53). It also includes situations where substances escaped from other parcels of land or where pollution is caused by others in the significant contaminant linkage pathways or receptors [30] (p. 54).

Exclusion tests for Class B persons encompass:

- A. Individuals occupying land under a license or similar agreement, provided the land has no marketable value or cannot be transferred to another person.
- B. Persons responsible for paying rent that matches the rack rent (the full market rent) for the land they occupy and do not possess any beneficial interest in that land beyond any tenancy related to that rent [30] (p. 58).

Liability rules for soil pollution in China are not explicitly defined in the SPL, while this can be inferred from the general provisions in the Civil Code of China. According to article 1234 of the Civil Code of China, to claim compensation for damage to the environment, one must demonstrate both the damage and a violation of state regulations [63]. Therefore, conducting activities without any fault is not an effective defence. Therefore, the conditions for assuming liability for soil pollution are: first, the party caused the soil pollution, and second, they violated state regulations. In the case of the usufructuary, the SPL does not specify any conditions, which seems to result in strict liability for them.

It should be noted that the defences towards environmental liability are not prescribed neither in the Civil Code nor in the judicial interpretation, but refer to specific environmental laws. If the environmental legislations do not list specific defences, the general provisions in the civil laws will be applied. For example, the SPL does not include any specific provisions regarding defences, the defences according to articles 1174, 1175, 1176 and 1177 of the Civil Code will be applied in the case of soil pollution liability, *inter alia* the fault of the victim, a third-party fault, force majeure, self-defence, and necessary measures in the course of emergent incidents [63].

4. Comparative Analysis of the Liability Regime of Contaminated Land in England and China

Based on the description of the liability regimes of contaminated land in the UK and China above, this section delves into an analysis of liability regimes in both jurisdictions, focusing on the fundamental principles, the nature, retrospective aspects, and the financial guarantees of the two liability regimes.

4.1. Fundamental Principles Underpinning Liability Regime

It is obviously observed in P2A of England and the SPL of China, the Polluter Pays Principle is widely accepted as the fundamental principle underling the liability regime for soil pollution. As indicated in Section 2.1, the Polluter Pays Principle directly contributes to the enactment of P2A and is a foundational element of P2A [27]. Similarly, the SPL is perceived as the application of the Polluter Pay Principle in the specific area of soil pollution. Article 3 of the SPL clearly prescribes that the prevention of remediation of soil pollution shall adhere to the Polluter Pays Principle.

Another fundamental principle underpinning the liability regimes is the stewardship principle, which can be loosely defined as: when individuals, groups, or the State have control over a valuable or scarce resource, they bear a duty to manage these resources carefully and in accordance with certain values [70–72]. This duty stems from the relationship between the duty bearer and the resource: the duty bearer exercises control or dominion over the resource in question [70]. In the realm of environmental law, stewardship broadly refers to a general, universal duty to protect the earth, or it can also refer specifically to the obligation placed on landowners to conscientiously manage their land [70]. The primary duty bearers, identified in both academic scholarship and specific legal regimes, are landowners [70]. This is because landowners are considered best positioned to safeguard land under their direct control, and their decisions regarding land use can significantly impact the environment and communal interests. Within the P2A, the liability arrangement designates landowners and occupiers as the second category of liable persons, aligning with the stewardship principle [73]. Notably, the concept of stewardship is not commonly employed in the Chinese legal context. The SPL, in fact, represents the first legal mechanism in China to introduce land usufructuaries as the supplementary responsible parties for environmental pollution [36]. As highlighted in section 3 concerning responsible parties under both the SPL and P2A, holding landowners, occupiers, and usufructuaries liable—even when they are not necessarily the original polluters—constitutes a practical approach which aims to find someone to pay, particularly when the initial polluter cannot be identified. This arrangement serves the remediation of historical pollution and can also be justified by the direct benefits these parties receive from remediating contaminated land.

From an economic perspective, while applying the guidance of general principles to distribute liability for land contamination, the resultant distribution might not be the most efficient due to variations in social transactions across different circumstances [74]. This is also why the legal regime has been supplemented by other mechanisms, such as voluntary remediation or planning systems.

4.2. Nature of Liability Regime for Soil Pollution

The common feature shared by P2A and the SPL is both liability regimes for soil pollution based on the public or administrative approach. This administrative nature is primarily evident in the initial identification of contaminated land or soil pollution [75] (p. 235). Under section 78B of P2A, local authorities bear the responsibility of identifying contaminated land [17]. If the local authority deems a piece of land should be designated as a special site, it must notify relevant parties, including the appropriate Agency, landowners, occupiers, and the appropriate person [17]. In the remediation notice issued to the appropriate person, pursuant to section 78E, the authority must specify the required actions and the timeframe for compliance [17].

Article 5 of the SPL places responsibility on governments at all levels for the prevention and control of soil pollution and the safe use of soil within their respective administrative regions [48]. Pursuant to article 15, the SPL establishes a soil environment monitoring system [48], with specific departments and local governments responsible for monitoring work. Their focus is on potentially contaminated land, based on article 16 and 17, such as land used for agricultural products exceeding pollution limits, former industrial, mining, or farming land, or land previously used for the production or disposal of toxic substances [48]. These specific departments and local governments, based on article 52, are also responsible for conducting soil pollution assessments when agricultural land is found to be at risk through general surveys, soil pollution monitoring, or on-site inspections [48]. In cases where land intended for construction is found to be at risk from soil pollution, according to article 59 and 60, the ecological and environmental department of the local government must require the land usufructuary to conduct a pollution survey and mandate that responsible parties assess the pollution risk [48]. Furthermore, pursuant to article 48, it is the government's responsibility to determine the polluter when their identity is uncertain or in question [48].

In England, while tort law can be employed to address environmental pollution, its scope is generally limited to cases of private nuisance resulting in harm to individuals and private possessory interests are required in cases of private nuisance [76]. P2A does not grant standing to other private parties to bring lawsuits to the court regarding contaminated land. Therefore, the administrative nature of P2A is not controversial [76]. In fact, English law maintains a cautious approach toward remedying public environmental interests through litigation and does not grant standing to public authorities or NGOs to bring lawsuits seeking compensation for environmental damage²⁷.

In China, however, there has been an ongoing debate regarding the nature of liability to the environment²⁸. Scholars have discussed whether environmental damage should be remedied through tort law or administrative law. The environmental liability regime is a good example to illustrate this divergence. Even though the SPL primarily operates as an administrative liability regime for environmental damage through administrative enforcement, it also leaves a window for civil law regime. Article 97 specifies that if soil pollution causes harm to the public and national interest [40], a qualified authority or organisation may file claims in court in accordance with the Environmental Protection Law of 2014 [40], the Civil Procedure Law [77], and the Administrative Procedure Law [78].

4.3. Temporal Dimension

Retrospectivity is a complex issue concerning the interplay of time and the force of law, particularly in how the law affects past events [79] (p. 215)²⁹. In the context of environmental law, retrospective effect means that the law can hold a polluter liable even for activities that occurred before the introduction of the law. The retrospective nature of a law can result in various effects on imposing liability for past events. These effects can include true retrospective and quasi-retrospective impacts. For instance, in Germany, the Federal Soil Protection Act only permits quasi-retrospective effects, which means it applies to polluting activities that began in the past but are still ongoing [80] (p. 321). In contrast, true retrospective effects can hold individuals or entities liable for polluting activities that have already concluded in the past.

Although the P2A does not explicitly indicate its retrospective application, it is widely acknowledged by courts and scholars that the P2A can retrospectively hold the polluter liable [81]. Similarly, the SPL does not expressly clarify its retrospective nature through provisions, but the intention of the legislature can be inferred from legislative materials and the broader context. During the drafting stages of the SPL, the legislature initially limited the liability for soil pollution to activities conducted after the 'Environmental Protection Law of the People's Republic of China (for Trial Implementation)' came into effect on September 13, 1979³⁰. However, this limitation was removed in the final legal text, allowing for the pursuit of retrospective liability for polluting activities that occurred before 1979. This change clearly demonstrates the legislators' intention to make the SPL a retrospective law and can be further supported by the overall context of the SPL. The P2A primarily targets historical pollution and seeks to establish liability for the original polluters, even if the polluting activities occurred before the enactment of the P2A. On the other hand, the SPL removed the time limitation (after 1979) for pursuing liability against polluters. In this regard, both the P2A and SPL exhibit a true retrospective effect.

When it comes to imposing retrospective liability on the successors of original polluters, P2A and the SPL take distinct approaches. Article 47 of the SPL explicitly states that if the polluter changes due to merger or insolvency, its successor is legally obligated to undertake clean-up activities [48]. This explicit provision confirms that the predecessor of the successor should have been held liable, and the responsibility for remediation can be shifted to the successor. However, in cases within England and Wales, courts have adopted a different stance, denying that the P2A can retrospectively hold a predecessor liable, particularly if the predecessor has ceased to exist [67]. This judicial interpretation effectively relieves the successor of liability for contamination caused by its predecessors.

4.4. Financial Guarantee in Case of Insolvency

Since the clean-up of contaminated sites is often expensive, financial guarantee is also a crucial component in developing an effective liability regime. This is not problematic if the responsible party can be easily identified and is financially solvent. However, practical challenges complicate the situation. One challenge is the difficulty of determining who should be held liable. As mentioned earlier, the nature of soil pollution makes identifying the parties responsible for it more challenging.

In England, when contaminated land is unattractive for development, or when there is no appropriate person under P2A, it has been recommended that the cost of clean-up should be covered by public funds, especially for orphan sites [82]³¹. Under section 78P of P2A, if an undue financial burden is placed on the appropriate person, which means that the cost of remediation would be excessively high for them, the enforcing authority can choose to waive or reduce the remediation cost [17]. In this way, public funds can cover part or even the entire cost of remediation. In the fiscal year 2009/2010, DEFRA allocated £17.5 million via the Contaminated Land fund; however, this funding significantly decreased to £2 million per annum in 2013/2014 [75] (P. 239). Starting from April 2017, DEFRA ceased providing contaminated land funding as capital grants to local councils [83]. According to the Environment Agency, from 2000 to 2013, the majority of contaminated sites (371 out of 460) in England were remediated directly by the Environment Agency or the local authority. Typically, 85% of these remediated land sites received direct funding from the central government, while only 13% were remediated through payments from class A and class B persons [32]. This underscores the significant reliance on the funding status of local authorities for the effectiveness of land remediation. Unfortunately, due to broader factors like austerity measures and Brexit, certain funding programs have been abolished or are no longer available [84]³². In this context, local authorities may struggle to effectively remediate contaminated land due to insufficient funding support.

In China, the State Council issued the Soil Pollution Prevention and Control Action Plan in 2016, calling for the establishment of a special fund for soil pollution [85]. From 2016 to 2019, the central government allocated 28 billion yuan to support detailed investigations of soil pollution status and efforts to prevent and control soil pollution [86]. Drawing lessons from the experiences of other countries, the SPL in China introduces several mechanisms to provide financial guarantees for historical environmental problems [87]. These mechanisms include funds, loans, and tax incentives. According to article 71, the State is responsible for establishing a dedicated fund for the prevention and remediation of soil pollution. This fund is set up at both central and local levels, with a specific focus on preventing and remediating agricultural land and managing the risks of contaminated sites when the polluter or land usufructuary cannot be identified [48]. However, many fundamental issues remain unanswered in this new law and in the previously mentioned Measures, such as the source of the funds and the practical functioning of the fund [36].

Both China and England have heavily depended on public funds to facilitate land remediation efforts [88,89]³³. In England, although the liability rules have been firmly established since 2000, practical implementation has shown that only a minority of contaminated land sites (less than 10%) have been remediated by the liable parties themselves [32]. This underscores the significance of supplementary mechanisms in addition to the liability regime. These insights might help both the judiciary and governments in China maintain realistic expectations regarding the effectiveness of the SPL regime.

5. Concluding Remarks

P2A in England and the SPL in China share a similar liability distribution design, attributing the liability for remediating contaminated land to firstly the original polluter and secondly the landowner/occupier/usufructuary. However, the implementation of these regimes reveals important insights, particularly when considering England's experience with P2A, which spans over 20 years. This experience serves as a valuable case study that highlights the limitations of relying solely on a legal framework to address historical pollution.

In England, where P2A has been in effect for over two decades, it becomes evident that legal regimes, while essential, are not the most important way for effectively managing historical pollution. A substantial portion of contaminated sites was remediated through development or directly by government entities. This realisation underscores the need for a more holistic approach that complements legal regulations with additional elements, such as financial support, robust administrative oversight, and active public engagement. Together, these components work in synergy to achieve the intended goals of land remediation. However, compared with broader environmental issues such as climate change and the loss of biodiversity, it has to be admitted that the contaminated land sites involve more identifiable sources of pollution and polluters. Due to their widespread nature and the complex causation, it is more challenging to pinpoint individual responsibility or establish direct cause-and-effect relationships for liability in the case of climate change and the loss of biodiversity [90,91].

Recognising that historical pollution is a shared responsibility among citizens, the inclusion of hardship provisions and clear exclusion of liability rules becomes crucial. These provisions ensure that the burden of liability is reasonable and fair for those identified as liable parties. Hardship provisions offer relief to liable individuals or entities when the cost of remediation would place an undue financial burden on them. On the other hand, exclusion tests help precisely define the scope of liability by determining which parties should be considered liable in the first place. By preventing the unfair allocation of liability to innocent parties, exclusion tests ensure that those who caused or significantly contributed to pollution bear the responsibility. Compared to SPL, P2A stands out with its well-defined and detailed rules regarding hardship and exclusion tests, making it a valuable source of lessons and practices.

Under the liability regimes developed by both P2A and the SPL, administrative authorities play a pivotal role in enforcing and overseeing contaminated land liability rules. These authorities are responsible for a range of critical tasks, including identifying contaminated land, determining liable parties, issuing remediation notices, and ensuring that clean-up efforts are conducted effectively and in compliance with regulatory standards. This administrative-oriented mode is prevalent among many legal systems, including the US [92], European Union countries³⁴ such as Netherlands [93], Germany [80] (p. 314) and Italy [94] (p. 177), and developing countries such as South Africa and Malawi [95]. The proactive involvement of administrative authorities is essential for translating legal provisions into tangible actions on the ground, thus bridging the gap between policy and implementation. China's use-type-based strategy, as reflected in SPL, introduces a more nuanced approach to land management, aligning pollution control efforts with the sources of contamination. This strategic approach demonstrates China's commitment to addressing environmental challenges through targeted and well-informed measures, adding to the regime's effectiveness.

Author Contributions

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Footnotes

1. Strictly, 'soil pollution' and 'soil contamination' are different. Soil contamination occurs when the concentration of a chemical or substance is higher than would occur naturally but is not necessarily causing harm. Soil pollution, on the other hand, refers to the presence of a chemical or substance out of place and/or present at a higher-than-normal concentration that has adverse effects on any non-targeted organism. This article does not differentiate them. See Reference [5].
2. The first overall official report on contaminated land was Indicators for Land Contamination. Published in 2005, this report demonstrated the detailed areas and classifications of contaminated land in England and Wales. It indicated that around 327,000 hectares on 378,000 sites were affected by chemical and radiological contaminating activities. Among these sites, a small portion was identified as 'Contaminated Land': 33,500 sites, less than 10% of the total number of sites, covering nearly 67,000 hectares. This is because the 'Contaminated Land' was given a narrow meaning in the report. Under current legal regime Part 2A of Environmental Protection Act 1990, land polluted has to meet certain risk standards to be identified as contaminated land. See Reference [9].
3. The UK comprises four countries. Contaminated land legislation is devolved to the parliament of Scotland and the Assemblies of Wales and Northern Ireland. This article focuses on the situation in England.
4. In this article, 'environmental damage' refers to the damage to the environment itself.
5. This can be illustrated by Hansard materials such as: 'I think the origin of the UK policy was, in fact, that the DoE (Department of the Environment) suddenly found that three major housing developments were threatened [by contamination]—the Thamesmead site, Willowtree Lane in Hillingdon and Beaumont Leys, Leicester, all of which were to be [...] small towns, 60,000 was the typical population'. See Reference [13].
6. In 1977, the Inter-Departmental Committee on the Redevelopment of Contaminated Land was established to provide guidance on the redevelopment of contaminated land. This committee was designed to give technical guidance or advice to local authorities, assisting them in dealing with land affected by industrial activities or landfill disposal, including land with no emergent environmental threat. See Reference [19].
7. They are incentive charges, distributive charges, and cost recovery charges. See Reference [13].
8. The Department for Environment, Food and Rural Affairs was formed in June 2001, when the Ministry of Agriculture, Fisheries and Food was merged with part of the Department of Environment, Transport and the Region and with a small part of the Home Office.
9. This article does not provide further introduction to voluntary remediation due to its inconsistent definition across various documents and scholarly sources. Even within the same official document, it might have different meanings. For instance, in the official document 'Dealing with contaminated land in England and Wales, 'voluntary remediation' on page 5 is described as 'site owners, those responsible for the site, or polluters voluntarily dealing with existing land contamination'. However, on page 36, it is defined as the 'remediation of land affected by contamination by the polluter, landowner, or other interested party, which is not enforced under the Environmental Protection Act 1990'. Scholarly discussions on voluntary remediation often present a broader perspective that encompasses remediation efforts by developers, such as Reference [34].
10. While this document contains inconsistent definitions of voluntary remediation, this particular number (4%) aligns with a narrow definition of voluntary remediation without including developers. This is because the document calculated data separately for voluntary remediation, planning remediation, and remediation from P2A. See Reference [24].
11. For example, conservation covenants may achieve higher environmental goals such as improvement for biodiversity.
12. Based on the statutory guidance of P2A in England, '[t]he authority will seek to minimise unnecessary burdens on the taxpayer, businesses and individuals; for example by encouraging voluntary action to deal with land contamination issues as far as it considers reasonable and practicable'. See Reference [32].
13. Article 20 of the EPL 1989 prescribes that governments at all levels shall strengthen environmental protection of rural areas, to prevent soil pollution, desertification, salinisation, alkalinisation, impoverishment, stony desertification, land subsidence, damage to vegetation, soil erosion, eutrophication of waters, the depletion of water resources, the extinction of species and other ecological imbalances. See Reference [39].
14. Article 33 of the EPL 2014 focuses on the protection of rural lands, by requiring local authorities at various levels to take measures to prevent soil pollution, desertification, salinisation, alkalinisation, impoverishment, stony desertification, land subsidence, damage to vegetation, soil erosion,

- eutrophication of waters, the depletion of water resources, the extinction of species and other ecological imbalances; Article 49 specifically combats the diffuse pollution in agricultural lands, by laying down specific rules for agricultural and livestock activities. See Ref. [40].
15. For example, Austria, Belgium (Walloon), Bulgaria, Estonia, Finland France, Hungary, Ireland, Italy, Netherlands, Poland, Romania, Slovakia, Spain, Sweden, United Kingdom. See Reference [55].
16. Article 10 of the Constitution of the People's Republic of China (2018 Amendment): Land in cities is owned by the state. Land in rural and suburban areas is owned by collectives except for that which belongs to the state as prescribed by law; housing sites and cropland and hillsides allotted for private use are also owned by collectives.
17. Section 39(3) of Regulatory Enforcement and Sanctions Act 2008 provides: ... [A] 'fixed monetary penalty' is a requirement to pay to a regulator a penalty of a prescribed amount.
18. Section 42(3) of Regulatory Enforcement and Sanctions Act 2008 prescribes: ...[A] 'discretionary requirement' means—(a) a requirement to pay a monetary penalty to a regulator ..., (b) a requirement to take such steps ... to secure that the offence does not continue or recur, or (c) a requirement to take such steps ... to secure that the position is, so far as possible, restored to what it would have been if the offence had not been committed.
19. If this constitutes a crime. See Reference [57].
20. The common situations are when the regulated person does not pay council tax or when a parent who should pay child maintenance fails to meet their child maintenance obligations. See References [58–61].
21. The competent authority may refer to several administrative agencies depending on the different types of lands, including the ecological and environmental protection agencies, agriculture and rural affairs agencies, forestry and grassland agencies and natural resources agencies.
22. Under Chapter VII Liability for Environmental Pollution and Ecological Damage, a tortfeasor is who has polluted the environment or harmed the ecological system and thus causes damage to others shall bear tort liability. See Reference [63].
23. According to Article 1235 of the Civil Code of China, where ecological and environmental damage is caused in violation of the State regulations, the State authorised agencies or the organisations authorised by law have the right to request the tortfeasor to compensate the following losses and expenses: (1) losses caused by loss of service function...; (2) losses caused by permanent damage to the function of the ecological environment; (3) expenses for investigation, appraisal, and assessment of the damage to the ecological environment; (4) expenses for cleaning-up the pollution and restoring the ecological environment; and (5) other reasonable expenses incurred to prevent the occurrence or aggravation of the damage. In English version of Civil Code, article 1235 provides about 'ecological damage' not 'ecological and environmental damage', however, based on the original Chinese version, it should be 'ecological and environmental damage'.
24. The obligee may, according to the division of duties, designate the relevant department or institution to be responsible for the specific work. See Reference [64].
25. Though this is not clearly indicated in P2A, it is accepted by both courts and academics. See References [67] and [68].
26. Under the current legal system in the UK, as no one can be held legally responsible for water pollution caused by abandoned metal mines, it falls to Government to act, taking the views of all stakeholders into consideration. See Reference [69].
27. In The Environmental Damage (Prevention and Remediation) Regulations 2009, remedying the general environmental damage is through administrative notice served by enforcing authority, and failing to comply with a remediation notice is an offence under criminal law.
28. Means the liability for the damage to the environment itself instead of to private parties.
29. In fact, the retrospective and retroactive effects are different regarding when it imposes liability on the polluter. Limited by space, however, this article does not discuss their difference and uses the two terms interchangeably. See Reference [79].
30. Article 3 in Measures for Identifying Persons Responsible for Soil Pollution in Construction Land (Trial Implementation) (Draft for Comment): Article 3 The person responsible for soil pollution refers to the person responsible for soil pollution after the Environmental Protection Law of the People's Republic of China (Trial) came into effect on September 13, 1979. Leakage, loss, scattering of pollutants or toxic and harmful substances, etc., causing soil pollution, units and individuals that need to undertake risk control and restoration responsibilities according to law.
31. It is worth noting that public funding is not limited to orphan sites, but applies also to private-public partnership projects and obviously contaminated sites that are already under public ownership, such as defence sites. Specific funding usage examples see Reference [82].
32. For example, Contaminated Land Capital Projects funding was abolished in Wales; this was the main source of public sector funding for contaminated land identification and remediation. Also, some EU funding programmes such Green Infrastructure Capital Grant were not available after Brexit. See Reference [84].
33. This feature also aligns with legal systems in countries like the US. In the US, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as Superfund) imposes liability for remediation on responsible parties for the presence of chemicals, regardless of fault or timing of their actions. However, the remediation heavily depends on public funds, as evidenced by newly funded sites. In 2021, the Bipartisan Infrastructure Law allocated \$3.5 billion for environmental remediation at Superfund National Priorities List sites. This investment is one of the largest in American history to deal with historical pollution. According to available data, among the 22 funded sites under this funding, over half underwent remediation funded by public sources, while fewer than four sites were remediated wholly or partly by the responsible polluters. See Reference [88] and [89].
34. This is relevant to the Environmental Liability Directive 2004/35/EC, which established an administrative-oriented regime and has been transposed into domestic laws in member states in the EU.

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