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Environmental Remediation Law and Economies in Transition

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Discussion Paper 99-21

January 1999



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Abstract

The paper discusses the design of environmental remediation laws in countries struggling with fundamental market and institutional reforms. Optimal cleanup standards, liability rules, and enforcement are discussed from the standpoint of both economic efficiency and practical implementation. Particular attention is paid to financing mechanisms and issues that arise during privatization.

Key Words: environmental remediation, liability, privatization, transitional economies

JEL Classification Numbers: K32, P21, Q28

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ENVIRONMENTAL REMEDIATION LAW AND ECONOMIES IN TRANSITION

James Boyd*

1. INTRODUCTION

Nearly a decade has passed since the former command economies of the Soviet-bloc began their journey toward market and institutional reforms. From the beginning, the larger social transition has also generated hope for environmental reforms. Openness, democratization, an increased emphasis on the rule of law, and greater financial strength were thought to bode well for improvements in the region's huge inventory of environmental problems. But like the journey toward economic reform, progress toward environmental improvements has been decidedly mixed. Conditions are generally no worse today than a decade ago, but progress has been slower than hoped for.¹ When it comes to environmental cleanup, the policy issues--like most of the hazardous waste sites themselves--are still very much present.

Several significant constraints have hobbled environmental progress in the region. Perhaps the most important are persistent institutional weaknesses. Whether it is the detection of illegal releases, clear jurisdictional responsibilities for enforcement, the establishment of cleanup priorities, or the actual punishment of environmental misbehavior, the region's environmental institutions remain relatively impotent. These problems are compounded by other institutional weaknesses, including ill-defined or ill-implemented laws governing contracts, bankruptcy, and dispute resolution. Of course, all of these institutional problems are at root due to ongoing financial constraints. Governments, public-sector enterprises, and private sector firms alike have precious little capital to devote to environmental remediation or enforcement. Finally, information constraints, due to a legacy of poor record-keeping, limit the identification, analysis, and prioritization of problems.

Western Europe and North America have had their own problems (and a ten or fifteen year head start on their Eastern European and Asian counterparts).² Difficult as they have been, reforms in the West have been built on an institutional and economic foundation that is currently not available in many of the former Soviet republics and satellite states. For this reason, analysis of environmental strategies in the region requires a clear vision of the hurdles

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¹ For an earlier note of pessimism regarding the pace of environmental change in the region see Bowman and Hunter (1992).

² See Acton (1989) and Church and Nakamura (1993) for descriptions of the hurdles--some cleared, others not--that confronted U.S. soil cleanup programs.

that must be faced. It also suggests that the best path to environmental improvement is likely to differ substantially from the path taken in the West.

This paper describes the institutional challenges to meaningful environmental reforms in the region. One thing that will be given particular stress is the inter-connectedness of needed reforms. The paper's primary focus is on the design of remediation laws to govern site cleanup standards. But it is immediately apparent that this type of reform is inextricably linked with liability law, which defines who is responsible; the privatization process, since the value of property assets is directly linked to environmental conditions and obligations; and the operation of state-run environmental financing schemes. Deciding which properties should be cleaned up--and how clean they should be made--in one sense can be viewed as a narrow technical exercise. The ramifications of remediation decisions are anything but narrow, however. Who is responsible for the cleanup, particularly if the contamination predates privatization? These are the questions for liability reform. If private entities are not responsible, or cannot be made to pay, how will funds be raised and directed toward remediation? What institutions will be responsible for the implementation of these rules and what resources do they have at their disposal? How does all of this affect the privatization of state assets and other economic activity? Clearly, it is difficult to draw a neat boundary around the issues. Having said that, a pragmatic analysis of the region's problems does yield a set of basic prescriptions: the need to identify risks, the need to prioritize the expenditure of scarce resources, and the need to achieve environmental improvements in the absence of the institutional controls we in the West take for granted.

The paper begins by describing an unobtainable ideal: an optimal approach to remediation standards based on cost-benefit principles and ideal institutions. This approach is an unobtainable aspiration in any country.³ Nevertheless, it provides a baseline of goals toward which any system should aspire. Then, the analysis allows the real world to intrude via a description of informational barriers and institutional weaknesses. Having explored the constraints, we conclude with a set of "second-best" prescriptions for legal reforms. The goal is a set of approaches that take into account the need for prioritized cleanup, the desire for harmony with the privatization process, and limited financial resources.

2. REMEDIATION POLICY IN ITS IDEAL FORM

The region is burdened with a legacy of environmental degradation due to decades of relatively unrestrained economic activity and governmental neglect of environmental controls. This legacy raises two fundamental questions. First, how are contaminated properties to be cleaned up (which ones should be targeted and how clean should they be made)? And second, who is responsible for the costs of that cleanup? We will begin the analysis by providing an idealized answer to those questions, based on normative economic analysis.

³ See Hamilton and Viscusi (1997) for a detailed description and analysis of proposed reforms to the U.S. Superfund law. Their article emphasizes the degree to which the relatively "advanced" U.S. program fails to incorporate principles that would emerge from a normative economic analysis of remediation policies.

2.1. Remediation Standards

Which sites should be environmentally restored and how clean is clean enough? Not surprisingly, the economic answer to this question makes reference to both the costs and social benefits of remediation. Sites should be cleaned when the benefits of remediation due to improved human and ecosystem health, development potential, and aesthetic improvements exceed the costs. Priority should be given to those sites where the net benefit is the greatest. While this may sound like a simple enough rule, the problem becomes significantly more complicated as the full range of relevant costs and benefits is contemplated. Moreover, the actual measurement of costs and benefits once relevant categories are identified is a formidable challenge in itself.

Remediation's costs

The most obvious categories of remediation costs are those arising from capital and labor expenditures. These are the direct outlays associated with a given remediation response. As experience with site remediation in the U.S. and Europe has shown, these direct outlays can be difficult to predict and are highly idiosyncratic to specific sites. Geologic factors such as soil permeability and groundwater transport vary from site to site and can require technological approaches whose costs vary widely. This category of costs is what is most commonly referred to as the "costs of cleanup."

In addition to direct outlays, however, there are several other types of cost that must be considered. First is the opportunity cost of using resources to clean sites rather than build bridges, schools, and hospitals. These opportunity costs are particularly high in less developed nations since environmental problems compete with a host of other significant social ills for social attention. In essence, the concept of opportunity cost allows for a comparison of broad social priorities. Second, remediation creates administrative, monitoring, and enforcement costs. These institutional costs vary across alternative remediation policies and loom particularly large in less developed economies, due to limited institutional resources.

Finally, the costs of environmental remediation are likely to be lower in the future as a consequence of technological innovation (and perhaps a lower social opportunity cost of capital as a nation's wealth increases). This means that the temporal "path" of cleanup costs may be relevant to the decision of when, and how much, to clean up.

Remediation's benefits

The benefits of remediation arise from improvements in human and ecosystem health or the avoidance of future degradation in health or environmental quality. The benefits of cleanup are therefore directly linked to the exposure pathways associated with a site. For example, are contaminants contained or are they spreading off-site to drinking water supplies? The benefits of avoiding off-site exposures tend to be much higher than the removal of contaminant from sites where there is little human exposure. In general, the benefits of

cleanup are greatest when toxicity is high and there is a large exposed population or habitat.⁴ As in the case of costs, numerous uncertainties complicate the measurement of benefits. From a technical and epidemiological standpoint alone, the fate and transport of contamination and its impact on health is difficult to calculate.

Once exposure pathways have been identified, calculation of cleanup benefits requires several other types of data. First, how are exposure pathways linked to land uses? The benefits of cleanup are high if the land is in close proximity to a population that cannot avoid the site. But alternative land uses can in some cases lower the benefits of remediation. For example, land use conversion from a grade school to an industrial facility, all else equal, lowers the benefits of remediation. It does this by providing an alternative means to avoid exposure. Benefits analysis therefore requires a broad analysis of demographic projections and land use alternatives. Having said this, it is worth noting that in financially and institutionally constrained economies, the ability to alter land uses and control development is limited.

Second, the social benefit of cleanup is ultimately derived from the value individual members of society place on their own health, the health of others, and the "existence value" of a cleaner environment. Ideally, these values are known by government decision-makers. In practice, they are notoriously hard to measure and tend to be expressed politically--an unavoidable, but inherently imprecise signal of individual values.

Third, the analysis of benefits requires knowledge of the "collateral" effects created by a given remediation strategy. For instance, does remediation require excavation and transport of contaminated material? If so, there will be exposure risks created by the remediation itself. The true incremental benefits of remediation must take these collateral effects into account.⁵

The assessment of options and the "ideal" solution

An assessment of benefits and costs--and risks associated with those benefits and costs--is central to an optimal approach to remediation. Risk and benefit-cost analysis is necessary to determine the priority that should be given to a site, relative to other sites. It also necessary to the determination of the most appropriate remedial measures to be undertaken at a given site. Typically, there is a range remedial options open to the regulator, including on- or off-site treatment of excavated soil; disposal of excavated, but untreated soil, on- or off-site; containment of soil that is neither excavated nor treated; and on-site treatment of soil that is not excavated.

Each of these options has site-specific benefits, for instance depending on the composition and location of wastes and geologic factors. Each also has site-specific costs. For example, the options' relative costs will vary depending on proximity to off-site disposal. Off-site disposal will also involve costs due to short-term exposure in transport that will vary

⁴ This is true for health-related benefits, but may not always be true for ecosystem benefits.

⁵ One of the reasons to encourage benefit-cost analysis is that it stimulates a full accounting of the consequences of different actions.

depending on the soil's characteristics. Cost-benefit analysis can be used to identify the approach at each site that yields the highest net benefit.

What about the question of how many sites should be cleaned up? Here, the prescription is to require remediation first at the highest priority sites (those where the net benefits are greatest) and then until the marginal social costs of greater stringency (including opportunity costs) exceed the marginal social benefits. Stated generally, this is a rather unhelpful rule. And because of uncertainties and data limitations it can never be applied with real precision. However, rules derived from benefit cost analysis do yield a set of practical, if qualitative, implications.

First, the optimal standard for remedial action is site-specific. This follows directly from the fact that the costs and benefits of remediation are site specific. Uniform standards are attractive in practice because they minimize ambiguity, are therefore easier to implement, and are superficially "fair." Generally, however, they are not economically efficient.

Second, not all sites should be aggressively remediated. When costs are high and benefits low, simple monitoring may be the most desirable intervention.

Third, remediation standards should probably be less stringent in less economically developed countries. This conclusion sounds ethically unappealing but is a direct consequence of differences in wealth and competing demands on budgets in the developing world. Rubles spent on site cleanup could be spent on healthcare. Given that there is relatively little government financing, remediation standards equivalent to those in the West would drain finances away from other socially beneficial programs.⁶ U.S. or European Union remediation standards are a desirable aspirational goal, but will quickly bankrupt environmental budgets if pursued in the near-term.

Fourth, because the costs and benefits change over time, the optimal level of remediation is intimately related to its timing. In particular, countries should not rule out a strategy of limited action, with actions focused on the containment of the most threatening sources. Also, care should be taken to not inhibit the development and application of innovative remediation technologies. Technology-based standards, while easy to monitor and apply, can thwart the search for more innovative and cost effective cleanup methodologies.

These conclusions are not entirely pragmatic. We have not yet adequately accounted for a whole set of relevant institutional and informational constraints. As a starting point, however, they define the broad outlines of an economically efficient remediation program.⁷

⁶ Of course, not all competing uses of state financing are as socially desirable as schools and hospitals. Nevertheless, if governments take a broad set of social benefits and costs into account, and if wealth is scarce, it follows that environmental standards should be lower in poorer countries.

Another argument for lower standards is that they are more realistically enforceable. In nations where there is often a vast difference between the letter of the law and its implementation, standards that cannot be practically enforced undermine respect for the "rule of law."

⁷ There is often a gulf between what is pragmatic and what suggested by economic efficiency. The point of this analysis is to incorporate pragmatic considerations into the economic analysis of options so that, of the pragmatic options, we can choose the one that is most economically desirable.

2.2. Liability for Remediation Costs

Liability law defines responsibility for the costs of remediation. The definition of responsibility for costs serves two conceptually distinct functions. First, responsibility deters future pollution by forcing environmental cost internalization. This is the *prospective* effect of liability, in that it relates to the current and future motivation of precaution against environmental contamination.⁸ An ideal liability system therefore includes full, prospective liability for polluters, whether the polluter is the state, foreign-based investors, or newly privatized firms.

Liability serves an additional function during periods of economic and legal transition. When environmental remediation laws are implemented for the first time there is always a question of who should be responsible for existing contamination. This *retroactive* liability may fall on the original polluter, the current owners of polluted assets, or the government.

The assignment of retroactive liability is at its heart a financing issue. The retroactive application of liability yields no deterrence-related benefit. The decisions that led to the retroactive liabilities were made years or decades earlier and were, by definition, legal at the time. Because the decisions which led to the pollution were made in the past, these environmental costs should be treated as given, or sunk. Therefore, the primary focus of this retrospective component of the problem should simply be on how remediation costs are best financed. The scale and retroactive nature of these costs has made the question of liability for historic contamination a contentious one in most countries that have undertaken environmental reforms.⁹

In established market economies the "original polluter" is usually a private firm (or firms) whose resources are tapped to finance remediation. In transitional economies the original polluter is usually the state itself. If there is no private party that can be identified as responsible for pre-existing pollution, there is obviously no private party that can be required to finance remediation. And even if a private party were responsible, financing is available from this source only if they continue to be a functioning legal entity with the ability to pay for remediation. There are therefore two sound options available to transitional economies: one, the state accepts responsibility and finances remediation out of public funds and two, responsibility is transferred to new owners via the privatization process.¹⁰

⁸ See Landes and Posner (1987) for a history of the development and justifications for the theory of strict liability. Strict environmental liability is also mandated by statute, as in the Superfund amendments.

⁹ Not all countries have pursued the same approach. As examples, and at the risk of oversimplification, Germany and Denmark did not hold polluters responsible for historic contamination, thus shifting the financial burden to the public sector. In contrast, the United States and the Netherlands favored private sector responsibility. In these countries polluters, subsequent site owners, and a range of other private parties were made liable for historic contamination even though they may have been in full compliance with applicable law when the pollution occurred. Not surprisingly, debate and dissatisfaction over this method of remediation financing continues to rage two decades after the initial legal reforms were instituted. For a country-by-country description of approaches to retroactive liability see Goldenman et al. (1994).

¹⁰ Indemnity agreements are the typical vehicle for state retention of liabilities. These agreements are a form of contract which absolves the new owner of legal responsibility for existing environmental problems. This system is the approach taken by Germany in its absorption of assets from the former East Germany.

There is an important proviso that must be attached to the latter option: namely, that new owners know that they are accepting responsibility at the time privatization deals are negotiated. This allows new owners to discount property prices by the amount of liability acquired. If asset purchasers are unaware of the liabilities they inherit, and fail to account for them at the time of purchase, the retroactive application of liability to newly-privatized firms is ill-advised.¹¹ Large retroactive liabilities threaten the solvency of fledgling firms and, because the liability is retroactive, there is no deterrence-related benefit. In fact, retroactive liability can weaken deterrence, precisely because it threatens firms with insolvency. This is because liability fails to adequately deter when the firm is unable to bear the full costs of pollution it can create. By weakening the firm's financial position, retroactive liability undermines the success with which the firm can be made to internalize future environmental costs.¹²

As long as there is full knowledge of the liability rule, state retention of retroactive liability and new-owner acceptance of liability are "distributionally equivalent." The state bears the cost of remediation in either case. In the former case, the state retains responsibility for cleanup. In the latter case, the state still pays for the remediation. This is true since the new owner requires compensation in order to accept responsibility. The most likely and direct form of compensation is a reduction in the property's purchase price. In theory, the privatization proceeds forgone by a shift in liability to the buyer will precisely equal the remedial cost (the liability cost is perfectly capitalized into the purchase price).

In summary, the ideal allocation of liability has the following properties. First, firms should be unambiguously liable for costs they create after privatization (full prospective liability). Second, the cleanup of historic contamination can be financed in a variety of ways. Two methods of particular relevance are the use of public environmental funds and a compensated transfer of responsibility to the private sector during the privatization process. In both of these cases it is the state that ultimately bears the cost of cleanup.

3. A LESS IDEALIZED DEPICTION OF THE ISSUES: INSTITUTIONS AND CONSTRAINTS

Economics can help guide the definition of optimal remediation standards. However, the larger legal and institutional context within which the standards will be defined, applied, and enforced presents a host of issues that must be addressed by a pragmatic economic analysis. Any discussion of institutional challenges in transition economies must begin with the stark fact that per-capita GDP in the former Soviet Union is less than a tenth of Western European and American levels. And unfortunately, economic weakness in the former Soviet system did not restrain the pace of environmental degradation. Remediation costs, while

¹¹ International investors, fresh from their own domestic experiences with retroactive liability, tend to be fully aware of the risks they face when acquiring tainted assets. Domestic investors may be more naïve regarding the environmental costs they inherit.

¹² For a more extensive exploration of the relationship between retroactive liability and prospective deterrence see Boyd and Kunreuther (1997).

difficult to estimate, will be huge.¹³ The combination of scarce wealth and costly remediation problems means that not all sites will be cleaned up in the near future. Thus, the greatest challenge for environmental policy in the region is the direction of scarce resources to the sites where expenditures will yield the highest benefit. *Ad hoc* distribution of remediation expenditures is both wasteful fiscally and dangerous environmentally.

A system to target the worst problems first must confront a set of important institutional constraints. The previous section identified the types of information relevant to a calculation of benefits and costs. The prescriptions identified were termed "ideal" because they avoided all discussion of the institutions required to implement an enlightened policy. It is to these institutional issues that we now turn.

3.1 Assessment

Prioritized remedial actions require the identification and assessment of existing pollution sources. Knowledge of the hazards of contamination and the costs of cleanup is costly to acquire, however. In terms of site identification alone, the task can be difficult. For instance, site assessments in the U.S. typically employ title searches, building permit audits, and regulatory compliance documentation to determine past property use and potential sources of contamination. These types of record-keeping are generally unavailable in transitional economies. Identification must therefore depend primarily on employee interviews and the detection of obvious forms of contamination.

Once a site has been identified as a potential source of environmental problems, an audit is necessary to reveal specific hazards and corrective actions. Unfortunately, environmental auditing can cost upwards of \$100,000 for an industrial site. Assessment requires expertise in remedial technologies, epidemiology, geology, and chemistry. Many of the post-Soviet economies are quite well-endowed with scientific expertise that can be harnessed to conduct such studies. To date, however, the skills and market for practical site assessment are under-developed.

Poor assessment capabilities pose a challenge not only to the identification of sites and appropriate remedial responses, they also complicate the assignment of liability. Recall from the previous section that it is desirable to distinguish between historic contamination and contamination that is created post-privatization. Two potential problems arise if we cannot accomplish--with assessment--this kind of precise separation. First, future owners may claim that pollution they created (and for which they should be responsible) was a pre-existing condition. If the government is legally responsible for retroactive liability, the lack of a precise inventory of pre-existing contamination undermines prospective deterrence.¹⁴

¹³ Per-country estimates of remediation expenses commonly range in the hundreds of billions of dollars. See Berz and Connolly (1992) and Gelb and Gray (1991). It is worth noting that these estimates are implicitly based on compliance with Western cleanup standards.

¹⁴ There is a form of moral hazard present when a new owner can claim their own pollution as pollution that was pre-existing and therefore the responsibility of the government.

Ambiguity cuts the other way, as well. For instance, the government may argue that pre-existing contamination was not in fact pre-existing and seek compensation from the new owner. Even with exhaustive environmental auditing, foreign investors may shy away from deals because of the risk that undetected pollution sources (or sources migrating from neighboring properties) will be revealed at a later date.¹⁵ Either way, the lack of a precise inventory of site conditions at the time of ownership transfer is problematic and will either negatively affect deterrence or the privatization deal itself.

3.2 The Expression of Social Preferences for Environmental Quality

The benefits of environmental improvement--and therefore remedial priorities--are inescapably value-laden. If attention is directed at one site, or toward one type of risk, this will inevitably come at the expense of a different set of hazards. Cost-benefit analysis holds out the hope of an objective methodology for the resolution of conflicts. But it does so by embedding often conflicting goals in the definition of "benefits." There can be no single "objectively optimal" level of remediation if members of society disagree over the types of risks that are most undesirable.¹⁶ Dose-response relationships, the relative risks presented by different exposure pathways, and the value of improved health are issues that cannot be answered by a purely objective methodology. Moreover, there is a vast literature on the divergence between public perceptions of environmental risk and so-called expert perceptions of environmental risk.¹⁷

The way in which objective methodologies incorporate the expression of less objective social preferences is not a problem limited to countries with emerging institutions. In the developed nations environmental policy calls on a range of social institutions to mediate the conflicts that arise from that kind of divergence--with varying degrees of success. For example, public participation, the delegation of enforcement authority to localities, and federalization are legal-institutional arrangements designed to make environmental policy more responsive to social values and perceptions. In fact, some form of public participation in the definition of standards is necessary in an ideal world. After all, how else are the social benefits of environmental remediation to be estimated?

If priorities are to be truly expressed, this must occur within the context of new forms of political expression and bureaucratic administration. Generally speaking, environmentalists have a relatively strong voice in the former Soviet economies, since environmentalism was historically one of the only acceptable forms of dissent. Objective standards for priority-setting are extremely important, particularly in economies where resources have tended to be

¹⁵ See Thomas (1994) who uses auction theory to emphasize the importance of environmental auditing to property transfers and the maximization of privatization revenues.

¹⁶ Disagreement reflects not only individuals' desires regarding the avoidance of risks they themselves face. It also reflects differing views regarding fairness in the distribution of risks throughout society.

¹⁷ As an example see Slovic, Fischhoff, and Lichtenstein (1980).

allocated politically, rather than "objectively." Nevertheless, it is also important to understand that the search for priorities will always be value-lade, and thus political.

3.3 Conflict Resolution and Rule Specificity

Even if remediation standards and liability rules are defined without conflict, conflict is virtually guaranteed to arise when the law is applied to real sites. There is always room for subjective interpretation of even the most precise, detailed standards. Is the responsible party meeting its obligations? Is the environmental authority acknowledging performance appropriately? Are the site's condition's being monitored effectively? These are all areas where private property owners, the state, NGOs, and neighboring citizens will find room for disagreement. Also, substantive disagreements over the issues in a particular case may be exacerbated by jurisdictional conflicts. Enforcement responsibility is notoriously fragmented (and simultaneously duplicative) in most of the transitional economies. Administrative reforms that more precisely delineate spheres of responsibility are perhaps the first step in the construction of a truly cost effective system of regulation. For remediation standards and liability rules to be effective there must be an institutional mechanism for the timely resolution of conflicts. Without such a mechanism, conflict leads to uncertainty and delay.

Moreover the costs associated with enforcement highlight a conflict between theoretically optimal remediation standards and standards that can be meaningfully enforced. Ideal standards reflect site-specific costs and benefits. This implies that remediation standards themselves should be site-specific.¹⁸ But site-specificity is at odds with uniformity. And uniformity is desirable if monitoring and the minimization of legal ambiguities is desired. The design of an efficient, but pragmatic, remediation policy must confront this tradeoff. As argued in the previous section, uniformity has a cost. Namely, that it does not focus expenditures on the highest-priority sites. But site-specific approaches create institutional costs associated with monitoring, enforcement, and conflict resolution.

3.4 Complementary, Non-environmental Legal Reforms

There are a set of legal reforms that have no explicit environmental content, but that are complementary to--and in some cases necessary for--the effective operation of remediation law.

The credibility of contracts and stability of regulatory agreements. Contracts are at the heart of the privatization and remediation agreements that will be reached under the law. At the time of privatization, assets will be transferred, but not necessarily liabilities. A buyer's belief in the retention of retroactive liabilities by the state is predicated on a sound, meaningful contract. The newness of property and contract reforms in the transitional countries can undermine confidence in contracts and thereby undermine the credibility of

¹⁸ This is true even if, say, the underlying level of acceptable risk is held constant across sites. Because exposure pathways and cleanup costs vary from site to site, the optimal standard of action to be taken will vary from site to site.

remediation law. Several problems can arise. For example, new property owners may lack confidence that what is "clean enough" for the government today will be clean enough tomorrow. This is a risk that will undermine investors' willingness to pay for assets during privatization.

Bankruptcy and commercial law. Bankruptcy law governs the conditions under which a firm has its debts—including its environmental liabilities—discharged in the event of insolvency. Given the financial weakness of newly privatized firms, bankruptcy law's effect on a firm's incentives should be carefully considered. First of all, will the government actually allow bankruptcies to occur? In many countries bankruptcy is resisted in order to avoid unemployment and the dislocation of assets. The threat of bankruptcy is necessary, however. Without it, firms have a weakened incentive to avoid environmental problems or meet their legal obligations. Only if bankruptcy laws are enforced are shareholders and managers adequately penalized for poor environmental performance. Rules of incorporation may also play a role in an effective compliance and enforcement system. Rules of incorporation can place conditions on the solvency of firms with environmental obligations. Firms without the assets to compensate for environmental damage or the resources to finance cleanup obligations are likely to be inadequately motivated.

Zoning and land use law. The aforementioned tradeoff between the desire for site-specific remedial standards (which reflect site-specific costs and benefits) and more uniform standards (which are easier to draft and implement) may lead us to consider an intermediate option: namely, a hierarchy of land use-sensitive standards. Standards could be uniform within a particular land use type, but vary across types. Zoning law is a natural vehicle for defining land use classifications. If zoning classifications existed, standards could be tied to a property's status as industrial, commercial, agricultural, residential, or recreational land. Zoning law may be a particularly desirable complement to remediation law because it is often locally-defined. Communities could have input to remediation standards by having input into zoning classifications. Zoning law also fosters environmentally rational land use planning. For instance, relatively hazardous land uses can be sited together and isolated from residential, agricultural, and recreational areas.

3.5 Liability-driven Distortions in Real Estate Markets

Adverse selection and the properties to be privatized. Because a full inventory of existing contamination is typically impossible and because the monetary value of responsibility is inherently uncertain there is the potential for significant distortions in the region's real estate markets. Whether liability is transferred or not, buyers are in effect purchasing an asset of unknown quality—where quality in this sense refers to the liability explicitly or inadvertently inherited through purchase. Information asymmetries between the government and potential purchasers can distort investment decisions. Investors will rationally discount their demand for properties based on an expectation of average environmental quality—and the implied liability cost of environmental conditions. This discount in willingness to pay restricts the government's supply of high quality (relatively

unpolluted) properties. In turn, a potential investor's discount is adjusted downward to reflect the rational expectation that clean properties will not be represented in the market. The result is an adverse selection problem--in which high quality, but environmentally risky, properties are not brought to market.¹⁹

Excessive greenfield development. An additional, negative consequence of the adverse selection problem is that it can create a distortion toward the development of so-called greenfield properties--i.e., properties that are free from environmental risks because they have not been previously associated with industrial or commercial activity. To the extent that there is a failure in the market for environmentally risky properties, demand for these greenfield properties may be artificially high. The development of greenfield sites is not likely to be socially desirable since greenfield properties lack the infrastructure and proximity to labor of existing industrial sites and their development by definition results in increased environmental degradation.²⁰

Negative value properties. A general maxim in economics is that resources should not be expended on the maintenance of properties or industrial facilities with a negative value. The term "negative value property" arises frequently in discussion of liability and privatization. But it is important to distinguish between properties that have a negative *prospective* value and properties whose prospective value is positive but smaller than the remedial costs associated with historic pollution. The former are truly negative value properties and should not be privatized or supported by government intervention. In contrast, the latter should be developed precisely because their prospective value is positive. The retroactive liability is a sunk cost and is therefore irrelevant--to quote another economic maxim.²¹

Of course, from an investor's private standpoint the retroactive liability is very relevant. For this reason, liability should not be transferred to the new buyer when a property has a positive prospective value but large existing remedial costs. If retroactive liability is transferred, the property will not find a buyer. This follows since the purchase price reduction required to compensate the buyer for accepting liability will exceed the property's prospective value. In such a case it is necessary for the state to retain at least part of the retroactive liability in order for privatization to occur.

3.6 The Impact of Remediation Law on the Privatization Process

The assignment of liability and the stringency of remediation requirements are inescapably linked to the process and politics of asset privatization. Liability rules and

¹⁹ The adverse selection problem may be mitigated to the extent that the government forces itself to sell the entire portfolio of state-owned assets. When privatization is forced, information asymmetries depress the sales revenue received by the government but will not reduce the number of properties that trade.

²⁰ For a more detailed analysis of this greenfield problem--distortions in land use by environmental liabilities--see Boyd, Harrington, and Macauley (1996). And see Segerson (1997) for an analysis of interactions between liability and real estate markets.

²¹ If development of the site increases the cost of remediation (for instance due to the need to achieve a higher level of safety) the incremental costs due to development are relevant to the development decision.

remediation standards have an immediate impact on privatization and investment decisions via their impact on the value of assets. Net asset values are reduced by the presence of liabilities attached to the property. In turn, liabilities attached at the time of privatization are a function of environmental conditions and the contractual, regulatory, and legal rules governing responsibility for existing conditions. All of this means that risks associated with environmental liability can significantly inhibit privatization. In fact, much of the attention that has been drawn to environmental problems in the former Soviet Union and Central and Eastern Europe has been due to the effect of environmental concerns on the privatization process. In turn, the politics and economics of privatization wield significant power over the direction of environmental reforms.

The privatization ministries. Ministries of privatization are a locus of financial and political influence in transitional economies. The scale of wealth being transferred via the privatization process, and the implications of that wealth transfer for political fortunes, guarantee the ministries' place near the head of the institutional food chain. The bureaucratic motivation of these ministries is fairly straightforward: maximize privatization revenue.

Section 2 described the way in which the state pays for retroactive remediation costs irrespective of whether it retains liability or transfers it to new owners.²² The implication is that the government should be indifferent between the two options. This is true in theory, but not in practice. In practice, privatization ministries seek to maximize *current* revenues. Note that this is accomplished by retaining retroactive liability. By retaining liability, the purchase price is maximized. While the government will eventually be liable for cleanup, that day is far in the future and quite probably some other ministry's problem. For this reason, domestic governments tend to pursue a policy of liability retention in privatization negotiations. This is usually at odds with the wishes of foreign investors, however.

Investor incentives. The transfer of liability at the time of sale is often preferred by investors. First, purchase price reductions provide direct compensation for expenses. Second, transfer of liability provides the investor with control over the property's environmental conditions. Most investors prefer ownership of a property that they will remediate (when remediation is compensated) to a property that the government is expected to remediate some time in the future. This is particularly true given the informational problems associated with determining what environmental contamination existed at the time of site transfer. It is reasonable to be concerned about the possibility that the state will not fulfill its remedial obligations and that ongoing contamination will be blamed on the new owner or will gradually erode the value of the property.

The expected cost of remedial obligations. There is often a "wedge" between the government's expectation of remedial costs and foreign investors' expectations. This is due to uncertainty regarding both the conditions at sites and future remedial obligations required by law. It is also due to foreign firms' experiences with liability in their domestic markets. Even

²² Recall that the state pays directly, by retaining its responsibility for cleanup, or indirectly, via reductions in purchase prices demanded by buyers who accept liability.

if transitional governments claim that remedial standards will not prove to be that costly, most foreign firms are risk averse when it comes to environmental remediation. Fearing the worst, and seeking to insure themselves against it, foreign firms desire western-style site cleanup (at least as long as the costs are compensated). Note that western-style cleanups are not likely to be efficient. The desire for comprehensive cleanup at a site is understandable, and may be necessary in order to attract foreign capital, but the cleanup of a relatively small set of sites to western standards is not the most efficient use of scarce remediation funds.

3.7 Policy Mechanisms to Finance Remediation

When the state retains liability for historic contamination remediation must be financed by the state. A common financing vehicle is a state-run "pooled" fund. Another common financing vehicle is the environmental escrow fund. These property-specific funds can be employed both when liability is retained by the state and when it is transferred to new owners.

Environmental escrow funds. Environmental escrow funds are time-limited accounts that place a portion (sometimes all) of a property's purchase price in a dedicated account. They can be established to reimburse new owners for both previously agreed upon and subsequently revealed environmental liabilities. The value of these accounts is typically negotiated, as are the terms under which funds can be drawn from them.²³

For a buyer, escrow funds are a form of insurance or warranty--a form that is particularly credible given their earmarked and protected nature. They serve several functions. First, when a liability is unknown at the time of sale and is subsequently revealed the fund acts as a form of insurance against remedial costs. Second, the fund acts as a performance bond, guaranteeing that the state will perform its remedial obligations when liability is retained by the state.

Escrow funds also protect the state's interests. Buyers commonly agree to investments at the time of privatization. For example, a foreign investor may agree to upgrade a plant's capital equipment. They may also agree to expenditures on environmental remediation. Escrow funds guarantee performance of these obligations.

Another advantage of escrow funds is that they can facilitate privatization negotiations by taking the precise definition of environmental obligations "off of the table." In other words, the parties can agree on a selling price that is independent of environmental considerations, knowing that an escrow fund will be in place to provide compensation. The government, for instance, can agree to remediate the site if problems are found and use the escrow account as its guarantee. Unfortunately, this only defers negotiations over the remediation approach. Because disbursement of the funds requires the joint approval of the new buyer and the

²³ For an example of a statute enabling the use of such funds see the Czech Republic, Resolution Concerning Environmental Liabilities During the Privatization Process (123/1993). The legislation instructs the Czech National Property Fund to compensate the property purchaser for the costs reasonably incurred by the purchaser as a result of discharging environmental liabilities up to 100% of the purchase price. Coverage typically applies to both undiscovered environmental problems and problems identified in the transaction contract.

For a detailed account and analysis of the Polish system, which is similar, see Bell and Kolaja (1993).

government, subsequent conflict can be expected to arise. Once the fund is established the buyer has an incentive to draw down its full balance so that the maximum level of environmental remediation can take place. After all, once established, escrow funds are a costless source of remediation financing from the buyer's perspective. There creates the danger that privatization proceeds may be directed toward relatively un-justified cleanups.²⁴

In theory the government can discipline these expenditures via its joint control of the escrow fund. In fact, the government may seek to minimize the use of the fund in order to maximize the net revenues it sees from the sale. The resolution of this kind of conflict ideally resides in an appropriate balancing of benefits and costs. It is an area, however, where institutional weaknesses can result in either excessive expenditure on remediation (the new buyer consumes all of the fund on remediation at its site) or inadequate expenditure (if the privatization ministry succeeds in confiscating the funds and redirecting them to non-environmental uses).

Pooled funds. When the state retains responsibility for historic remediation costs, via an indemnity or other contractual agreement, the state must create a financing scheme for collecting and disbursing environmental financing.²⁵ Most of the countries in the region have previous experience with some form of environmental fund. Potential revenue sources include general government revenues, taxation of polluting products, fines, or taxation of privatization proceeds. Indeed, in the CEE economies several of these revenue sources already exist.²⁶ The administration of such funds--in principle--allows for the coordination and rationalization of a nation's risk reduction activities. With government control of expenditures on remediation, the remediation of problems presenting the greatest social costs could, in principle, receive priority.

Unfortunately, experience has shown that these kinds of funds are often under-financed and subject to political "redirection." Because of this, it is reasonable for new owners to be concerned that funds promised for remediation by the government will not be forthcoming in a timely manner. Also, the hope that a government-controlled and nationwide system of risk discovery, assessment, ranking, and cleanup will yield an efficient allocation of remediation expenditures may be overly optimistic. As indicated earlier, the scientific and administrative challenges associated with risk ranking are formidable.²⁷

²⁴ If there is agreement on remediation goals and cost-benefit principles are applied to the search for solutions, it is generally advisable to have the private sector undertake the remediation task itself. Evidence from the United States suggests that cleanups cost 20 percent less when conducted by the liable parties rather than the government (Probst, 1995).

²⁵ State funds are also necessary for the financing of remediation at "orphan" sites--sites where no private party is or will be available as a source of compensation.

²⁶ See OECD (1995).

²⁷ The U.S. Superfund program is itself a cautionary tale. While well-financed and technologically advanced, the program is criticized often for failing to pursue the highest priority cleanups. For an empirical analysis that attempts to address the issue see Gupta, Van Houtven, and Cropper (1995).

It is also highly undesirable for pooled funds to become a permanent fixture in a government's environmental policy portfolio. There is always the danger that funds will become a source of financing for *prospectively* generated pollution. If private firms believe that all or even a fraction of their potential future liabilities will be borne by a public fund, then the private incentive to invest in risk reduction is reduced.²⁸ As indicated earlier, new property owners must be made to feel that they are responsible for contamination they create in the future.

4. TURNING THEORY INTO PRACTICE: CONCRETE RECOMMENDATIONS FOR POLICY REFORM IN ROMANIA

The previous section described the complex web of institutional changes triggered by the pursuit of environmental reforms in transitional economies. With the vast inheritance of contamination, current institutional weaknesses, inescapable financial constraints, and the simultaneous privatization of assets, the challenges are sobering. But a practical program for reform does lie somewhere between these challenges and the goals toward which any system should ideally strive--the allocation of resources based on cost-benefit principles, cost-effective financing of retroactive liabilities, meaningful prospective deterrence. What are the characteristics of a pragmatic and economically rational policy?

To answer the question, this section provides an overview and analysis of certain recommendations made to the government of Romania by a team of analysts brought together by the Harvard Institute for International Development (HIID).²⁹ It should be emphasized that the proposal's recommendations do not correspond to current Romanian policy and do not represent an "ideal" approach. Instead, the proposal is a call for pragmatic actions, based on the experience of experts familiar with practical remediation issues and Romanian institutions. The Romanian project is an example of one way in which the pursuit of an ideal remediation system can be tailored to adapt to real-world constraints and barriers to implementation. The proposal deals with both remediation guidelines and the liability scheme.

Generic Remediation Standards with an Opt-out Provision

The Romanian remediation project recommended "opt-out" system for determining site remediation standards. Under this system, regulations would define a set of national numerical cleanup standards for soil and groundwater that can be used at any site. However, if the property owner or other responsible party wishes, they can opt-out of these standards and conduct a site-specific risk assessment that is subsequently translated into site-specific

²⁸ See Boyd (1996).

²⁹ The team included John Fitzgerald of the Massachusetts Department of Environmental Protection, David Phillips of Fenviron, Keith Welks of the Pennsylvania Department of Environmental Protection, Marilena Patrascu and Clifford Zinnes of HIID Romania, and this author. The ideas presented in this section are a product of this team's work. Also, it should be noted that the project is ongoing and is substantially more detailed than is presentation here. See HIID (1998).

standards. The standards take the form of a numerical listing, for the 50 to 100 most common site contaminants, of maximum acceptable concentrations in soil and groundwater. This template would be further de-composed into standards for particular, very general land use categories (e.g., two sets of standards, one for residential and agricultural land uses and one for commercial and industrial land uses).

The system affords expediency and certainty by removing the need to do costly and time-consuming risk assessments at all sites. The opt-out provision allows for cost savings when the owner believes that generic standards will force an overly-costly remedy (though note that the opt-out must be justified via a potentially costly site assessment). The standards' sensitivity to land use categories is an attempt to prioritize expenditures. Standards are more stringent for residential and agricultural land uses since these land uses act as a proxy for population exposure. All else equal, the greater the exposure, the greater benefits of remediation--and the more stringent the standard.

Of course, as discussed earlier, uniformity has a cost: namely that the most cost-effective and most protective response may not be pursued at a given site. Sites will be misclassified. Some will be under-remediated relative to the ideal allocation of social resources; others will be over-remediated. Nevertheless, the system's administrative and scientific simplicity is a decided advantage.

A Phased Approach to Remediation

The goal of most remediation efforts in the developed world is restoration. While complete restoration need not occur, the goal is a "final" cleanup where contaminants are removed or otherwise eliminated from the site. An alternative that is likely to be much more cost effective, particularly in financially and technologically constrained countries is an emphasis on "initial containment" as a near-term alternative to final cleanup. The goal of initial containment is to sever exposure pathways and the migration of contaminants, rather than the virtual elimination of contaminants from a site. Examples of initial containment include "capping" a site with topsoil to limit airborne transport of contaminated soil and the construction of barriers to limit leaching.

The virtue of an initial containment strategy is its relatively low cost and technological simplicity. In essence, initial containment buys time by focusing on the principal social cost of pollution: human exposures. The medium- and long-term hold the promise of more favorable fiscal conditions and technological innovation. Initial containment acknowledges the dynamic nature of costs, in particular the idea that costs are likely to be lower--perhaps substantially so--in the future.³⁰

³⁰ In addition, there is the possibility of natural attenuation, the process whereby hazardous chemicals degrade over time into more benign compounds. In some situations, this natural process can be a sound remedial approach.

Sequential Allocation of Liability and Innocent Landowners

As discussed in sections 2 and 3, the rules that assign responsibility for retroactive liability are likely to have an important effect on both the remediation program and the privatization process. The goal is a liability system that minimizes uncertainty for investors, directs capital to the highest priority remediation efforts, and promotes prospective deterrence. The outlines of the proposed liability scheme are as follows.

First, there is a clear sequence or "chain" of responsibility starting with the polluter. Parties lower in the sequence are held responsible only if parties higher in the sequence are unable to pay. If no party is capable of payment, the site is remediated only if there are funds available from a state-run compensation mechanism. This system resembles the U.S. system in that parties that did not themselves pollute can be held responsible for remediation costs. It differs from the U.S. system in that non-polluting parties can be held liable *only* if the polluter is unable to pay. This sequence of liability has a quality of fairness that is absent in the U.S. system. The real motivation for the recommendation, however, is the desire to reduce new investors' exposure to retroactive liability.

Second, the scheme suggests the definition of two classes of "innocent landowner." The first class are those parties that purchase a previously-contaminated property, and whose property is the source of the contamination. Innocent landowners are not without responsibility. If the previous owner (the polluter) cannot pay, or if the previous owner is the state, the new innocent landowner is liable for the costs of initial containment only. They are absolved of costs associated with final cleanup, which remain with the state. The average new investor will be an innocent landowner. While they are held responsible for initial containment costs, recall that these costs can be discounted from the properties' purchase price. Liability is shifted to the private sector, but the liability is capped and is subject to less uncertainty. Initial containment costs, by definition, are smaller and easier to quantify than final cleanup costs. It is desirable to shift some liability to the private sector since the private sector may manage remediation more effectively than the state.

The second class of innocent landowners are "downgradient" innocent landowners, persons whose property has been contaminated by migratory pollution from another site. These owners are absolved of liability for all costs, including initial containment costs, as long as they did not cause or contribute to the contamination.³¹ For both types of innocent landowner, the law would require guaranteed access to their property in order to ensure that they are in fact not contributing to the pollution.

The innocent landowner cap on retroactive liability is much more likely to be compensable during privatization than the transfer of liability for final cleanup. The cap at initial containment reduces uncertainty to investors and reduces the amount of privatization proceeds that the government must forego in order to encourage property sales (the cap

³¹ The magnitude and age of many waste plumes in Romania mean that there are a relatively large number of small landholders that will fit the description of downgradient innocent landowners. Making this group liable for any cleanup cost is not only unfair but completely impractical due to their lack of wealth.

reduces the amount of compensation that must be offered to the new owner for accepting liability). The transfer of liability also creates a set of incentives that address the optimal temporal path of cleanup. Initial containment must be conducted expeditiously.³² Final cleanup is deferred and conducted in a prioritized fashion as costs fall and fiscal resources improve.

It is important to emphasize that the cap on innocent landowner liability only applies to contamination inherited from a previous owner. If a new owner's actions cause contamination, as the polluter they are first in sequence for the full application of liability. This full "polluter pays" liability for prospective environmental degradation is necessary in order to promote deterrence.

This liability system is not ideal. While it is probably efficient to delay final cleanups for some period of time, final cleanup is an important social goal. Final cleanup's environmental benefits are obvious. Moreover, final cleanup is beneficial to new property owners, whose land value will be depressed until final cleanup is complete. The state will most often be responsible for final cleanup at newly privatized sites. This is a potential drawback because the vulnerability of environmental funds to waste and redirection is real. For environmental reasons and for the security of new property purchasers, it is imperative to immediately establish a credible mechanism for long-term remediation financing. Also, a recurrent theme throughout this analysis has been the need to distinguish pre-existing contamination at the time of privatization. This delineation of responsibility is absolutely necessary under the proposed scheme. Because final cleanup is deferred and is the state's responsibility there is the danger that new property owners will add to site contamination in the hope that the state, rather than they, will bear the cost. At least a baseline contamination inventory is necessary to avoid this moral hazard problem.

5. CONCLUSION

Economics is an important guide to the definition of optimal remediation standards and liability rules. However, when it comes to recommendations for policy reform in transitional economies care must be taken to account for their unique institutional characteristics and constraints. This paper has emphasized the fiscal weakness of these economies, their need to complete the transfer of assets to private ownership, and their huge and hugely costly inventory of existing environmental problems. Given these realities, environmental policy in the region should not precisely mirror its form in more developed economies. The analysis emphasizes the design of institutions to target scarce resources at the highest priority problems. In the end, a system that seeks to contain and limit existing damage may ultimately be more effective than a system that seeks the most desirable, but perhaps unattainable, goal of immediate, comprehensive site remediation.

³² The proposal recommended a 5-year post-privatization deadline for completion of containment projects.

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