

# **Privatization and Contaminated Site Remediation in Central and Eastern Europe: Do Environmental Liability Policies Matter?**

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## Abstract

This paper examines the effects on site remediation decisions after state-owned firms have been privatized of providing environmental information to potential investors and undertaking site remediation planning prior to privatization. The literature suggests that to minimize distortions created by uncertain environmental problems, governments should invest in environmental information for potential investors, inventory problems and develop plans for remediation. One of the believed benefits is a higher probability of site remediation, because with uncertainty resolved potential conflicts after privatization are less likely. Few countries in Central and Eastern Europe, which has experienced both environmental problems and privatization on enormous scales, have adopted this advice. Using firm-level data, empirical analysis is presented, which suggests providing only information to investors is insufficient to spur remediation. Inventorying site contamination and planning remediation prior to privatization is a much more effective measure. Combining provision of information with remediation planning is found to be the most powerful policy package for encouraging remediation

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## **1. Introduction to the Issues**

Since the early 1990s, the countries of Central Europe (CE) have been in the process of converting their economies from ones based on economic planning to markets. These economic changes are some of the most dramatic the world has seen, with major shifts in economic structure occurring in many cases in only a few years. Such realignments offer many potential lessons for other countries undergoing perhaps less dramatic changes.

Privatization is a particularly important instrument in the process of economic change, with several privatization vehicles having been utilized in CE countries. These include direct sales to strategic investors, auctions, voucher sales and management/employee buyouts. Simultaneously with privatization, though, countries often face severe environmental problems left over from previous regimes. Site contamination is one important challenge. As Goldenman (1993) and EAP Task Force (1998) note some manufacturing, oil refining, smelting and waste oil processing, nonferrous metallurgy, iron and steel, pulp and paper and chemicals have the potential to be particularly problematic. Privatization and site contamination are related, because when investors buy firms they face the risk that they are purchasing major liability problems.

That environmental liability is a concern of investors, and particularly foreigners, has been discussed for a long time and continues to be considered (Lovei and Gentry, 2002). In a study of 1000 large North American and West European firms conducted in 1992, among investors that actually evaluated sites in CE countries, half rejected them partly on environmental grounds. Liability for past practices and inherited contamination risks then ranked as the most important environmental concern among surveyed firms (Klavens and Zamparutti, 1995).

Avoiding complications for privatization processes is, of course, not the only goal. Cleanup and improvement in on-going environmental performance may also be necessary to

avoid serious current and future risks to human health and the environment. Most would agree that as ownership of enterprises and sites transfer to private hands, it is important that policies promote site remediation when appropriate. The infusion of financial and human capital that privatization provides also offers a potential opportunity to address these site contamination issues (Lovei and Gentry, 2002; Auer, Reuveny and Adler, 2001; Goldenman, 1997).

This paper examines the degree to which some of the believed best practices for handling potential environmental liabilities at the time of privatization have been used in Central Europe and if those policies appear to increase site remediation. The next section discusses the literature on the use of policy instruments for reducing the negative effects of environmental liabilities on privatization markets and site remediation. Section 3 presents the privatization and environmental liability policies of Hungary, Lithuania, Poland, Romania and Slovakia, which are the five CE countries analyzed in this paper. Section 4 discusses the data and empirical methods used and Section 5 presents the results. The final section concludes.

## **2. Policies for Addressing Environmental Liabilities at the Time of Privatization**

Uncertainty about future liabilities (either for site contamination or on-going pollution) is a risk tax on privatization markets, which can make assigning responsibility for site remediation difficult. Current thinking on best practices suggests that provision of information by privatization agencies and offering investors the opportunity to investigate for themselves are keys to resolving this uncertainty and reducing risk, (Earnhart, 2004; Lovei and Gentry, 2002; Bluffstone and Panayotou, 2000). Such information can take many forms, but begins with including basic environmental information in packets prepared for potential investors. Preliminary audits may also be conducted and secondary audits that include sampling and analysis may also be used.

Only after some environmental analysis can privatization agencies take control of cleanup decisions. The German privatization agency, the *Treuhandanstalt*, and its successor agency, the *Budesanstalt fur vereinigungsbedingte Sonderaufgaben*, used environmental audits particularly effectively to keep costs down. In the early 1990s cleanup costs in Eastern Germany were expected to run into the hundreds of billions of dollars. As of 1996, privatization was virtually complete and only \$6.4 billion had been spent, largely because remediation activities were prioritized based exclusively on health risks.<sup>1</sup>

The Hungarian government learned the value of information gathering prior to negotiating with investors when the Swedish firm Electrolux purchased the Lehel Refrigerator Factory in 1993. Anxious to court the well-known firm, without an environmental audit or clearly defined cleanup standards, the Privatization Agency (called APVRt) agreed to finance all site remediation costs and 60% of the privatization proceeds were placed in escrow for that purpose. Electrolux spent all the funds in the escrow account and requested additional resources to complete the cleanup. The government responded by conducting a financial audit and found that many of the expenditures would not be considered warranted under Hungarian environmental law and refused to pay. The matter had to be resolved in court (Baka, 1995; Bluffstone and Panayotou, 2000; Csanadi and Bell, 1999).

Once site contamination is estimated, plans for remediation and assignment of responsibility for settling environmental liabilities can be undertaken. Transferring an uncertain burden to investors would be expected to cause them to discount their price bids for the uncertainty and risk involved (Earnhart, 2004; Balaban, Bluffstone and Panayotou, 1994; Boyd,

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<sup>1</sup> The *Treuhandanstalt* has also been criticized for focusing too much on costs and too often choosing containment rather than site remediation measures (Goldenman, 1995).

1996; Goldenman, 1997). Alternatively, governments might retain the responsibility for past polluting activities using indemnifications or releases.<sup>2</sup>

<b>Table 1</b>		
<b>Best Practice Environmental Liability Policies</b>		
<b>I</b>	<b>Environmental Liability Policy</b>	<b>Expected Outcomes</b>
<b>N</b>	State invests in information regarding potential environmental liabilities and provides that information to investors. Investors also have the opportunity to investigate environmental issues themselves.	State has information that can then be provided to investors, reducing their risks; state is better informed for its negotiations with investors, resulting in higher privatization prices; higher quality investors attracted; State and firms can better plan for environmental remediation; more site cleanup actually occurs.
<b>R</b>	Pre-privatization environmental problems are inventoried and delineated from problems occurring after privatization.	Post-privatization conflicts regarding remediation are reduced; more remediation takes place.
<b>C</b>	On and off-site remediation requirements and responsibilities are clearly defined and allocated between the State and investors.	Post-privatization conflicts are reduced; levels of remediation are well known and both firms and the state are able to budget for these costs; more remediation actually takes place.
<b>R</b>	States accept financial responsibility for a share of remediation. Some authors suggest that clearly defined indemnifications rather than price reductions should be used.	Risks to investors are reduced if they know they are not financially responsible for remediation they do not cause; investors are better able to evaluate firms; higher quality investors attracted; privatization prices higher than with more risk; firms hold the State responsible for financing cleanup and therefore more remediation occurs.
<b>E</b>	Future environmental performance is improved through better handling of environmental liabilities in privatization contracts. On-going pollution included in privatization contracts.	Higher quality investors attracted; Risks to investors are reduced if they know their on-going environmental responsibilities; investors better able to evaluate firms; on-going environmental performance is improved.
<b>A</b>		
<b>S</b>		
<b>I</b>		
<b>N</b>		
<b>G</b>		
<b>S</b>		
<b>O</b>		
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<b>A</b>		
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<b>I</b>		
<b>O</b>		
<b>N</b>		

As Bluffstone and Panayotou (2000) show in a theoretical model, with symmetric information between privatization agencies and investors, price discounts and indemnifications

<sup>2</sup> As was argued by Boyd (1996), however, exclusive reliance on price discounts is undesirable because such methods do not necessarily specify the level of purchaser liability. As such, they invite adverse selection.

are equivalent. As price discounts shift risk to investors, these should be preferred by privatization agencies. It is only when governments have better information about firms than investors, there is a likelihood of adverse selection by investors or if there exist a systematically deteriorating privatization pool quality that indemnifications become a useful policy tool. Under such circumstances, indemnifications may help overcome information problems and keep investors from excessively discounting firms. The main categories of superior policies and expected outcomes are summarized in Table 1.

### **3. Experience with Privatization and Environmental Liability in CE Countries**

The privatization programs in Hungary, Lithuania, Poland, Romania and Slovakia have some features in common, most importantly the goal to transfer whole economies to private hands as quickly as possible. All programs also have in common the tendency for larger state-owned enterprises to be broken up into component parts for privatization. As a result, the number of entities created by privatization was always higher than the number of firms slated for privatization.

Very different approaches are also of note. In Poland, early industrial privatizations heavily utilized liquidation. In Lithuania, Romania and Slovakia, voucher mass privatization was the main way ownership was transferred to the private sector, with Poland also using vouchers combined with fifteen investment funds. Hungary, on the other hand, focused mainly on a capital privatization program (Goldenman, 1997). Views regarding privatization and the treatment of environmental liabilities differed dramatically across countries and also evolved over time. In Hungary, for example, the civil code says that when property is transferred all rights and duties associated with that property change hands as well. Early in its privatization program, environmental issues were generally ignored unless an investor (usually a foreigner)

raised the topic (Csanadi and Bell, 1999; Goldenman, 1997). Negotiations with investors on environmental issues tended to be *ad hoc* and generated problems such as that associated with the Elektrolux deal.

Though price reductions and earmarked escrow accounts have been consistently used tools, as Csanadi and Bell (1999) note, the sophistication of Hungary's policies increased throughout the 1990s. For example, in 1994, APVRt hired a full-time environmental expert to coordinate its environmental audit program. As part of a change in the privatization law in 1995, environmental provisions were also more systematically included. An environmental unit was also established to oversee environmental audits and negotiate with investors.

Perhaps the most poignant indication of the government's sophistication after 1995 was the privatization of the oil and gas firm MOL Rt in 1995-1996. At the time of privatization, MOL Rt was the largest firm by revenue in Hungary and its sale was the first time shares were sold internationally using a leading international stock exchange (Tillson, 1996). To prepare for MOL Rt's sale, APVRt commissioned a full-scale environmental audit with the explicit goal to increase the company's value. All of the MOL Rt shares were placed successfully using the New York Stock Exchange (Goldenman, 1997).

In an analysis of 2600 privatization records, though, Csanadi and Bell (1999) found that only 147 transactions included environmental aspects. In seventy-nine cases APVRt took on cleanup commitments and in seventy-eight cases purchasers agreed to environmental measures. For cases where escrow accounts were established, probably because of bureaucratic roadblocks erected by APVRt, only 4.1 percent of the earmarked funds were actually drawn on for cleanup. Csanadi and Bell conclude that the use of escrow accounts probably helped APVRt close deals, but the status of contaminated sites now in private hands is unclear.

Lithuania has a diverse industrial sector including fertilizer, chemical, cement and electronics industries. By 1995, eighty percent of the enterprises slated for privatization had been transferred and 50% of the economy was in private hands (Lithuanian Government Interministerial Working Group, 1995; Brada, 1996). By 1997, 70% of GDP was produced by the private sector, with most ownership transfers having occurred via mass privatization ([www.worldbank.org/ecspf](http://www.worldbank.org/ecspf)). Certain key facilities were privatized under the country's capital privatization program, but virtually no transactions included hard currency components ([www.worldbank.org/ecspf/final/html/gdf/Lithuania.htm](http://www.worldbank.org/ecspf/final/html/gdf/Lithuania.htm)).

Privatization in Lithuania was carried out in two rounds. The first round began in 1991 under the Law on Initial Privatization of State Property passed in 1991 and was carried out under the auspices of the Ministry of Economy.<sup>2</sup> A total of 5714 companies were sold by 1995, with 2928 privatized using vouchers and 2726 mainly small firms sold at auction. ([www.worldbank.org/ecspf/final/html/gdf/Lithuania.htm](http://www.worldbank.org/ecspf/final/html/gdf/Lithuania.htm)). The second round took place under a revised privatization law passed in 1995. This law focused on capital privatization, but included no environmental components (Lithuanian Government Interministerial Working Group, 1995). During the period 1996 – 1999, 1119 additional firms were sold, with most being sold at auction. By the end of 1999, there were 3100 firms awaiting privatization, but most of these were shares in enterprises where the state did not have a controlling interest (Lithuanian Free Market Institute, 2000).

Though the government has looked at issues of environmental liability, most notably through an inter-ministerial working group convened in 1995, Lithuania has no specific legislation dealing with environmental damage that occurred during the period of state ownership

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<sup>2</sup> The Ministry of Economy was abolished in 1998.

and no requirements for the gathering or providing environmental information during privatization. Indeed, it is our understanding that only one capital privatization contract has explicitly included environmental requirements. This was when Phillip Morris purchased Klaipedos Tabakas in 1993. As part of the contract, the Government of Lithuania agreed to close down Kovos Tabakas, which was the only other cigarette producer in Lithuania, but in return Phillip Morris was required to co-finance site remediation at Kova. With no real environmental stipulations in privatization contracts, future liabilities will be settled using the civil code.

Privatization in Poland is the responsibility of the Ministry of the Treasury. During the period August 1990 – January 2002, a total of 5362 medium and large state-owned enterprises were included in Poland's privatization program.<sup>3</sup> Poland's program has three main components. Direct privatization is initiated at the regional (Voivod) level and focuses on small and medium sized enterprises. This component has basically met its goals, with virtually all the over 2000 included enterprises having been sold (Ministry of the Treasury Privatization Website [www.mst.gov.pl/en/prywat](http://www.mst.gov.pl/en/prywat)).

Indirect privatization, involves the creation of what are called treasury corporations and includes a variety of mechanisms, including public stock offerings, tenders, invited negotiations with strategic investors, free distribution of shares to employees, voucher privatization and mass privatization through the transfer of shares to National Investment Funds. As of 2002, 1521 firms had been reorganized as treasury corporations. Of these, 975 firms had had their shares distributed, with 521 being through National Investment Funds (Ministry of the Treasury Privatization Website [www.mst.gov.pl/en/prywat](http://www.mst.gov.pl/en/prywat)).

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<sup>3</sup> Firms were brought into the program over time. For example, by the end of 1995, only 3515 firms had been included in the program.

The National Investment Funds (NIFs) are a uniquely Polish institution. In 1994 fifteen investment funds were established to take control of 512 firms. During the second phase of the program (1996 – 98) shares in the NIFs were distributed free to the public and in 1997 their shares began to be traded on the Warsaw Stock Exchange. By the end of 2001, 16% of all companies given to the NIFs were either liquidated or bankrupt and they held only 213 of the original 521 firms (Ministry of the Treasury Privatization Website [www.mst.gov.pl/en/prywat](http://www.mst.gov.pl/en/prywat)).

Liquidations have been used when firms were bankrupt and their assets sold or when management/employee buyouts were desired (Bell, 1993). Indeed, as Frydman *et al* (1993) and Bell (1993) argue, early liquidations were often just covert and politically expedient ways to transfer ownership directly and quickly to firm insiders! By January 2002 a total of 1752 enterprises had been targeted for liquidation, with the disposal of assets having actually occurred in 871 firms. Of the 1752 firms, 656 bankrupt firms remained in state hands, leaving 225 non-bankrupt firms to be liquidated ([www.mst.gov.pl/en/prywat](http://www.mst.gov.pl/en/prywat)).

There is relatively little known about the treatment of environmental liabilities for the vast majority of privatized firms, but it is probably fair to say that prior to 1993 little or no attention was given to environmental issues. This is likely to have been particularly true for liquidated firms where assets were disbursed or simply changed owners informally. When environmental liabilities were incorporated into privatization processes, generally it was on an *ad hoc* basis (Bell, 1993; Thomas, 1994). In 1993, an inter-ministerial unit focusing on environmental liabilities and privatization was established. This unit had representatives from the Privatization Department and Ministry of Environmental Protection and was charged with commissioning environmental audits and negotiating environmental issues with investors on a case-by-case basis, but environmental issues are addressed via price reductions rather than

indemnifications; all liabilities pass to new owners (Goldenman, 1996; Goldenman, 1997). This approach is generally viewed as sophisticated, but time-consuming.

Poland's mass privatization has probably given relatively little attention to environmental liabilities. Exceptions may be the 521 firms distributed to the NIFs. The NIFs generally took European Bank for Reconstruction and Development (EBRD) loans to help in restructuring companies and five percent of those funds were earmarked for environmental audits. The NIFs therefore may have considered potential environmental liabilities when developing their portfolios. They also had access to EBRD environmental training (Goldenman, 1997).

Privatization in Romania really only began in 1993 and as a result, compared with other countries in the region the private sector is rather small, with only 58% of GDP generated by the private sector in 1997 ([www.worldbank.org/ecspf/PSD-Yearbook/romania.html](http://www.worldbank.org/ecspf/PSD-Yearbook/romania.html)). Of the 3257 medium and small enterprises slated for privatization, by 1999 approximately 1189 had at least some portion of their capital transferred to the private sector (CESEP, 1998 updated using MIGA database, 2000 at [www.ipanet.net](http://www.ipanet.net)). As of 2001, though, the largest companies had yet to be privatized and there was dissatisfaction with the pace and form of privatization (APAP, 2001).

Privatization in Romania shares elements with those in other CE countries. With the passage of the Law on Privatization in 1990, 6300 enterprises were targeted for privatization. About half were medium or large companies employing at least 500 people. Thirty percent of the authorized capital of these enterprises was transferred to five so-called Private Ownership Funds, which managed the assets for owners of roughly ten million privatization vouchers that were distributed free-of-charge to citizens. The remaining 70% interest was transferred to a State Ownership Fund, which was responsible for selling the shares to investors.

A revised privatization law passed in 1995 expanded the mass privatization program so that citizens who had not previously used their vouchers could receive shares in 4000 state-owned enterprises included in the new program. A maximum of 60% of the authorized capital of these enterprises could be distributed by this method (CESEP, 1998). The remaining shares were sold to foreign or domestic investors by direct negotiation, public share offering, auction, management/employee buyout and direct sale. Since 1998, auctions have been the most common method used (MIGA database, 2000; CESEP, 1998).

It is believed that environmental issues were generally ignored in the mass privatization and capital privatization programs, at least prior to 1999. A revised law on capital privatization was passed in 1997, which included some provisions related to environmental liabilities. In 1999 a government decree spelled out a variety of procedures, including a series related to the environment. The government decision also explicitly included environmental protection as one of the criteria for evaluating investor offers and made obligatory the presentation of environmental information to prospective buyers. The law also required that environmental assessments be done for all firms in the capital privatization program. Based on those evaluations, firms were required to create compliance plans to manage potential environmental liabilities and mitigate risks to human health. The law also stipulated that specific remediation requirements be included in purchase and sale agreements. Investors are then responsible for implementing cleanup.

Privatization in the Slovak Republic is under the auspices of the Ministry for Administration and Privatization of National Property, which was founded in 1990. The National Property Fund was established the following year to prepare enterprises for privatization, conduct the privatization of firms and transfer ownership to private owners. The

privatization program has had both mass and capital privatization components. The first wave of privatization occurred from 1991 to 1993 and utilized mainly vouchers. Capital privatization played a relatively minor role. Under voucher privatization, each citizen had the right to buy a booklet with 1000 vouchers that could be invested in enterprises. Approximately 2.6 million citizens (roughly half the adult population) participated and a total of 678 companies were privatized (Ministry for Administration and Privatization of National Property website).

In 1993 the second wave of privatization started, which focused on capital privatizations. Most recently, privatization has accelerated, with the year 2000 being particularly important. Roughly \$600 million was earned by the government from the sale of a 51% interest in Slovak Telecom to Deutsche Telecom AG. Also of significance was the sale of the metallurgical part of VSZ to the US steel giant USX for \$495 million, the purchase of shares in the Slovak oil refinery Slovnaft by Hungarian MOL Rt for \$270 million and the purchase of a 50 per cent interest in the Slovak pulp and paper producer SCP Ruzomberok by Austrian Neusiedler AG for \$80 million.

The National Property Fund operates under its original enabling legislation, which specifies that all assets and liabilities be transferred to investors at the time of privatization (Tillinghast, 1993). Part V. states that Fund resources can be used “for defrayal of expenses accrued by the acquirer due to settlement of environment-related liabilities arising prior to the privatization of the enterprise, *including those that were unknown to the acquirer before entering into the purchase agreement* concerning the enterprise or a part thereof.” It is unclear, however, to what degree this provision has been used. It also seems that no system exists for evaluating potential environmental liabilities and assigning responsibility.

A delegation from the Foreign Investment Advisory Service of the IFC/World Bank assessed the situation in June 1999 during a visit to Slovakia. Their summary perhaps states the

situation well. "There remains great uncertainty as to the potential liability of investors for 'previous' environmental damage.... The Slovak government needs to establish policies to address this potential barrier to foreign direct investment. Presently in Slovakia, most of the 'major' foreign investors are dealing with the environment issue by essentially ignoring it. Foreign investors recognize that there is a potential risk for future environmental liability, but they simply calculate the risk as 'low' ([www.slovakembassy-cd-london.co.uk](http://www.slovakembassy-cd-london.co.uk))."

In summary, like most other economic and environmental policies appropriate to market economies in 1990-91 the countries analyzed in this paper had limited laws and policies for addressing environmental liabilities during the process of property transfer. In the absence of specific policies, sometimes there were only very vague notions of the environmental liabilities that were passed to investors. Often privatization was therefore accomplished with the tacit understanding on both sides that contingent liabilities were unlikely to ever be manifested. Mass privatization particularly ignored environmental issues. Prior to ownership transfer (generally via vouchers), environmental assessments were rarely done and those who initially owned the companies had little reason to invest in information themselves or incorporate environmental liabilities into their voucher investment decision processes. Further, at the time of privatization there were no requirements placed on or agreements with investors that cleanup of contaminated sites or other settling of environmental liabilities would occur. Environmental problems were therefore probably just put off for the future when owners would be forced to face the liabilities they perhaps unknowingly took on. As there is little reason to expect environmental liabilities in any way affected or were addressed by mass privatization, the focus of the empirical portion of this paper is on capital privatization where firms were sold outright.

#### 4. Data and Empirical Method

Given the limited attention to environmental liabilities at the time of privatization, the question arises whether the conclusions derived from theory are really correct. Perhaps, for example, clarifying the environmental statuses of industrial firms only make investors more wary and actually deters site remediation? To shed light on this question, the remainder of this paper examines whether the believed best practices for handling potential liabilities at the time of privatization increased the probability that remediation was undertaken at the firm level. Our null hypothesis is that providing information to investors, planning site remediation and allocating responsibility is unrelated to the probability of site remediation.

The analysis relies on firm-level, cross-sectional survey data collected by research organizations headquartered in the five countries. Data were primarily collected from privatized firms, but were also assembled from privatization agencies and other government organizations. A total of 216 firms were surveyed in Hungary (29), Lithuania (50), Poland (64), Romania (54) and Slovakia (19) during the third quarter of 1998. Only firms operating in the generally highly polluting animal raising, mining, electric power and manufacturing sectors were included. Approximately 25% of the sample was from industries like chemicals, paper, petroleum and coal, rubber and non-ferrous metal manufacturing that often have site contamination problems. Those considering investing in these firms could therefore reasonably be concerned about potential site contamination liabilities.<sup>4</sup>

A second feature of the sample was that only firms whose owners were truly in control and could respond to environmental liability policies were included. Post-privatization

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<sup>4</sup> A copy of the questionnaire is available from the author. This stratification follows the various “screening” methods proposed in the literature. See for example Rotschke (1996) and Chvojka and Tylova (1996).

ownership therefore had to be relatively concentrated.<sup>5</sup> The date of privatization was when either of the following criteria was fulfilled:

1. Thirty-percent interests were sold outright to individuals, firms or consortia;
2. Enterprises that were sold using mass privatization techniques had at least 51% owned by one person, firm or consortium by July 1998.

Data were collected on firm characteristics, firm-level environmental management, privatization efficiency, handling of environmental liabilities during privatization and treatment of environmental liabilities after privatization. The literature highlights fully clarifying the environmental status of firms through the provision of environmental information as key policies for making sure that environmental issues are addressed after privatization and appropriate levels of site remediation are conducted.

Our dependent variable is whether firm management reported site remediation had been conducted after privatization. To what degree did site remediation actually occur? Of 182 firms reporting, 21.4% said that some degree of site remediation had taken place since privatization, with 54.8% saying the cleanup was complete and of the remainder 41.2% indicated they planned to continue with remediation.. We do not have information on the quality of remediation.

<b>Table 2 Degree to which Site Remediation was Conducted by Country</b>	
<b>Country</b>	<b>Percentage of Cases Where Some Site Remediation was Undertaken</b>
Hungary	40%
Lithuania	21.3%
Poland	20%
Romania	12%
Slovakia	7.1%

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<sup>5</sup> See, for example, Gray (1996).

We then use four independent variables to test our hypothesis that better information and remediation planning does not increase the probability of remediation. These dummy variables are given below. Variable names are in parentheses.

1. Prior to privatization, if an information packet was prepared was there an environmental section that dealt with site contamination included? (**Information**)
2. Was a preliminary environmental audit conducted prior to privatization? (**Prelim\_audit**)<sup>6</sup>
3. Was a secondary environmental audit conducted prior to privatization? (**Secondary\_audit**)
4. Was a site remediation plan that included clearly defined cleanup measures developed and in place at the time of or shortly after privatization? (**Remediate\_plan**)

These policies are clearly linked, with site remediation planning with clearly defined cleanup measures representing a significant increase in commitment by governments compared with only providing information to investors. Remediation planning typically involves a serious commitment to planning and allocating responsibility for remediation. We note, though, that we do not have information on who prepared remediation plans or how detailed they were.

The literature also suggests that remediation planning should be combined with provision of information. This was, for example, the approach used by MOL Rt in Hungary. For this reason, a total of ten econometric models are presented. The first includes Remediate\_plan alone as a policy variable. Models that include the three information variables are then presented with these variables alone, along with Remediate\_plan (i.e. whether either policy was used) and with an interaction term indicating if both information and remediation planning were conducted. Depending on the information policy considered, 3% - 7% of privatizations experienced both

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<sup>6</sup> Preliminary audits involve desk studies of environmental issues, including site contamination, but no soil samples are taken. Secondary audits augment preliminary studies with soil samples if site contamination issues are likely to be present.

policies prior to privatization. Variable names for the interaction terms are the following: **info\_rempln**, **prelim\_rempln**, **secondary\_rempln**.

**Table 3: Conditioning Variables (Variable Names in Parentheses)**

Variable	Hypothesis Regarding Sign and Reason to Include
Year of Privatization <b>(Priv_Year)</b>	(-) Investors and governments learn over time, affecting outcomes. Earlier privatizations expected to have less site remediation than later sales.
Chemical Industry (e.g. basic chemicals, resins, paints, pesticides) Dummy Variable (NAISC Code 325) <b>(Chemical)</b>	(+/-) This economic sector is particularly prone to site contamination problems. Investors likely to treat systematically differently than other sectors. Remediation may be more or less likely
% Total Shares Held by Government in 1997 <b>(Gov_Share)</b>	(+/-) Governments may value site remediation more than private investors, but may have fewer resources for site remediation. Retention of stakes by government may imply systematically different focuses on site remediation.
% Total Shares Held by Largest Private Investor or Group <b>(Large_Invest)</b>	(+) Larger shares held by single investors or groups could imply deep pockets that increase remediation.
% Total Shares Held by Foreigner Investors <b>(For_Share)</b>	(+) Foreign investors may bring experience and norms that are likely to systematically increase remediation.
Revenues (in \$US 1997) in Year Prior to Privatization <b>(Rev_1997)</b>	(+) Larger firms have more resources for site remediation.
Dummy Variable Indicating Whether More than One Member of Senior Management Changed within One Year of Privatization <b>Mgt_chg)</b>	(-) This variable is included as a proxy for management hostility at the time of privatization. Hostile management may make agreement on site remediation more difficult.
Dummy Variable Indicating Whether the Firm is in the Higher Income and More Advanced Reform Countries of Hungary and Poland <b>(Hung_Pol)</b>	(+) As environmental protection is a normal good, higher income and advanced reform countries likely to do more remediation than slower reform countries.
Revenue (in \$US 1997) per Employee <b>(Efficiency)</b>	(+) More efficient companies may more aggressively address site contamination issues.

Given the binomial nature of our dependent variable, binomial logit and probit models are the appropriate tools to investigate the effects of our independent variables on the probability that site remediation was conducted after privatization. Conditioning variables used in all regressions and rationales for including them are given in Table 3 above.

## 5. Results

In the sample the median enterprise was privatized in 1995, with the earliest sale occurring in 1990. Over 79% of firms (170) were privatized by outright purchase of at least 30% shares and 21% (46 firms) accumulated a controlling interest by July 1998. Of those firms privatized by outright purchase, 63% were sold using tenders, 29% by auction and 8% by other means. The mean employment in the sample was 1264 people in the year prior to privatization and 1027 in 1997. Firms in the sample were therefore generally large, but exhibit significant attrition. Output of firms' main products was generally higher in 1997 than in the year prior to privatization, with a mean of 18% higher. In 1997 foreign participation was the exception, with 76% having no foreign ownership and an average foreign ownership share of 12%. Average government ownership was 35%, with 28% having no government ownership. On average, 70% of governments' shares were sold at the time of privatization. Twenty percent transferred all shares to investors at the time of privatization.

Among firms sold outright to investors, privatization on average took about nine months. Environmental issues were typically not reported to be an important determinant of the length of time needed to privatize. In only 7.3% of cases privatization officials reported that environmental issues delayed privatization, suggesting that environmental issues were either handled efficiently or not at all. Prior to privatization, governments prepared information packets for 76% of firms in the sample. Among those firms for which information packets were prepared, 33% also had sections that dealt with environmental and site contamination issues. Sixty percent of packets were prepared by firms, 30% by consultants and ten-percent by privatization agencies. Written information focusing explicitly on possible site contamination was typically not, however, provided to investors. Indeed, only 21% of 187 firms reporting data said that such information was provided to most or all investors. Perhaps because of this lack of

written information, 47% of firms reported that preliminary environmental audits were conducted prior to privatization. Of firms reporting sources of finance for preliminary audits (choices given were investors, privatization agency, both investors and privatization agency and other), 70% said that investors financed audits, while only two said that privatization agencies financed their audits. Fourteen percent of firms conducted secondary audits prior to privatization, with virtually all financed by investors. It therefore seems that potential buyers themselves invested in information.

	Environmental Information Provided to Investors in Privatization Packets	Information about Possible Site Contamination Provided to Investors	Preliminary Environmental Audits Conducted	Secondary Environmental Audits Conducted
Hungary	64.7%	42.9%	32.1%	21.4%
Lithuania	15.4%	19.1%	10.4%	2.0%
Poland	50.0%	30.6%	48%	9.0%
Romania	13.0%	7.4%	98.1%	26.4%
Slovakia	50.0%	0.0%	0.0%	0.0%

The information from audits does not, however, seem to have been used for planning site remediation. In only 9.1% of cases prior to or shortly after privatization were site remediation plans developed that included clearly defined cleanup measures. Our data do not tell us who created remediation plans, but it seems reasonable to suppose that firms (either pre-privatization or after privatization) prepared them. These documents were then likely reviewed and refined in conjunction with government agencies, including ministries of environment and privatization agencies. When site remediation plans were developed, in all cases cleanup costs were the responsibilities of investors. For cases where remediation plans were in place, an average of 31.4% of plans had been completed as of July 1998. Whether a plan was developed or not, in

only five cases did privatization agencies exempt investors from cleanup costs (80 respondents reporting); liability therefore seems to have virtually always passed to investors. Environmental enforcement actions, such as notification of violations, fines or closures were rare after privatization, but not unheard of. Indeed, 9.3% of firms reported having been subject to some kind of enforcement action. Environmentally oriented legal actions brought by the public against firms were, however, quite rare, with 97% of firms reporting no such issues. Similar results were reported for lawsuits brought by governments against firms. In terms of on-going environmental behavior, 68% of firms reported having internal audit, pollution prevention or waste minimization programs. Twenty-three percent were seeking ISO 14000 series certification and 46% had environmental management plans.

In sum, the data suggest that most firms in the sample were privatized by tender and that over 30% shares were typically purchased outright rather than accumulating controlling interests over time. Foreign investment was the exception rather than the rule. General information was typically provided to investors, but relatively rarely was environmental information given. Potential purchasers therefore often invested in audits, but planning of site remediation was rare, suggesting that audits were for the purpose of due diligence. Despite the relative lack of planning, site remediation at some level was reported by over 20% of firms. Few indemnifications or price discounts were given to investors, but environmental enforcement actions and lawsuits were also quite rare. These results suggest that up until 1998 at least, pollution and site contamination issues may have been handled informally.

We now present logit model results to explain whether site remediation was reported at particular companies. Probit results are available from the author and are very similar to those of the logit models. Table 5 presents results for provision of environmental information in

privatization packets given to investors and development of site remediation plans including clearly defined cleanup measures. Tables 6 and 7 present similar results, except for preliminary and secondary audits.

**Table 5 Logit Estimation**

**Dependent Variable: Whether Firms reported any Site Remediation**

	Model 1		Model 2		Model 3		Model 4	
	Marginal Effect	p-value	Marginal Effect	p-value	Marginal Effect	p-value	Marginal Effect	p-value
Information			0.09	0.41	-0.04	0.70	0.01	0.90
Info_remlan					0.69**	0.05		
Remediate_plan	0.42***	0.0063					0.44***	0.006
Priv_Year	-0.004	0.85	-0.01	0.61	-0.01	0.60	-0.02	0.47
Chemical	-0.06	0.57	-0.09	0.48	-0.18	0.11	-0.13	0.19
Gov_Share	-0.0007	0.70	-0.0004	0.87	-0.0003	0.89	-0.0002	0.91
Large_Invest	-0.0008	0.54	-0.0009	0.61	-0.002	0.22	-0.002	0.33
For_Share	0.0005	0.72	0.001	0.46	0.002	0.29	0.002	0.26
Rev_1997	0.9E <sup>-9</sup> **	0.04	0.13E <sup>-8</sup>	0.11	0.18E <sup>-8</sup> **	0.05	0.1e <sup>-8</sup> *	0.10
Mgt_chg	0.06	0.36	-0.003	0.97	0.02	0.81	0.01	0.83
Hung_Pol	0.21**	0.05	0.17	0.16	0.21	0.11	0.23*	0.07
Efficiency	-0.4E <sup>-6</sup>	0.34	-0.6E <sup>-6</sup>	0.52	-0.47E <sup>-6</sup>	0.61	-0.5e <sup>-6</sup>	0.59
Constant	7.57	0.86	28.06	0.61	27.20	0.61	0.35	0.47
McFadden R <sup>2</sup>	0.20		0.17		0.25		0.28	
Chi Sq. (d.f.)	24.45 (10)		18.44 (10)		24.87 (11)		27.84 (11)	
N	118		105		100		100	

\*, \*\*, \*\*\* Significant at the 10%, 5% and 1% levels respectively

**Table 6 Logit Estimation with Independent Variables Preliminary Audits and Site Remediation Plans. Dependent Variable: Whether Firms reported any Site Remediation**

	Model 5		Model 6		Model 7	
	Marginal Effect	p-value	Marginal Effect	p-value	Marginal Effect	p-value
Prelim_audit	0.13	0.11	0.07	0.40	0.07	0.36
Prelim_rempln			0.30*	0.10		
Remediate_plan					0.36**	0.02
Priv_Year	-0.003	0.91	-0.013	0.56	-0.02	0.51
Chemical	-0.05	0.65	-0.08	0.49	-0.09	0.38
Gov_Share	-0.002	0.27	-0.0012	0.52	-0.0009	0.63
Large_Invest	-0.001	0.43	-0.0016	0.27	-0.001	0.31
For_Share	0.0008	0.65	0.0015	0.35	0.001	0.35
Rev_1997	0.15 E <sup>-8*</sup>	0.06	0.12 E <sup>-8*</sup>	0.09	0.11 E <sup>-8*</sup>	0.08
Mgt_chg	0.087	0.24	0.08	0.27	0.09	0.19
Hung_Pol	0.141	0.16	0.15	0.15	0.17*	0.09
Efficiency	-0.78 E <sup>-6</sup>	0.27	-0.56 E <sup>-6</sup>	0.37	-0.55 E <sup>-6</sup>	0.37
Constant	5.23	0.91	26.48	0.57	30.01	0.51
McFadden R <sup>2</sup>	0.192		0.23		0.25	
Chi Sq. (d.f.)	23.3 (10)		24.27 (11)		26.48 (11)	
N	117		110		110	

\*, \*\*, \*\*\* Significant at the 10%, 5% and 1% levels respectively

**Table 7 Logit Estimation with Independent Variables Secondary Audits and Site Remediation Plans. Dependent Variable: Whether Firms reported any Site Remediation**

	Model 8		Model 9		Model 10	
	Marginal Effect	p-value	Marginal Effect	p-value	Marginal Effect	p-value
Secondary_audit	0.24*	0.07	0.22	0.15	0.12	0.33
Secondary_rempln			-0.01	0.95		
Remediate_plan					0.41**	0.02
Priv_Year	-0.005	0.82	-0.004	0.84	-0.01	0.57
Chemical	-0.08	0.46	-0.06	0.56	-0.03	0.80
Gov_Share	-0.001	0.42	-0.001	0.47	-0.001	0.50
Large_Invest	-0.002	0.13	-0.002	0.22	-0.002	0.24
For_Share	0.0008	0.63	0.0007	0.67	0.0007	0.65
Rev_1997	0.10 E <sup>-8**</sup>	0.05	0.11 E <sup>-8*</sup>	0.07	0.85 E <sup>-9**</sup>	0.03

Mgt_chg	0.13*	0.09	0.11	0.16	0.09	0.24
Hung_Pol	0.15	0.14	0.13	0.22	0.13	0.18
Efficiency	-0.61 E <sup>-6</sup>	0.28	-0.56 E <sup>-6</sup>	0.28	-0.47 E <sup>-6</sup>	0.37
Constant	9.21	0.83	8.65	0.84	23.85	
McFadden R <sup>2</sup>	0.20		0.17		0.22	
Chi Sq. (d.f.)	23.09 (10)		18.42 (11)		23.83 (11)	
N	110		107		107	

\*, \*\*, \*\*\* Significant at the 10%, 5% and 1% levels respectively

We see from the tables that these models typically explain a significant portion of the overall variation in the data. McFadden R<sup>2</sup> statistics are generally greater than 0.20, which is good for cross-section models. Only Model 2, which includes only Information as a policy variable does not yield Chi-Squared statistics that are significant at better than the 1% level (Model 2 is significant at the 5% level).

In terms of the conditioning variables, the most robust result across the 10 models is that larger firms are more likely to have engaged in site remediation. In most models 1997 revenues were positively related to site remediation and significant at either the 5% or 10% levels. The estimated magnitudes are small, however. A \$10 million increase in 1997 revenues (about 25% of mean revenues) is estimated to increase the probability of remediation by 1- 2% or 5 – 10% compared with the mean remediation probability of 21.4%. Other results were also significant at the 5% and 10% levels. In three models Hungarian and Polish firms were estimated to have a significantly higher probability of remediation (17% - 23% or approximately twice the mean) and in one model management change was associated with a higher probability of remediation.

For our four policy variables, the most significant finding is that the existence of remediation plans alone is highly correlated with increased probabilities of remediation. Whether included in models alone or with our three information variables, Remediate\_plan was

associated with 36% to 44% increases in the probability of remediation at either 1% or 5% levels of statistical significance. These estimated effects are very large compared with the mean probability of remediation of 21.4%, suggesting that the existence of remediation plans may easily double the probability that industrial sites are cleaned up.

In two models the use of both information and site remediation planning was significantly and positively associated with the probability of site remediation. The estimated effect of providing both environmental information to investors in privatization packets and preparing site remediation plans (Info\_rempln) had a very large estimated effect. Using both those variables together is estimated to increase the probability of remediation by 69%, which is three times the mean remediation probability (significant at the 5% level). When site remediation planning was combined with preliminary audits (Prelim\_rempln) the probability of remediation increased by 30% or 140% of the mean (significant at 10% level).

Providing only environmental information in privatization packets was not correlated with an increased probability of remediation, but the use of audits – which are much more significant steps – appears to be related to remediation. The use of secondary audits in-and-of-themselves was correlated with a doubling of the probability of remediation compared with the mean (significant at 10% level). The use of preliminary audits was also positively associated with site remediation (though estimated coefficient was much smaller), but was significant at only the 11% level.

## **6. Concluding Observations**

This paper focused on the privatization of firms in industries that are likely to have site contamination and other environmental problems. These firms tend to be large, with high levels of employment. Most investors purchased majority shares at the time of privatization and few of

those investors were foreigners. In general, governments maintained significant stakes in these firms. General information on firms was typically provided to investors, but, in only one-third of cases was environmental information (including on site contamination) also offered. This does not mean that by the time of privatization the information did not exist. Quite to the contrary, it appears that almost half of investors themselves financed preliminary audits and 14% paid for secondary audits.

Firm owners report that over 20% of firms had engaged in some type of site remediation. Over half said they were done remediating and among the remainder most reported they planned to complete it. Though we do not know to what level remediation was planned or implemented, these results somewhat call into question the claim that domestic investors are unlikely to engage in site cleanup (see, for example, Auer, Reuveny and Adler, 2001). At least among firms that are highly likely to have environmental problems, the regression results indicate that information and particularly site investigation may play an important role in spurring site remediation when firms are privatized. The existence of remediation plans with clearly defined cleanup measures was positively and significantly associated with remediation in all models. Whether combined with information to investors or environmental audits, it appears that actually digging in to inventory site contamination and plan the necessary cleanup measures is absolutely crucial. Our results indicate that if average firms had taken this step the rate of site remediation would have been 60% rather than the 21% actually observed.

The literature suggests that the explanation for such findings is that clarification of site problems allows the government and potential investors to plan their reactions to the existence of site contamination problems. They can then define what needs to be done and allocate responsibility. This avoids post-privatization arguments that could interfere with remediation.

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