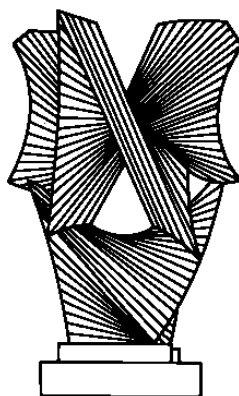


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Environmental Violations, Legal Penalties, and Reputation Costs

Jonathan M. Karpoff, John R. Lott, Jr., and Graeme Rankine¹

Abstract

This paper examines the sizes and determinants of fines, damage awards, remediation costs, and market value losses imposed on companies that violate environmental laws. We find that legal penalties are not significantly related to firm size, indicating no support for views that large companies face unusually small legal penalties. In fact, we can explain very little of the cross-sectional variation in legal penalties, lending support to arguments that such penalties are highly variable and unpredictable. On average, firms violating environmental laws suffer statistically significant losses in the market value of firm equity. The losses are of similar magnitude to the legal penalties imposed, indicating that legal penalties, and not reputational losses, are most important in disciplining and deterring environmental violations.

I. Introduction

Few policy issues raise as much controversy as do those relating to the environment. Two related controversies characterize the debate over the optimal structure of penalties for companies that violate environmental regulations. The first is over the significance, bias, and predictability of legal penalties. Advocates of stiffer penalties argue that firms do not suffer large enough penalties to encourage compliance with environmental regulations, and that large firms in particular are punished lightly. Opponents of stiffer penalties argue that many environmental violations wrongfully have been criminalized, and that legal penalties are arbitrary and unpredictable. The second controversy is over the cost to defendant companies of allegations or charges of environmental violations. In particular, do companies experience significant losses in market value, and do they experience reputational losses?

In this paper we examine these controversies by providing evidence about the size and predictability of legal penalties, the share value effects of news about environmental violations, and the reputational costs of such violations. Using data from 283 environmental violations by publicly traded companies from 1980 through 1991, we find that legal penalties frequently are substantial. The mean fine or damage award in our sample is \$9.43 million (the median is \$600,000), and the average forced compliance or remediation cost is \$59.97 million (the median is \$8 million). There is no robust

¹ University of Washington Business School; University of Chicago School of Law; Thunderbird, The American Graduate School of International Management. We thank June Mauceri and particularly Eric Wehrly for excellent research assistance.

evidence that legal penalties are related to firm size, or, for that matter, the characteristics of the violation, the party bringing the action, or the type of action brought. These results are consistent with arguments that legal penalties are idiosyncratic and difficult to predict.

We find that allegations or charges that a firm violated environmental regulations correspond to economically meaningful and statistically significant losses in the firm's share value. Initial press announcements containing allegations of a violation are associated with an average abnormal stock return of -1.58%. When the initial announcement indicates that the firm has been charged with, or sued for, a violation, the average abnormal stock return is -1.92%.

While these share value losses are significant, on average they are not larger than the legal penalties imposed. This indicates that the share value losses tend to reflect the cost of legal penalties. Reputational penalties, in contrast, appear to be negligible. This result is consistent with arguments that legal penalties, and not market-induced penalties, are the primary deterrent to environmental violations.

Our investigation is related to a growing body of research on the monitoring and enforcement of environmental policy.² Several researchers examine the share value impacts of unfavorable environmental news, such as oil or chemical spills.³ Others examine the regulatory fines imposed for single types of environmental discharges. Cohen (1987), for example, finds that monetary penalties imposed by the U.S. Coast Guard for oil spills increase when the spill involves personnel error or maintenance problems, but decrease with natural causes—suggesting that the Coast Guard uses a negligence standard and not a strict liability standard in assessing penalties. Hamilton (1996) finds that EPA administrative fines for hazardous waste violators are lower when the EPA follows its formal rules rather than negotiating an informal settlement, suggesting that negotiations tend to occur after more costly violations. Our paper differs from this work by examining the determinants of the total legal penalties—including fines, damage awards, compliance, and cleanup costs—for firms committing a wide variety of environmental violations.⁴ Also, by relating the total penalty to the size of the market value loss, we provide the first empirical measures of the sizes of any reputational costs that arise from environmental violations.

The paper is organized as follows. Section II describes the two primary controversies regarding the optimal penalties for environmental violations, and summarizes the issues we seek to address empirically. Section III describes the data and

² See Cohen (1998) for an excellent review of this literature.

³ See Muoghalu, Robison, and Glascock (1990), Lanoie and Laplante (1994), Hamilton (1995), Klassen and McLaughlin (1996), and Badrinath and Bolster (1996).

⁴ Cohen (1992) also examines the total legal penalty for a variety of environmental violations. We find substantially less evidence than does Cohen that the penalty is related to characteristics of the violation or the firm committing it.

reports on the legal penalties for environmental violations. Section IV reports on the sizes and determinants of share value losses for firms investigated or charged with violations, and section V investigates the importance of reputational penalties. Section VI concludes the paper.

II. Controversies about Environmental Penalties

A. *The Legal Penalties Controversy*

Environmental offenses in the United States historically have been prosecuted as civil matters or under general criminal statutes.⁵ Environmental regulations, and the use of criminal sanctions to enforce them, have appeared only recently. Criminal sanctions were included in the major environmental laws passed in the 1970's, including 1972 amendments to the Federal Insecticide, Fungicide, and Rodenticide Act, the Safe Drinking Water Act of 1974, the Resource Conservation and Recovery Act of 1976, and the Toxic Substances Control Act of 1976. In 1981, the EPA established its Office of Criminal Enforcement and the Department of Justice established its Environmental Crimes Unit, both to investigate and prosecute criminal violations of environmental law. In subsequent years, Congress went further by reclassifying some misdemeanors as felonies.⁶

As a result of these actions, most environmental regulatory violations can be prosecuted as criminal violations. Cohen (1992) reports that the number of new federal criminal prosecutions of environmental laws increased to more than 100 per year by the late 1980's. Lazarus (1994) reports that between 1983 and 1993, the Department of Justice recorded 911 criminal indictments against individuals and corporations, with 686 guilty pleas or convictions. During this time period, \$212,408,903 in criminal penalties were assessed, and more than 388 years of imprisonment were imposed on individuals.

The increasing criminalization of environmental violations is both a result and a cause of considerable controversy. Administrative fines for environmental violations are low—for example, averaging \$10,181 in 1995 (see Lear 1998)—prompting arguments to increase legal penalties. Although criminal sanctions are now frequently imposed, proponents of higher penalties argue that they should be used even more. In 1992, for example, the Congressional Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce considered accusations that incompetence and

⁵ Lazarus (1994) reports on several criminal cases, noting they were the exception rather than the rule. These include *United States v. Alaska S. Packing Co.*, 84 F.2d 444 (9th Cir. 1936), in which the defendant was prosecuted for discharging oil into a lake, and *State v. Buckman* 8 N.H. 203 (1836), which involved water pollution from dumping animal carcasses into a drinking well. Carter (1980) reports that, in the early 1970's, several federal criminal cases were brought under the strict liability provisions of the Refuse Act of 1899.

⁶ Examples of legislation that increased criminal penalties include the Hazardous and Solid Waste Act Amendments of 1984, the Water Quality Act of 1987, and the Clean Air Act Amendments of 1990.

malfeasance at the Department of Justice allow defendants to avoid significant penalties for environmental violations. The committee chairman, Rep. John Dingell, charged that environmental laws are enforced selectively, and that “large and powerful corporations” in particular receive preferential treatment and face small penalties.⁷ As an example of preferential treatment, Siegel (1993) describes the small penalties eventually imposed on Rockwell International for its participation in the environmental degradation of the area surrounding the Rocky Flats nuclear weapons facility.

The counter-argument holds that legal penalties should be used more selectively. Lazarus (1994), for example, argues that criminal sanctions have been applied too widely and unevenly to activities that do not merit them. As a result, the prosecution of environmental violations is unpredictable, even arbitrary. Coffee (1991) notes that the increased use of criminal penalties for environmental violations helps blur the distinction between crimes and torts. Cohen (1992) argues that overdeterrence is socially costly, as firms undertake excessive measures to avoid environmental violations.

The debate over the penalty levels, particularly the use of criminal sanctions, is complicated by the nature of many environmental violations. Unlike street crimes, which have negligible social value, most environmental violations arise from socially productive activities. Furthermore, most environmental violations involve matters of risky rather than certain outcomes. There is no threshold below which murder is acceptable, for example, whereas most types of pollution are not unlawful *per se*. Because of such complexities, the penalties imposed for environmental violations depend to an unusually large extent on the discretion of prosecutors, courts, and juries.⁸

Disagreement over the appropriate legal penalties for environmental violations has impeded the U.S. Sentencing Commission’s efforts to adopt sentencing guidelines for environmental crimes. The Commission’s sentencing guidelines for crimes by organizations became law on November 1, 1991. The Commission specifically excluded environmental violations from these guidelines, however, intending to adopt environmental guidelines at a later date. Since then, the Commission has considered, but failed to adopt, several proposals for such guidelines.

Virtually all of the proposals the Commission has considered would assign higher fines for environmental crimes than for other business crimes covered by the existing guidelines. A proposal put forth in 1994 by the Commission’s Advisory Working Group, for example, would impose higher fines and limit the extent to which mitigating circumstances or compliance programs could be used to reduce the fines (see Fiorelli and Rooney (1995)). Although the proposal was not adopted, Fiorelli and Rooney (1995)

⁷ Letter from John Dingell, Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, to William P. Barr, Attorney General (July 6, 1992), cited in Lazarus (1994), pp. 874-5.

⁸ Cohen (1992, p. 1070) discusses the criteria used by the Department of Justice to prosecute environmental violations as criminal or civil cases. See also the U.S. Department of Justice (1991).

argue that its relatively harsh provisions are likely to characterize the Commission's ultimate environmental guidelines.

B. The Reputational Cost Controversy

The Commission's decision to adopt separate environmental sentencing guidelines reflects a belief that environmental violations differ fundamentally from other business crimes. One way that environmental violations differ is that they may involve fewer reputational costs. Evidence indicates that frauds, product recalls, false advertising, and punitive damage lawsuits all impose reputational penalties on the perpetrating firms.⁹ Karpoff and Lott (1993) find that most of the penalties suffered by firms committing private frauds—over 90%—reflects lost reputation. Only a small portion of the financial penalties imposed on such firms is due to criminal penalties and other court-imposed costs.

As Klein and Leffler (1981) and Lott (1996) argue, reputation disciplines certain types of crime because market transactions internalize their costs. Companies that defraud customers, for example, lose sales. Those that cheat employees or other suppliers face higher input costs or lost trade credit. The cost of the illegal activity is internalized because the cheating firm loses at least some of the gains that accrue from repeat business with consumers, employees, or suppliers.¹⁰

Much of the controversy over the size of legal penalties for environmental violations arises from disagreement about the extent to which reputation and private incentives discipline environmental crimes. Porter and Van der Linde (1995), for example, argue that environmental insensitivity directly increases a firm's cost of business. Pargal and Wheeler (1996), Arora and Cason (1996), and Konar and Cohen (1998) claim that community pressure and informal sanctions can penalize environmental violations. As an example, a waste incinerating firm that does not comply with environmental regulations may incur higher future costs when locating its operations. Cohen (1992) argues that evidence that a firm falsified documents or discharged wastes might adversely affect customers' perceptions about the safety or quality of the firm's products. The firm's customers, employees, or suppliers also can be motivated by environmental concern to change their reservation prices in doing business with the firm. Environmentally costly activities that attract unfavorable attention could then lower demand for the firm's products (e.g., through consumer boycotts), or increase the firm's costs. According to each of these arguments, market-

⁹ Karpoff and Lott (1993) examine frauds, Jarrell and Peltzman (1985) examine product recalls, Peltzman (1981) examines false advertising, and Karpoff and Lott (1998) examine punitive damage lawsuits.

¹⁰ Recent well-known examples of such market discipline include financial losses at Sears and Roebuck after the discovery of systematic fraud at some of its auto service centers, and losses at BeechNut after its apple juice for infants was discovered to be caramel-colored sugar water.

imposed sanctions—what we label reputational costs—impose significant penalties on firms that violate environmental regulations.¹¹

A competing view, however, holds that reputation plays only a small role in disciplining environmental crimes. This view is implicit in the U.S. Sentencing Commission's efforts to impose higher penalties for environmental violations than for other illegal activities. Optimal penalty theory (e.g., as in Becker (1968)) requires that the expected total penalty for a crime—including both legal and reputational penalties—is equal to the total social cost of the crime. Therefore, from an optimal penalty framework, the U.S. Sentencing Commission's efforts make sense only if environmental reputational penalties are relatively small.

The Commission's (implicit) view is quite plausible. Environmentally harmful activities typically impose costs on parties *other than* those with whom the firm does business. The parties who are damaged therefore cannot impose costs on the firm by, for example, refusing to buy its products. The parties with whom the firm does business—customers and suppliers, for example—typically have small direct incentive to impose costs on an ecologically insensitive firm. As an example, downstream fishermen are damaged if an electroplating company dumps toxic chemicals into a municipal storm sewer. The firm's customers, however, have no direct incentive to lower their demands for the firm's products if the dumping does not affect the quality of those products.

C. Empirical Issues We Address

The controversies over the legal penalties for environmental violations, and the possible importance of reputational penalties, raise the following questions:

1. Are the total legal penalties for environmental violations consequential? How large are the fines, damage awards, compliance costs, and cleanup costs paid by firms?
2. Are legal penalties for environmental violations predictable? That is, are they systematically associated with the type or cost of the violation?
3. Do violations that are prosecuted as criminal cases receive higher legal penalties than violations prosecuted as civil cases?
4. Controlling for characteristics of the violation, are legal penalties systematically related to firm size? In particular, do large firms receive lower penalties?

¹¹ Downing and Kimball (1982) suggest that managers comply with environmental regulations because they care about their companies' images, a notion that is supported by survey evidence reported by Cahill and Kane (1991), Doonan, Lanoie, and Laplante (1998), and Zerbe (1996). This argument also is consistent with the notion that reputational concerns motivate compliance.

5. Do firms discovered to have violated environmental regulations experience significant losses in market value?
6. Do firms that violate environmental regulations have reputational losses? That is, do firms lose market value over and above the costs of any legal sanctions?

III. Data

To provide answers to these questions, we examine 283 cases in which publicly traded firms were investigated, accused, or settled charges of environmental violations from 1980 through 1991. The sample is obtained from a search of *The Wall Street Journal Index* under its “Environment” and “Environmental Crime” listings. To be included in the sample, the defendant firm must have stock returns available on the 1996 CRSP daily returns file on the day of the earliest *Wall Street Journal* report of its environmental violation, plus at least 60 of the preceding 250 trading days.

The sample consists of a wide variety of actions involving different types of environmental harm and initiated by different regulatory agencies or private parties. The following examples illustrate typical cases:

- (i) FMC Corp. was indicted in 1980 for providing false data to the EPA about the amount of carbon tetrachloride the firm had released in the Kanawha river in Charleston, West Virginia;
- (ii) In 1986, a Kerr-McGee Corp. storage tank ruptured and distributed radioactive uranium hexafluoride gas over a part of eastern Oklahoma, prompting a civil lawsuit from a group of nearby residents;
- (iii) In 1990, the New Jersey Department of Environmental Protection ordered PPG Industries, Inc. to pay \$31.5 million to clean up contamination from a chromium plant the company had previously operated in the state.

The wide diversity of events in the sample permits us to investigate several hypotheses regarding the penalties and share value losses incurred by defendant firms. We classify the sample by the following criteria: (i) the year in which the first news about the environmental harm was published in the *Wall Street Journal*; (ii) the type of lawsuit or regulatory action; (iii) the medium (e.g., air, water) involved; and (iv) the party bringing the action.

(i) *Event year*: Panel A of Table 1 reports on the distribution of the sample by year and the type of action involved. The sample displays no significant time clustering during the 1980 - 1991 period.

(ii) *Type of action*: As discussed in Section II, criminal enforcements are at the center of much controversy over the penalties for environment violations. Relatively few actual enforcement actions, however, involve criminal charges against firms. In our

sample, only 19 cases involve criminal lawsuits. Many more (101) involve civil lawsuits filed by either private parties or such agencies as the EPA. State and federal regulatory fines or actions comprise an additional 91 cases, and in 19 cases a firm and regulatory agency agreed to a court-sanctioned consent order. In 35 additional cases, a firm recalled a product to avoid environmental sanctions. As an example, in April 1984 American Motors recalled 62,000 of its 1979 model automobiles because of clean air violations. A final 18 additional cases are classified as “liability assignments.” These involve situations in which the initial *Wall Street Journal* press announcement reveals that the defendant firm had been assigned liability for an environmental charge. For example, in June 1989, a federal judge ruled that Allied Signal Corp. was liable for the clean-up costs at two Maryland toxic waste sites.

(iii) Medium involved: Panel B of Table 1 reports the breakdown of the sample by the type of medium involved. Of the 283 cases in the total sample, 92 involve air emissions, including violations of the Clean Air Act and its 1990 amendments. Fifty-eight cases involve surface water contamination, including Clean Water Act violations. Eleven cases involve contamination of drinking water supplies and possible violations of the Safe Drinking Water Act. An additional 79 cases involve contaminated sites and/subsurface water contamination, typically involving violations under the Resource Conservation and Recovery Act of 1976 or the Comprehensive Environmental Clean-Up and Liability Act of 1980. In 13 cases, the violations involve two or more of the preceding categories, and are classified as multiple media cases. A total of 30 additional cases are classified as miscellaneous. These include violations under the Toxic Substances and Control Act, charges of improper storage of hazardous materials, and several cases in which the medium or specific violation are not discernible from the available press articles.

(iv) Party bringing the action: Roughly 50% (143) of our cases involve lawsuits or regulatory actions brought by the EPA. An additional 46 cases involve civil or criminal lawsuits filed by the Department of Justice. In many of these cases, however, the Justice Department acted in cooperation with or relied in part upon EPA investigations. In 58 cases, the action was brought by a state or local environmental agency. Environmental groups, such as the Sierra Club Legal Defense Fund, brought 7 of the cases, and 29 other cases were initiated by individuals. This last category includes a number of class-action lawsuits.

IV. Legal Penalties for Environmental Violations

A. Sizes of Legal Penalties

Firms committing environmental violations face several forms of legal penalties, including fines, payments to damaged parties, compliance costs, and cleanup expenses. To examine the sizes of these penalties, we obtained information from the *Wall Street*

Journal about the legal penalties imposed for 117 of the 283 cases in the sample. Fines were imposed or monetary damages awarded in 77 cases, and in 55 cases, the firm agreed to pay the costs to comply with regulations or remediate prior damage. In 15 of these cases, a firm paid both a fine and a cleanup cost.

Panel A of Table 2 reports data from the 77 cases in which fines were imposed or monetary damages awarded to victims. The mean amount awarded is \$9.43 million, although most amounts are substantially smaller than this. The median, for example, is \$600,000. Although the mean payment levels vary by the type of environmental harm, the differences are not statistically significant. The F-statistic from an analysis of variance is 1.16, with a p-value of .34. Air emission violations are associated with the largest mean penalty, \$28.10 million. This mean, however, is affected by two settlements that are not typical among the air emission cases. The first is Union Carbide's \$350 million settlement of claims stemming from the December 3, 1984 leak of poison gas from the firm's Bhopal, India pesticide plant, and the second is Monsanto Co.'s \$81.9 million settlement of claims arising from the use of Agent Orange during the Vietnam war. Omitting these unusual cases, the mean assessed penalty for air emission cases is \$8.33 million. (Among the remaining cases, another outlier consists of a 1983 U.S. Justice Department \$112 million penalty against LTV Corp. for failing to install anti-air pollution equipment required by an earlier consent decree.)

Even excluding these large outliers, the data indicate that defendant companies typically pay large amounts in fines and damage claims. A more typical air emission case, for example, is a \$990,000 fine paid by International Paper Co. in 1989 for violations of the Clean Air Act at a Maine paper pulp mill. Typical examples of fines for surface water violations include a 1982 Mobil Oil Corp. agreement to pay the State of Alabama a \$2 million for illegally discharging drilling fluids into state waters, and a 1989 agreement by Pennwalt Corp. to pay \$500,000 to settle U.S. federal criminal charges arising from a discharge of sodium dichromate into a Washington state waterway.¹²

Panel B of Table 1 reports on the 55 cases for which we have information on firms' estimated costs to comply with regulatory or court-imposed mandates, or to clean up environmental damage. In general, compliance and cleanup costs are substantially higher than fines and damage awards. In the 1989 International Paper Co. case cited above, for example, in addition to its \$990,000 fine, the firm also agreed to spend \$4.2 million to install air pollution control equipment at its Maine plant. As another example, in 1981 Ohio Edison was fined \$1.55 million for sulphur dioxide and other emissions at

¹² The Exxon Valdez oil spill, which occurred in March 1989, resulted in a 1994 jury award of \$5.3 billion in compensatory and punitive damages. We include this case in our sample, but use data on the smaller monetary damages that were reported in *The Wall Street Journal* through 1991, which is the end of our sample period.

its coal-burning power plants. At the same time, the firm agreed to spend an estimated \$367 million to comply with Clean Air Act requirements.

Overall, the mean compliance or cleanup cost is \$59.97 million, with a median of \$8.0 million. Once again, although the mean values differ according to the type of medium involved, the differences jointly are not statistically significant.

For 62 additional cases, we obtained information not on the penalties actually assessed, but rather, on the maximum penalties that potentially could be assessed. For example, in 1989 a federal court jury awarded \$136 million in damages in a mock trial to class-action plaintiffs who sued National Lead of Ohio Inc. for contamination at its Fernald, Ohio uranium plant. The purpose of the mock trial was to establish the firm's approximate liability should the case go to full trial, and to encourage an out-of-court settlement. As another example, in 1991 the EPA announced its intention to seek a \$4.7 million fine from a unit of Bayer AG for alleged violations of the Toxic Substances Control Act. In both of these cases, the penalty amounts were not actually awarded or assessed. We conjecture that the amounts actually assessed subsequently were lower. Nonetheless, we use this as information about the penalties that potentially could have been assessed.

Summary data on such potential penalties are reported in Panels C and D of Table 1. The mean levels are substantially higher than those in Panels A and B, reflecting the speculative nature of these assessments. Overall, the mean potential fine or damage award is \$82.67 million. The differences across media, while substantial, are not statistically significant.

Prospective compliance and cleanup costs are particularly large. The mean level for the 11 cases reported in Panel D is \$352.77 million. This includes a 1983 case in which the U.S. Army sued Shell Oil Co. for \$1.8 billion to cover actual and projected clean up costs at a pesticide plant the company operated on Army property. In another extreme example, in 1990 New Jersey state authorities announced their intentions to seek \$2.25 billion from Allied Signal Inc., PPG Industries, and Maxus Energy Co. to clean up toxic waste from the site of a former chromium refinery.

B. The Determinants of Legal Penalties

The data in Table 2 indicate that firms accused of environmental violations face potentially large fines, damage awards, or compliance and cleanup costs. Table 3 reports on tests that examine whether the legal penalties are systematically related to the characteristics of the firm or the nature of the violation. The first column in Table 3 reports coefficients and t-statistics from an ordinary least squares regression in which the actual fine or damage award is the dependent variable. The regressors include:

- Firm size, measured as the natural log of the market value of equity ten calendar days before the initial press announcement;

- Dummy variables for the party that initiated the action, including state or local government agencies, environmental groups, and individuals (leaving the constant term to reflect actions by the EPA or Department of Justice);
- Dummy variables for the type of action, including criminal lawsuits, consent orders, and assignment of cleanup liability (leaving the constant term to reflect civil lawsuits or fines imposed by regulatory authorities);
- Dummy variables for the types of environmental harm (i.e., the medium involved);
- Dummy variables for the type of payment, including fines paid to state or federal government authorities, payments that are designated for cleanup costs, and combinations of payments (leaving the constant term to reflect civil payments to private parties); and
- A dummy variable that is equal to one if the firm also was subject to an enforced cleanup or compliance cost.

The coefficient for the log of the market value of firm equity is positive (0.99), although not significantly different from zero. This result is inconsistent with conjectures that larger firms receive relatively small penalties for environmental violations. The coefficient for criminal lawsuits is 7.50, and also is not significantly different from zero. This result indicates that, in our sample, criminal charges are not associated with higher legal penalties than those imposed through civil lawsuits or regulatory sanctions. Thus, while the criminalization of environmental violations has increased the potential for high penalties, criminal cases in practice are not associated with unusually high penalties.

Most of the other coefficients in the regression also are statistically insignificant. In particular, the penalty amount is not significantly related to the medium involved or the payment type. The one statistically significant coefficient is for the dummy variable indicating that the case was initiated by individuals or through class-action lawsuits. This suggests that such lawsuits are associated with relatively large legal penalties. Even this result, however, should be interpreted with caution in light of the regression's poor fit. The adjusted R^2 is 0.073, and the F-statistic is 1.38. We cannot reject at the 10% level the null hypothesis that all coefficients are zero.

In the second regression reported in Table 3, the dependent variable is the amount of the compliance or cleanup cost. The results are similar to those in the first regression. Compliance or cleanup costs are not significantly related to firm size, the medium involved, or the payment type. The coefficient for actions brought by individuals is positive, and the coefficient for cases in which the firm is assigned liability for a cleanup cost is negative. Again, however, the F-statistic of 1.24 indicates that the model fit is very poor.

To check the robustness of these results, we estimated several different models seeking to explain the cross-sectional variation in the penalty amounts, including variables that control for the year of action and interaction effects involving the action type, the party initiating the action, and the type of environmental harm. All of the results are similar to those reported in Table 3. Neither the fines or damage awards, nor the compliance and cleanup costs, are systematically related to characteristics of the defendant firm or the nature of the violation.

Our inability to explain much of the cross-sectional variation in legal penalties is consistent with the results of research into the predictability of legal penalties for firms that are charged with other types of illegal behavior. Karpoff and Lott (1998), for example, find that punitive damage awards are not systematically related to the characteristics of the damage, consistent with arguments that punitive awards frequently are arbitrary and not easily predicted. Like punitive damage awards, the penalties imposed for environmental violations also are difficult to explain. Thus, our results are consistent with arguments that environmental penalties are highly variable, with large idiosyncratic and perhaps arbitrary components.

C. The Relation between Fines and Cleanup Costs

In a small subset of our sample, involving 15 cases, we have information that both fines (or damage awards) and cleanup costs were imposed on defendant companies. This small subsample provides an opportunity to examine whether fines and cleanup costs are related. Table 4 reports the results of three regressions using data from these cases. In each regression, the dependent variable is the fine or damage award amount.

Model 1 in Table 4 suggests that the fine is weakly but positively related to the cleanup cost: the coefficient is 0.0253 with a t-statistic of 1.52. Cleanup costs provide one measure of the cost of the environmental damage that results from the violation, so these results suggest that penalties are positively related to the environmental harm. The coefficient on firm size is negative with a t-statistic of -1.91. This provides some evidence that penalties are negatively related to firm size, consistent with charges that large firms pay small penalties.

The results in Model 1 are the strongest evidence we have that fines are somewhat predictable. The adjusted R^2 indicates that 23.2% of the cross-sectional variation in penalties can be explained by firm size and the cleanup cost. However, as illustrated in Models 2 and 3 in Table 4, these results are not robust. In Model 2, we include as a regressor the square of the cleanup cost, as a control for any non-linear relation between fines and cleanup costs. Both the cleanup cost and its square are insignificantly related to the fine amount, and the regression's F-statistic has a p-value of .18. In Model 3, we also include dummy variables that reflect the type of environmental harm and the party bringing the action. Here, the coefficients on firm size and cleanup costs both are statistically insignificant. The only significant coefficient is, again, for the dummy

variable indicating that the action was brought by individuals or through a class action lawsuit. Overall, these results do not provide much support for the proposition that fines are systematically related to characteristics of the violation or the size of the firm committing it.

V. The Market Value Effects of Announcements of Environmental Violations

A. Average Abnormal Returns, by Announcement and Media Types

The results in Tables 2 - 4 indicate that the legal penalties for environmental violations are substantial but not systematically related to the characteristics of the violation. In this section we investigate the effects on share values when news about actual or potential violations is first announced. In 60 of our cases, the initial press report indicates that an environmental violation may have occurred. We label these "allegation announcements." In 80 cases, the initial press report indicates that charges have been filed against the defendant company. And in 143 cases, the initial press report indicates a settlement of the case. Settlements include agreements between the defendant firm and the initiating party, consent orders, trial outcomes, and announcements of fines by regulators.

Table 5 reports on the average two-day abnormal stock returns for the initial press announcements of environmental violations for all 283 cases and for each announcement type. The two-day event window consists of the day before plus the day of the initial press report. Abnormal returns are calculated as the difference between the actual two-day return minus a forecast return from a one-factor market model. We estimate the market model using trading days -230 through -31 relative to the initial press date, and measure market returns using the CRSP equal-weighted index with dividends. Test statistics are calculated using the procedure discussed by Mikkelson and Partch (1988), which avoids a bias from errors in the estimation of the market model parameters (see Salinger (1992)).

For all 283 initial press announcements, the average two-day abnormal stock return is -0.85%, with a t-statistic of -3.40. Thus, on average, the initial press report of a possible or actual environmental violation is associated with a significant decrease in the defendant company's share value. The share price effect, however, depends on the type of information contained in the initial announcement. For allegation announcements, the mean abnormal stock return is -1.58% with a t-statistic of -2.32. For announcements indicating that charges have been filed, the mean abnormal stock return is -1.92% with a t-statistic of -3.25. For settlement announcements, however, the mean abnormal stock return is 0.06% and is not significantly different from zero.

Our result regarding settlement announcements is similar to those reported by Karpoff and Lott (1993, 1998) for criminal frauds and punitive damage awards. Like us,

Karpoff and Lott find that initial announcements of settlements are associated with statistically insignificant stock price reactions. We interpret this result as consistent with the conjecture that an initial announcement about a settlement is not the first news of the violation to reach financial markets. Instead, the settlement announcement is likely to contain new information primarily about the outcome of a previously known investigation or charge. Hence, the data indicate that, on average, investors form unbiased expectations about the nature of the outcomes of environmental violations.¹³

Initial press reports about allegations or charges filed, however, are associated with a statistically significant negative average abnormal return. Furthermore, the average abnormal return is negative for all types of media involved. Among allegation announcements, the largest average stock price drop is for 15 cases involving contaminated sites.¹⁴ Among charges filed announcements, the largest average stock price drops involve surface water and drinking water violations, as well as the 13 miscellaneous cases. Perhaps because the sample sizes in the individual cells are fairly small, however, the differences in average abnormal returns across different media types are not statistically significant.

For 53 cases, other potentially confounding news about the defendant company was announced in *The Wall Street Journal* the day before, the day of, or the day after the initial press announcement about the environmental violation. Many of these are routine announcements regarding dividends or earnings reports. Others involve non-routine announcements regarding asset sales or potential takeover rumors. Omitting these 53 events from the sample, the average abnormal return becomes more negative. For allegation announcements, it becomes -1.73% ($t = -2.22$), for charges filed announcements, -2.25% ($t = -3.41$), for settlement announcements, -0.05% ($t = -0.19$), and for all announcement types together, -1.10% ($t = -3.67$).

For 64 of the 283 cases in our sample, we identified a subsequent article in *The Wall Street Journal* with additional information about the matter. The average abnormal two-day stock return for these 64 announcements is -0.37% with a t-statistic of 0.84. Thus, unlike the initial announcements, these 64 secondary announcements are not associated with statistically significant share value effects. This suggests that the abnormal return upon the initial announcement is an unbiased estimate of the longer-term impact of the violation on the firm's market value.

¹³ In two cases, the settlement announcement revealed that any pending charges against the defendant company had been dropped. We replicated all tests after omitting these cases, but the results are qualitatively identical to those reported here.

¹⁴ This average is influenced by an outlier. On August 7, 1985, Louisiana state officials announced the pending closure of a commercial waste facility operated by Rollins Environmental Services, in response to problems including air emissions and possible groundwater contamination. The two-day abnormal return for Rollins Environmental Services is -31%. Omitting this case does not affect the overall results materially. For example, the mean abnormal return for the remaining 282 cases is -0.74% with a t-statistic of 3.22.

B. Determinants of the Cross-Section of Abnormal Returns

The results in Table 5 indicate that announcements of allegations and charges filed are associated with statistically significant stock price declines. In this section we examine whether the stock price reactions are associated with other characteristics of the announcement, the violation, or the defendant company. Table 6 reports the results of ordinary least squares regressions in which the dependent variable is the firm's two-day abnormal stock return divided by its standard error. The independent variables include:

- Firm size, measured as the natural log of the market value of equity ten calendar days before the press announcement;
- A dummy variable for allegation announcements;
- A dummy variable for charges filed announcements;
- Dummy variables for the types of environmental harm;
- Dummy variables for the initiator of the action;
- Dummy variables for the type of action;
- A dummy variable set equal to one if we have information on the actual or potential fines, damages, compliance, or cleanup costs imposed on the company; and
- The total dollar amount of the actual or potential fines, damages, compliance, or remediation costs imposed on the company, divided by the market value of the firm's equity (this variable is zero for firms for which we do not have penalty data).

The results are reported as Model 1 in Table 6. The coefficient on firm size is positive and statistically significant, indicating that, in percentage terms, the market value loss is a decreasing fraction of firm size. This finding is consistent with our earlier finding that the absolute size of the legal penalty imposed is not related to the size of the defendant firm. The coefficients for allegation and charges filed announcements are significantly negative, consistent with our findings in Table 5 that the negative average abnormal returns concentrate among these types of announcements. None of the coefficients on any of the dummy variables representing the type of environmental harm are statistically significant. This also is consistent with the results, reported above, that the differences in average abnormal returns across the different media involved are not statistically significant.

The coefficient on the dummy variable for actions initiated by state and local agencies is negative, with a t-statistic of -2.32. This indicates that such actions are associated with significantly more negative share value changes than actions initiated by the EPA or Department of Justice. Among the type of action dummy variables, the only one with a p-value less than .05 is for product recalls. The coefficient for

assignments of liability also is negative, and is significant at the 10% level. Product recalls in response to environment violations and assignments of liability for environmental violations both have direct impacts on firms' cash flows. These results suggest that such actions have larger impacts on share value than do regulatory fines or the prospect of loss from lawsuits over environmental damages.

Nevertheless, when monetary penalties or damage awards are assessed, there is statistically weak evidence that they affect share values. The dummy variable representing whether such monetary penalties are assessed is negative, although not statistically significant (t-statistic = -1.27). The variable representing the size of the actual or prospective penalty assessed also is negative, with a p-value of .11 (t-statistic = -1.60). These results, although statistically insignificant, suggest that share values are affected by the size of the monetary penalties firms pay for environmental harms.

To examine the effects of monetary penalties more closely, we decomposed the penalty variables into four groups: fines and damage awards assessed, compliance and cleanup costs, potential fines and damage awards, and potential compliance and cleanup costs. For each group, we define a dummy variable that equals one when we have data for that type of penalty. We also define a second variable that equals the dollar amount of the penalty (or potential penalty). This has the effect of partitioning the two monetary variables into eight variables.

The results from including these eight variables are reported as Model 2 in Table 6. None of the new variables is statistically significant at the 10% or even 20% level. Thus, we find no evidence to support the notion that the type of actual or potential monetary penalties has a significant impact on share values.

VI. Estimates of Reputational Costs for Environmental Violations

Jarrell and Peltzman (1985) and Mitchell and Maloney (1989) demonstrate that reputational losses frequently impose large costs on firms that produce poor quality products. In their examination of firms committing criminal frauds, Karpoff and Lott (1993) find that the market value losses were far greater than any criminal fines, restitution, or other court-imposed penalties. They attribute the difference largely to reputational losses, which consist of the value of lost revenues or higher input costs arising from the frauds.

In this section we examine the reputational costs imposed on firms committing environmental violations. To do so, we compare the firms' market value losses with their legal penalties. To control for firm size effects, we divide both the market value loss and the legal penalty by the market value of the firm's equity. Because settlement announcements appear to yield little new information to financial markets, on average, we focus on allegation and charges filed announcements. In our sample, there are 35 such cases in which we also have information about actual legal penalties assessed, and

an additional 42 cases in which the press announcement contains information about potential penalties.

Panel A of Table 7 compares the mean abnormal stock return for these 77 cases with the legal penalty. Overall, the mean abnormal stock return for these 77 cases is -2.11%. The mean value of the actual or potential legal penalty, in contrast, is 36.68% of the market value of equity. (The t-statistic for the difference in means is 1.60.) Thus, the legal penalty, on average, far outweighs the market value loss.

Among these 77 cases, however, are five for which the actual or legal penalty far outweighs the market value of equity. Four of these cases involve prospective damage awards in civil lawsuits or potential liability for an expensive cleanup.¹⁵ It is reasonable to presume that the potential costs projected in news articles were overstated and known to be so. Panel B of Table 7 therefore reports on mean abnormal returns and legal costs excluding these five cases from the sample. Even excluding these cases, however, the mean legal penalty still is greater in magnitude (2.85% of firm value) than the abnormal stock return (-2.05%). (The t-statistic for the difference in means is 0.71.)

The results in Panel B may still be biased because they include cases in which the legal penalty is computed as its *potential* amount forecast at the time of the initial press announcement. In Panel C, we include data only from cases in which the actual legal penalty is reported. In 24 of these cases, the actual legal penalty was reported after the initial press announcement date. Assuming that investors have rational expectations about legal penalties, however, the actual penalties are reasonable measures of their expected amounts at the times of the initial press announcements.

Using this smaller sample, the average legal penalty is 1.70% of the market value of firm equity. The corresponding mean abnormal return is -1.55%. (The t-statistic for the difference in means is 0.16.) Thus, even in this smaller sample, the average abnormal return is not significantly larger than the average legal penalty.

In addition to any legal penalties that we measure, firms typically must pay attorneys' fees and court costs, and may suffer lost profits from foregoing the activity that violated environmental regulations. It therefore is reasonable to presume that our measure of the legal penalty actually understates a firm's total explicit costs from charges of an environmental violation. Even with such understatement, the data indicate that the explicit costs imposed through legal procedures are no less than the average firm's loss in share value. There is no share value loss that confidently can be attributed to lost future revenues or higher expected operating costs because of

¹⁵ These cases include: (i) the announcement of a \$1.8 billion lawsuit seeking damages from Charter Co. for dioxin poisoning; (ii) a \$100 million lawsuit seeking damages from RSR Corp. for pollution at its Texas recycling plant; (iii) a \$225 million lawsuit seeking damages from SCA Services for pollution from improper storage of industrial wastes, and (iv) Gulf Resources and Chemical Corp.'s possible liability for a \$100 million cleanup of a Superfund site. The fifth case is Union Carbide's Bhopal disaster, which resulted in a \$350 million settlement.

reputational issues. Thus, these results indicate that the average reputational penalty for environmental violations is negligible. Unlike criminal frauds and product recalls, it appears that reputational costs do little, on average, to discourage environmental violations.¹⁶

VI. Conclusions

This paper provides empirical evidence on the legal penalties and market value losses experienced by companies that violate environmental regulations. The evidence addresses controversies over the sizes and predictability of the legal penalties, and over the importance of reputational costs for environmental violations. Using data initially from 77 events in which firms were investigated, convicted, or cited for environmental violations, we find that fines and damage awards are substantial, averaging \$9.43 in our sample. Enforced compliance and cleanup costs are even larger, averaging \$59.97 million among the 55 events in our sample in which such costs were imposed. These legal penalties are not significantly related to the size of the defendant company, contrary to arguments that large firms receive relatively small legal sanctions for environmental harms. Criminal penalties also are not higher than civil penalties. There is some evidence that actions initiated by individuals, including class-action lawsuits, are associated with relatively high penalties, primarily because these include civil lawsuits that seek punitive damage awards. Overall, however, we are unable to explain much variation in the legal penalties using information on the type of environmental harm, the party that initiates the action, or whether the penalty consists of criminal, civil, or cleanup payments. The poor fit of our models that seek to explain cross-sectional variation in legal penalties is consistent with arguments that such penalties are highly variable and not easily predicted.

Using data from a broader sample of 283 cases, we find that firms investigated or charged with environmental violations experience statistically significant and economically meaningful decreases in common share values. For announcements of alleged environmental violations, the average abnormal stock return is -1.58% with a t -statistic of 2.32. For announcements that charges had been filed against the firm, the average abnormal stock return is -1.92 with a t -statistic of 3.25. (Initial press announcements that a firm settled allegations of violations, in contrast, are associated with negligible and statistically insignificant average abnormal stock returns.) Share value losses are negatively related to firm size, and are relatively high for violations that lead to product recalls or assignment of liability for an environmental harm. Such losses also are higher, on average, for actions brought by state and local authorities than for

¹⁶ An alternative but not mutually exclusive interpretation is that, on average, the social cost of these violations is small. If this is the case, the reputational penalty is negligible *and* legal penalties are suboptimally high.

actions brought by the EPA or Department of Justice. One interpretation of this result is that enforcement actions by local governments effectively impose significant costs on defendant companies.

Finally, we find that firms' share value losses are of similar magnitude to their legal penalties. This implies that the share value losses can be completely attributed to the legal penalties rather than to expectations of lower profits due to reputational losses. The reputational penalty for violating environmental regulations is negligible, on average. This result supports arguments that environmental violations are unlike frauds, product recalls, or punitive damage lawsuits, all of which have been found to impose substantial reputational penalties on the offending firms. Using Becker's (1968) optimal penalties framework, this supports the view that optimal legal penalties should be higher for environmental crimes than for such other illegal activities as criminal fraud, which are efficiently disciplined by reputational effects.

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Table 1: Environmental Violations Sample

Distribution of 283 first-time announcements of environmental violations obtained from *The Wall Street Journal* during the period 1980-1991. Panel A reports announcements by year and type of action initiated by the plaintiff. Panel B reports announcements by the type of environmental harm involved in the dispute. Panel C reports announcements by the party bringing the action.

Panel A: Type of Action

Year	Criminal Suit	Civil Suit	Regulatory Fine/Action	Consent Order	Product Recall	Liability Assignment	Total
1980	1	17	7	2	7	0	34
1981	2	11	3	2	0	3	21
1982	1	5	5	0	2	0	13
1983	2	8	9	2	4	0	25
1984	1	4	7	0	4	3	19
1985	1	5	15	1	5	4	31
1986	1	7	9	3	6	1	27
1987	2	10	6	1	2	0	21
1988	3	6	7	1	2	0	19
1989	1	8	4	1	3	2	19
1990	1	8	9	2	0	3	23
1991	3	12	10	4	0	2	31
Total	19	101	91	19	35	18	283

Panel B: Type of Environmental Harm

	Air	Surface Water	Drinking Water	Contaminated Site	Multiple Media	Miscellaneous Media	Total
All years	92	58	11	79	13	30	283

Panel C: Party Bringing Action

	State/Local Agency	EPA	Justice Dept	Environmental Group	Individuals	Total
All years	58	143	46	7	29	283

Table 2: Sizes of the Legal Penalties Levied for Environmental Violations

Panel A provides summary information on the *actual* fines or damage awards assessed against in 77 environmental violations, categorized by the type of environmental harm. Panel B reports on the compliance or cleanup costs imposed in 55 cases of environmental violations. The data are drawn from our sample of 283 environmental violations obtained from *The Wall Street Journal* Index during the period 1980-1991. In some cases, we have information only on estimates of the potential legal penalties that could be imposed. Panel C reports on the estimated potential fines and damage awards in 51 additional environmental violations, and Panel D reports on the estimated potential compliance or cleanup costs in 11 additional cases. Amounts are in millions of dollars.

	Type of environmental harm						
	Air	Surface Water	Drinking Water	Contaminated Site	Multiple Media	Miscellaneous Media	Total
<i>Panel A: Actual Fines and Damage Awards</i>							
Mean	28.10	1.45	0.48	3.36	12.30	1.05	9.43
Median	0.60	0.55	0.48	1.73	12.30	0.45	0.60
Obs.	21	22	1	20	2	11	77
<i>Panel B: Actual Compliance and Cleanup Costs</i>							
Mean	77.77	13.97	38.53	75.71	99.38	33.48	59.97
Median	8.00	1.25	2.90	11.00	103.75	0.33	8.00
Obs.	9	12	3	24	4	3	55
<i>Panel C: Estimated Potential Fines and Damage Awards</i>							
Mean	84.48	53.40	57.90	156.54	136.00	0.86	82.67
Median	7.75	1.00	35.00	5.68	136.00	0.90	2.10
Obs.	12	13	3	14	1	8	51
<i>Panel D: Estimated Potential Compliance and Cleanup Costs</i>							
Mean	150.00	--	--	373.05	--	--	352.77
Median	150.00	--	--	98.75	--	--	100.00
Obs.	1			10			11

Table 3: Determinants of the Fines and Cleanup Costs Imposed for Environmental Violations

Ordinary least squares estimates of the relations between the legal penalties imposed on firms committing environmental violations, and characteristics of the violations. The dependent variable in the first regression is the dollar amount of the fine or damage award imposed. The dependent variable in the second regression is the dollar amount of the compliance or cleanup costs imposed on the firm. All coefficients are in millions. t-statistics are in parentheses.

	Dependent variable	
	Fine or damage award imposed	Compliance or cleanup cost imposed
Market value of equity (natural log)	0.99 (0.32)	23.94 (1.14)
<i>Dummy variables for party bringing action:</i>		
Action brought by state agency	1.05 (0.07)	-67.19 (-1.19)
Action brought by environmental group	2.65 (0.08)	24.38 (0.14)
Action brought by individuals (including class action lawsuits)	62.04 (2.97) ^c	307.22 (3.16) ^c
<i>Dummy variables for action type:</i>		
Criminal lawsuit	7.50 (0.47)	41.77 (0.41)
Consent order	16.81 (1.00)	16.75 (0.25)
Assignment of cleanup liability	-3.02 (-0.09)	-212.39 (-2.52) ^a
	Dependent variable	
	Fine or damage award imposed	Compliance or cleanup cost imposed
<i>Dummy variables for type of environmental harm:</i>		
Air emission violations	11.75 (0.72)	41.91 (0.26)
Surface water violations	-10.57 (-0.62)	-37.53 (-0.22)
Drinking water contamination	-71.99	-43.27

	(-1.52)	(-0.23)
Contaminated site (including CERCLA and subsurface water violations)	0.71 (0.04)	50.14 (0.32)
Violations of multiple media	-15.75 (-0.46)	-34.40 (-0.18)
<i>Dummy variables for type of payment:</i>		
Payment made to a state or federal government agency	-12.68 (-0.96)	-32.98 (-0.16)
Amount paid is designated for cleanup	-14.89 (-0.43)	27.23 (0.15)
Amount is a combination of fines, damage awards, and/or cleanup costs	-9.59 (-0.38)	51.03 (0.26)
Dummy variable equal to 1 if compliance or cleanup cost also is imposed	-0.96 (-0.04)	
Dummy variable equal to 1 if a fine or damage award also is imposed		-34.15 (-0.47)
Intercept	-5.01 (-0.10)	-321.53 (-0.96)
F-value	1.38	1.24
p-value	[0.185]	[0.288]
Adjusted R ²	0.073	0.065
Number of cases	77	55

a,b,c denote significance at the 0.10, 0.05, and 0.01 levels, respectively, based on a two-tailed test.

Table 4: Determinants of Fines when Cleanup Costs Are also Imposed

Ordinary least squares estimates of the relations between the fines imposed on firms committing environmental violations, and characteristics of the violations. This table reports results based on the 14 cases in the sample for which the firm paid both a fine and a cleanup cost. The dependent variable is the dollar amount of the fine or damage award imposed. t-statistics are in parentheses.

	Model 1	Model 2	Model 3
Ln of the market value of equity ($\times 10^7$)	-2.80 (-1.91) ^a	-2.77 (-1.82) ^a	-1.14 (-0.57)
Clean-up cost paid by company ($\times 10^2$)	2.53 (1.52)	5.73 (0.08)	-1.98 (-0.32)
Square of the clean-up cost paid by company ($\times 10^{11}$)		5.07 (0.29)	0.11 (0.76)
<i>Dummy variables for type of environmental harm:</i>			
Air emission violations ($\times 10^7$)			1.67 (0.25)
Surface water violations ($\times 10^7$)			-2.12 (-0.38)
Contaminated site, including CERCLA and subsurface water violations ($\times 10^7$)			2.54 (0.41)
<i>Dummy variables for party initiating action:</i>			
Action brought by state agency ($\times 10^7$)			--0.33 (-0.07)
Action brought by individuals ($\times 10^7$) (including class action lawsuits)			19.57 (2.48) ^b
Intercept			0.20 (0.04)
F-value	3.11	1.94	36.68
p-value	[0.082]	[0.181]	[0.000]
Adjusted R ²	0.232	0.346	0.942

^{a,b,c} denote significance at the 0.10, 0.05, and 0.01 levels, respectively, based on a two-tailed test.

Table 5: Abnormal Stock Returns Associated with Announcements of Environmental Violations

Average two-day cumulative abnormal returns -1,0 for 283 first-time announcements of environmental violations obtained from *The Wall Street Journal* Index during the period 1980-1991, categorized by the type of environmental harm and the announcement type. The table reports the mean, median, t-statistic and the number of announcements in each category.

Announcement Type		Type of Environmental Harm						Total
		Air	Surface Water	Drinking Water	Contaminated Site	Multiple Media	Miscellaneous Media	
Allegation	mean	-1.44	-0.08	0.24	-4.17	-0.93	-0.11	-1.58
	median	-0.91	0.36	0.24	-0.98	-0.49	0.42	-0.57
	t-statistic	-1.87 ^a	-0.12	--	-1.80 ^a	-0.69	0.09	-2.32 ^b
	no. of obs.	18	13	1	15	5	8	60
Charges Filed	mean	-1.13	-2.29	-2.36	-1.74	--	-2.36	-1.92
	median	-0.70	-0.74	-1.08	-1.51	--	0.43	-0.96
	t-statistic	-1.26	-1.76 ^a	-1.83 ^a	-3.11 ^c	--	0.87	-3.25 ^c
	no. of obs.	15	20	7	25	0	13	80
Settlement	mean	-0.03	0.38	-0.12	-0.07	-0.40	0.71	0.06
	median	-0.18	0.84	0.61	-0.07	0.38	-0.06	0.12
	t-statistic	-0.09	0.58	-0.16	-0.17	-0.49	-1.04	0.27
	no. of obs.	59	25	3	39	8	9	143
All Announcement Types	mean	-0.48	-0.65	-1.51	-1.38	-0.60	-0.84	-0.85
	median	-0.57	0.18	-0.17	-0.41	-0.39	0.31	-0.39
	t-statistic	-1.60	-1.14	-1.70 ^a	-2.60 ^c	-0.87	-0.69	-3.40 ^c
	no. of obs.	92	58	11	79	13	30	283

^{a,b,c} indicate statistical significance using a two-tailed test at the 10%, 5%, and 1% levels, respectively.

Table 6: Determinants of the Firms' Announcement Period Abnormal Returns

Ordinary least squares estimates of the relations between abnormal returns associated with initial *Wall Street Journal* announcements of environmental violations, and characteristics of the announcement and the defendant company. The dependent variable is the two-day announcement period abnormal stock return divided by its standard error. Independent variables include the natural log of the market value of firm equity, dummy variables for the announcement type, the identity of the party initiating the action, the action type, and the type of environmental harm, plus variables that represent the cost of any legal sanctions imposed. All coefficients are in percent (i.e., multiplied by 100). t-statistics are in parentheses.

Variable	Model 1	Model 2
Market value of equity (natural log)	2.42 (2.78) ^c	2.03 (2.18) ^b
<i>Dummy variables for announcement type:</i>		
Allegation announcements	-11.41 (-2.65) ^c	-8.99 (-1.89) ^a
Charges filed announcements	-9.11 (-2.27) ^b	-6.49 (-1.33)
<i>Dummy variables for party bringing action:</i>		
Action brought by state agency	-8.73 (-2.32) ^b	-9.00 (-2.33) ^b
Action brought by environmental group	-8.88 (-0.93)	-9.31 (-0.96)
Action brought by individuals (including class action lawsuits)	-1.22 (-0.23)	1.00 (0.18)
<i>Dummy variables for action type:</i>		
Criminal lawsuit	2.14 (0.33)	0.20 (0.03)
Civil lawsuit	-4.97 (-1.16)	-3.96 (-0.87)
Consent order	0.21 (0.03)	1.66 (0.25)
Product recall	-15.20 (-2.30) ^b	-11.92 (-1.71) ^a
Assignment of (clean-up) liability	-11.27 (-1.69) ^a	-11.42 (-1.61)
<i>Dummy variables for type of environmental harm:</i>		
Air emission violations	1.67 (0.30)	1.21 (0.21)

Surface water violations	1.70 (0.31)	1.93 (0.34)
Drinking water contamination	-13.85 (-1.69) ^a	-14.81 (-1.75) ^a
Contaminated site (including CERCLA and subsurface water violations)	0.05 (0.01)	-0.51 (-0.09)
Violations of multiple media	-1.66 (-0.21)	-3.91 (-0.47)
<i>Variables for the type and cost of the legal penalty imposed:</i>		
Dummy variable equal to 1 when legal penalty information is available	-4.20 (-1.27)	
Dollar amount of the legal penalty divided by the market value of equity	-1.75 (-1.60)	
Dummy variable equal to 1 when fine or damage award information is available		3.55 (0.64)
Dollar amount of the fine or damage award divided by the market value of equity		-0.05 (-0.58)
Dummy variable equal to 1 when compliance or cleanup cost information is available		4.25 (0.63)
Dollar amount of the compliance or cleanup cost divided by the market value of equity		0.02 (0.48)
Dummy variable equal to 1 when <i>potential</i> fine or damage award information is available		-1.08 (-0.17)
Dollar amount of the <i>potential</i> fine or damage award divided by the market value of equity		-0.00 (-1.10)
Dummy variable equal to 1 when <i>potential</i> compliance or cleanup cost information is available		0.51 (0.51)
Dollar amount of the <i>potential</i> compliance or cleanup cost divided by the market value of equity		-0.02 (-1.23)
Intercept	-26.83 (-1.83) ^a	--23.23 (-1.48)
F-value	2.42	1.79
p-value	[0.001]	[0.011]
Adjusted R ²	0.085	0.074

a, b,c denote significance at the 0.10, 0.05, and 0.01 levels, respectively, based on a two-tailed test.

Table 7: Comparisons of Firms' Market Value Losses to the Legal Penalties Imposed

Comparisons of the average abnormal stock return to the size of the actual or prospective legal penalty imposed on firms alleged to commit or charged with environmental violations, 1980 - 1991. Events for which the initial press announcement is of a settlement are excluded. Panel A includes data from all 77 events for which actual or prospective legal penalty data are available. Panel B excludes five events for which the prospective legal penalties are extremely large outlier amounts. Panel C includes only events for which the actual legal penalty is known.

	Type of Environmental Harm						Total
	Air	Surface Water	Drinking Water	Contaminated Site	Multiple Media	Miscellaneous Media	
<i>Panel A: All observations</i>							
Mean % loss in market value	1.81	1.42	4.19	2.48	-3.24	2.49	2.11
Mean legal penalty (% of market value)	47.80	1.08	4.60	58.12	0.03	0.14	38.68
Number of observations	17	17	4	26	1	12	77
<i>Panel B: Excluding five cases with extremely high prospective legal penalties</i>							
Mean % loss in market value	1.74	1.42	4.19	2.35	-3.24	2.49	2.05
Mean legal penalty (% of market value)	1.95	1.08	4.84	5.94	0.03	0.14	2.85
Number of observations	15	17	4	23	1	12	72
<i>Panel C: Only cases with known legal penalties (i.e., excluding all cases with prospective legal penalties)</i>							
Mean % loss in market value	3.22	1.17	3.54	1.58	-3.24	-0.37	1.55
Mean legal penalty (% of market value)	1.96	0.26	1.88	3.63	0.03	0.30	1.70
Number of observations	7	7	3	10	1	5	35

This paper is a preliminary draft, last revised October 23, 1998. All rights reserved. Readers with comments should address them to:

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