

# The Impact of a Change in Regulation on Environmental Disclosure: SAB92 and the US Chemical Industry

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## Abstract

This study investigates environmental disclosure in the annual reports of US public companies in the chemical industry during a time when there was a substantial change in reporting regulation. This change concerned contingent environmental liabilities. We draw on signal theory and the economic cost perspective to generate predictions about environmental disclosure strategies. We find evidence that managers use disclosure to distinguish their companies from other companies: first by disclosing environmental liabilities that many other companies did not reveal; and later by disclosing other future-oriented financial information. We assumed initially, that this behaviour was indicative of signaling strategy. We find, however, that the companies which we initially thought were signaling have higher levels of pollutant emissions (per dollar of assets) than non-signaling companies. This evidence does not support our earlier assumption. We argue that public concern about this industry, and the fact that emissions levels are open to public scrutiny, lowers the disclosure-cost threshold for high emission companies, leading managers to disclose information they previously withheld.

**Keywords:** *Environmental disclosure, Environmental performance, Signal theory, Voluntary disclosure theory*

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## INTRODUCTION

In 1993 the Securities and Exchange Commission (SEC) issued Staff Accounting Bulletin No. 92, *Accounting and Disclosure Relating to Loss Contin-*

*gencies* (SAB92). This legislation dealt largely with contingent liabilities, a serious issue in the chemical industry. In this study we use econometric modelling to examine the disclosure of US chemical companies from two related perspec-

tives: voluntary disclosure, and signaling. More specifically, we examine how disclosure changed following the introduction of the new legislation. We also seek to establish the nature of the relationship, if any, between companies' actual environmental performance and their disclosure of environmental information.

Our paper explores the suggestion of Blacconiere and Patten (1994) and Blacconiere and Northcut (1997) that environmental information is a signal of company expertise in the management of environmental risks and costs. We extend these prior studies by examining whether these 'signals' were a deliberate management strategy, or merely the serendipitous result of investor interpretation. Furthermore, we attempt to identify the basis for the signaling strategy, if that is indeed what it was. Finally, we try to identify the specific types of disclosure that managers or investors focus on. In this paper we ask the following questions:

1. Do managers use disclosure to distinguish their companies from others?
2. Is the basis for this distinction (if any) related to environmental performance?
3. Are managers trying to signal 'good quality', or management expertise, in the area of environmental management?

Our paper builds on research that examines the disclosure cost/benefit trade-off. For example Li, Richardson and Thornton (1997) suggested that environmental disclosure should rise as the risk of attack by outsiders falls. Richardson (1998) argued that one way to increase

disclosure would be for the government to publicize corporate environmental performance. Bewley and Li (2000) found that pollution propensity, political exposure, and actual pollution levels are statistically significant in distinguishing the disclosure levels of companies in different industries. However they found a stronger correlation of these three factors with the release of general environmental information than with financial environmental information. The data in our study are drawn from a single, high profile industry, with a large propensity to pollute, thereby allowing us to control for the factors identified in the Bewley and Li paper while we examine the nature of disclosure in an environment where environmental performance is public knowledge.

We find that companies that were voluntarily disclosing the information that SAB92 made mandatory, began disclosing additional future oriented financial information (FOFI) after SAB92 came into effect. We interpret this to be evidence that these companies had deliberately defined a disclosure strategy that entailed the use of voluntary information. We use toxic release inventory (TRI) emissions to measure environmental performance, and we find, in keeping with Patten (2002) that the voluntary disclosers emit larger amounts of pollution per dollar of asset. This does not support the claim that managers use disclosures to signal environmental expertise, or good environmental management. We argue instead, that SAB92 prompted managers to reassess the economic costs and benefits of information production. This reassessment caused a downward shift in the disclosure-cost threshold, which increases the amount of

information a company will voluntarily reveal.

Unrecognized environmental liabilities such as those associated with Love Canal in New York triggered the US Superfund regulation, legislation that creates massive costs for industry that continue to this day. The focal point in our study is a change in regulation pertaining to the way these liabilities are measured and reported. Our finding that companies with the higher prospective costs (arising from higher pollution levels), were the companies in which management specifically engaged expertise to obtain information about those costs, and, furthermore, incurred the political costs of disclosing it to the public, should be of interest to industry analysts and regulators.

Also of interest to regulators is the question of whether imposing regulation is better for society than allowing free market forces to elicit management choice. This is an on-going subject of debate. Sometimes regulation is imposed in response to a high-profile problem, and not based on a careful analysis of costs and benefits. For example, the Sarbanes-Oxley legislation introduced in the US<sup>1</sup> imposes reporting requirements related to a company's internal controls. The consequences and costs of these reporting requirements are a subject of ongoing debate. Our study informs this debate by examining regulatory invention in a controlled research setting, pro-

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<sup>1</sup> The Sarbanes-Oxley Act was passed into US law in 2002 in response to the Enron, WorldCom and other corporate scandals. It was intended to strengthen the financial reporting system and increase the reliability of financial reporting for public companies. The Act imposed sweeping regulations affecting corporate financial reporting and internal control, expanded reporting requirements, and imposed oversight and monitoring responsibilities on independent auditors.

viding insight into how regulation works in practice.

The motivation for this study is to understand management response to a change in regulation. Our focus is environmental reporting regulation, and the context for our examination is the chemical industry in the rule-oriented US disclosure regime. Later in this paper we present a future opportunity to re-examine this matter in Canada, where a change in environmental reporting regulation affects a high profile sector of that economy. This current study examines environmental reporting in its early stage of development. While this early setting limits the insights our study can provide given the expanded, complex state that environmental reporting has now reached in developed countries, the paper provides fundamental insights that may be relevant to developing countries where environmental concerns and regulated reporting are at a similarly early stage.

The next section of the paper reviews the prior literature and develops the study's conceptual framework. The following section explains the study's research design and the data analysis, and summarizes the results. The final section discusses the study's findings and its limitations, and provides directions for future related research.

## LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Environmental costs are a significant factor in the chemical industry. The notoriety of the industry has been established through a variety of media channels, such as professional magazines

(Rubenstein, 1991), in the wake of land-contamination in Niagara Falls, New York, and in a docudrama (*Touchstone: A Civil Action*, 1998) examining the toll on human health of chemical contamination in Woburn, Massachusetts. Both the general public and the investment community are concerned with the substantial future cash flow obligations associated with environmental impacts. Managers must anticipate the repercussions of disclosing information about these impacts of business activity. For example, lobby groups may be prompted by information disclosure to target companies with calls for legislative constraints that could affect cash flow and share price. On the other hand, greater disclosure could have a positive affect on share price if investors interpret the disclosure as evidence of management expertise, as suggested by Blacconiere and Patten (1994) and Blacconiere and Northcut (1997).

When Blacconiere and Patten (1994) offered the following interpretation of share reaction to the accident in Bhopal (p. 375): "If firms tend to disclose 'good news' and suppress 'bad news' concerning their exposure to environmental risk, investors may interpret these prior disclosures as a positive signal concerning the firm's exposure ... [to future regulatory costs]," they in effect opened the door to future explorations of the relationship of environmental performance with disclosure strategy. This paper extends the prior disclosure literature by investigating the possibility that company managers specifically and deliberately tailor environmental disclosure for strategic purposes. We specifically look for evidence that signal strategy is employed.

The basic premise of signal theory is that a high quality firm wants to signal its value to the external audience. "Quality" can refer to many different things, such as investment opportunities, research and development, or expertise in managing environmental risks and costs. Signal theory offers companies a strategy for addressing the information asymmetry that exists between management and the external stakeholders. While there could be information that management would like to discuss, direct disclosure of certain facts could reveal valuable proprietary information. This raises the disclosure-cost threshold and reduces the volume of information a company will willingly reveal. A signaling strategy employs the release of financial or non-financial information that is both correlated with company quality and can be communicated without simultaneously releasing proprietary information (Healy & Palepu, 1993). According to signaling theory, there is an economic cost to management to make the signal, which discourages competing companies from mimicking the signal in an effort to fool its audience (Toms, 2002; Spence, 1973).

The economic perspective of information production provides an alternative yet related lens for the examination of disclosure decisions. The economic perspective argues that disclosure strategy requires a careful trade-off of the costs and benefits of disclosure. Verrecchia (1990) and Richardson (1998) have argued that market forces can act as regulation to determine the right amount of disclosure. If insufficient information about risks and obligations is released, the capital markets will punish the company by downgrading its share value. On the other hand too much disclosure ex-

poses it to the threat of increased lobbying and regulatory costs (Barth, McNichols, & Wilson, 1997).

Dye (1985) describes a framework in which market participants' uncertainty about whether or not a manager is endowed with private information provides incentives for the manager to withhold unfavourable information beyond a certain threshold level. When managers are uncertain of the quality of their information, their fears that capital markets will punish the company for non-disclosure are reduced (Dye, 1985). However, when information about company performance is public knowledge, people will not assume that management is silent on the issue because of lack of knowledge, or lack of certainty. In this situation management silence is likely to be interpreted as bad news, which could put downward pressure on share price. For this reason, if environmental performance is public knowledge then management is likely to be more forthcoming with information. There is empirical evidence to support this framework. Li, Richardson and Thornton (1997) find the decision to disclose environmental liability information relates to the amount of private information outsiders believe management has, and the potential for adverse reaction by environmental stakeholders.

Disclosure strategy has received considerable attention in the accounting literature. Identifiable patterns of disclosure have been linked with company-specific issues such as leverage, size and financial performance (Patten, 1992; Neu, Warsame & Pedwell, 1998; Bewley and Li, 2000), and plans to raise new capital (Magness, 2006). However, studies of the correlation of environmental per-

formance with disclosure have been unable to define a systematic relationship, leading to conclusions that environmental disclosure is vague, incomplete, or unreliable (Wiseman, 1982; Rockness, 1985; Freedman and Wasley, 1990; Gamble, Hsu, Kite and Radtke, 1995; Deegan and Gordon, 1996). However, these studies looked at companies from a variety of industries simultaneously, and the absence of controls for propensity to pollute and nature of pollution may have confounded the results. Furthermore a company's pollution performance may play an important role in determining a disclosure strategy. We specifically examine the role of environmental performance in this paper. Our understanding of that role could be the key to deciding whether companies engage in signaling behaviour, or some other form of disclosure strategy. If they are signaling, the managers of the good environmental performers will disclose more information so as to advertise their companies' 'high quality' status. On the other hand the economic costs (such as loss of share value) of withholding pertinent information about a problem could lead management of a 'low quality' company to choose disclosure over silence. This latter type of disclosure strategy is more accurately captured by the voluntary disclosure perspective.

**Staff Accounting Bulletin 92** - The context for this study is a dynamic model involving an explicit change in disclosure regulation. This change in regulation has a significant impact on the disclosure costs/benefits trade-off in the chemical industry. Prior to June 1993, the accrual and disclosure of contingent environmental liabilities were subject to considerable discretion. For example, if contingent liabilities were

less than five percent of total liabilities then disclosure was not required (Barth, McNichols, & Wilson, 1997). Furthermore many companies used uncertainty of measure as justification for not disclosing environmental liabilities at all (Roberts and Hohl, 1994). In June 1993, SAB92<sup>2</sup> was issued, requiring companies to strictly follow FASB SFAS No. 5 and Interpretation No. 14, particularly the requirement to accrue the best estimate in a range of estimates. The rule also eliminated zero as a choice of best estimates in situations where a known liability exists. Finally, the five percent materiality cut-off point was eliminated (Barth et al. 1997).

The impact on disclosure of SAB92 has been the subject of prior investigation. For example, Stanny (1998) showed that firms responded to the SAB92 call for environmental liability disclosure by increasing their disclosure of other environmental information, and by increasing the amounts reserved for future remediation. In this current paper we use the discretionary nature of the previous five percent cut-off rule to ask whether or not companies that voluntarily disclosed their environmental liabilities differed from other companies in terms of their respective levels of emis-

sions. We also examine whether these companies, having lost the discretion to make one particular type of disclosure, chose some other form of new disclosure after SAB92 came into effect. In this manner we seek to identify deliberate managerial disclosure strategy.

This paper extends the work of Blacconiere and Patten (1994), and Blacconiere and Northcut (1997), who said that shareholders interpret environmental disclosure as a signal of management expertise. If it can be shown that certain companies, identified on the basis of disclosure content before June 1993, altered their disclosure content after June 1993, then this could be evidence of deliberate signaling behaviour. For example, if signaling (if that is indeed what it is) occurred before June 1993 by means of disclosure of environmental liabilities (a form of FOFI), then a response to the regulatory change could be an increase in the disclosure of other future-oriented financial information. On the other hand, Walden and Schwartz (1997) said that management relies on non-financial elements of disclosure to capture the subtle aspects of impressions management. If signaling was an intended corporate disclosure strategy, it is possible that these companies responded to SAB92 by releasing

<sup>2</sup> Effective June 1993, SEC Staff Accounting Bulletin No. 92 provided the SEC's interpretation of GAAP with regard to contingent liabilities, environmental liabilities in particular. Its purpose was to promote the timely recognition of contingent losses and to address the diversity in practice with respect to accounting for and disclosing of environmental liabilities. The SEC had found this diversity to be unacceptable. SABs are administrative interpretations and principles rather than official rules; however, they do provide insight into the kinds of deficiencies likely to result in SEC enforcement actions – a costly and undesirable outcome for registrants (Fekrat, Inclan & Petroni, 1996). Three key requirements of SAB92 are these:

- (i) Contingent liabilities must be displayed on the balance sheet separately from any recoveries recognized; there must be no offsetting;

- (ii) Discounting of an environmental liability for a specific site is only appropriate under the conditions noted in EIFT 93-5. In addition, the discount rate must be no higher than the rate on risk-free monetary assets with a maturity corresponding to the expected cash payments;

Disclosure is expected to follow strictly FASB SFAS No. 5 and Interpretation No. 14; in particular, the requirement to accrue the best estimate in a range, even if a point-estimate is uncertain. In SAB92, the SEC staff noted that zero is unlikely to be the 'best estimate in the range' if a known liability exists, and that it will not accept lack of certainty as a justification for the failure to provide investors with all material factors relating to contingent liabilities.

additional non-financial discussion such as information about uncertainty, or about management commitment to environmental protection, as a way to manage investor impressions.

It is also possible that a deliberate change in disclosure following the introduction of SAB92 is not evidence of signal behaviour. A change in disclosure may reflect the rebalancing of political costs. An examination of the relationship of environmental performance with disclosure will provide insight here. If the good environmental performers (low pollution emitters) make the greater disclosures both before and after the change in regulation, then we have evidence of signaling behaviour. On the other hand if this is not the case, then some other factors are driving the disclosure decision-making process.

## RESEARCH DESIGN AND DATA ANALYSIS

### Sample selection

This study uses a sample of annual reports covering the period 1991 to 1996. This time frame spans the introduction of SAB92. SAB92 outlines the SEC interpretation of generally accepted accounting principles concerning contingent liabilities. The objective of SAB92 was to reduce the diversity of corporate practice in the accounting for and disclosure of environmental liabilities. The companies chosen for this study are all U.S. firms in the chemical industry (primary SIC 28) that are listed on the New York Stock Exchange and that reported an accrued environmental liability. These selection criteria eliminate variation due to industry, market and

country-specific factors while providing some assurance that each company contends with issues related to environmental liabilities. The initial sample was obtained by using a key-word search of the Edgar database of electronic filings of SEC-registered companies; this process identified 28 chemical companies that reported an environmental liability accrual in one or more years of the study period. In order to ensure that data would be available to study the periods before and after the date of interest, the sample was restricted to companies that accrued environmental liabilities in each of the years 1991 to 1996. This restriction reduced the sample to 11 companies (see appendix A) with six observations for each company (66 annual reports). While this sample is relatively small, it provides sufficient degrees of freedom to estimate all the empirical models used to test the study's hypotheses, since none of the models have more than five independent variables.

### Dependent variables

Environmental disclosure was measured using the companies' annual reports. While environmental disclosure is not limited to the annual report (Zéghal & Ahmed, 1990), this report is the most widely circulated communications document for investors, creditors and other users (Hutchin, 1994; Epstein and Freedman, 1994; CICA, 1994; Barron, Kile & O'Keefe, 1999). Rankin (1996) observed that most stakeholders seeking environmental information look first to the annual report. While the emergence of the standalone environmental report in the 1990s and corporate website reporting in the 2000s has led to questions about the relative importance of the annual report as a disclosure medium, annual report

disclosure of environmental information was on an upward trend at that time (Gibson and O'Donovan, 2000).

The disclosure literature describes several tools for analyzing information content, and the index used in any particular study is often designed to reflect the aspects of disclosure that are the focus of that particular research. This suggests that in a given situation some disclosure tools may be more appropriate than others. This study uses alternative disclosure scores developed in prior research, each involving some form of content analysis that identifies the extent and/or nature of environmental information.

The Wiseman (1982) study used a comprehensive disclosure measure of company efforts to minimize the consumption of and damage to environmental resources (appendix B). This broadly defined measure, hereafter referred to as the Wiseman index, was designed to measure both monetary and narrative disclosure. The Wiseman index is a quantitative score that captures both the extensiveness and quality of disclosure. In contrast, Barth, McNichols, and Wilson (1997) designed an index to reflect the extent to which disclosure captures the salient features of U.S. Superfund site liabilities (appendix C). As it is linked to a specific piece of legislation, the Barth, McNichols, and Wilson (BMW) score is more narrow in scope than the Wiseman index.

Prior studies have also measured disclosure in terms of the number of words of environmental discussion in the annual report. While this method fails to reflect the emphasis that management places on a particular topic (a 10,000 word report with 500 words of environmental discus-

sion would automatically outscore a 2000 word report with a 200 word environmental discussion), a simple word count has been employed in numerous publications as a measure of management response to environmental or other social responsibility issues (Cowen, Ferreri, & Parker, 1987; Guthrie & Parker, 1989; Patten, 1991; Neu, Warsame, & Pedwell, 1998).

Magness (2006) developed a disclosure index using a point system designed to reflect the disclosure guidelines of the Canadian Institute of Chartered Accountants' Handbook. This index was initially designed for application in the Canadian mining industry, and has been modified here to capture additional disclosure items specified by U.S. accounting standards (appendix D). Given its focus on operational issues, the Magness index is more narrowly defined than the Wiseman index.

The Magness score is unweighted. Unweighted scores were used by Blacconiere and Patten (1994) and Blacconiere and Northcut (1997) in an effort to assess share response to the quantity of information disclosed. Weighted scores award higher points to information that is quantified, specific, and verifiable, and lower points to information containing vague statements that need not necessarily reflect any actual action on the company's part. For example, Wiseman (1982) awarded three points for quantified information, two for non-quantitative but specific information, and one for general qualitative information items. With a weighted scoring tool such as this, the higher scores are more likely to reflect disclosure of quantified information. This cannot be guaranteed, however. A document with a sufficient

number of low value items could have a score that exceeds that of a document containing just one or two high value items. This problem can be overcome by grouping the unweighted items into subscores, with each subscore defined according to content. For example, one subscore could contain quantified information, a second could have the voluntary information items, while a third could include future-oriented items. This approach was used by Barth, McNichols and Wilson (1997) who began with a thirteen-item unweighted score in the initial application of their statistical model, and then used subscores in four reiterations.

In this paper we use both the BMW and the Magness scoring systems to assemble the unweighted items into subscores. The weighted Wiseman score is also split into subscores. In all, we generate eight alternative disclosure measures to be used as dependent variables, as shown in Table 1. We use the Wiseman and BMW indexes to create measures of financial and non-financial disclosure. We draw upon the US Financial Accounting Standards Board *Concepts Statement No.2* (FASB, 1978), which calls for information that helps users to assess the amount, timing and uncertainty of future cash flows, to generate alternative combinations of the Magness index items. Our objective with the Magness score is to capture information

specific to cash flow prediction as well as uncertainty<sup>3</sup>.

The Wiseman and BMW measures were each rated by two different research assistants, neither of whom were aware of the nature of prospective tests. The raters' scores were then averaged. In the case of disagreement between the raters, one of the authors' scores was included in the average. However, inter-rater reliability was assessed for consistency and found to be high. For example, the average net difference for the WSUM scores was 3.2 (compared to WSUM's mean of 28.85). For BMW-SUM scores, the average net difference was 0.13 (compared to BMW-SUM's mean of 6.75). The Magness scores were rated by the two co-authors. For MSUM the average net difference was 0.18 (compared to MSUM's mean of 3.45). The WORDS measure was calculated by one of the authors using the standard word-count tool in word processing software (MS-Word). The WORDS measure is an objectively determined quantity, so alternate raters were not used during application of the WORDS disclosure tool.

Prior literature has found several factors to be correlated with the extent and nature of disclosure. For example, corporate environmental disclosure is expected to be related to the company's size and financial performance (Patten, 1992; Neu, Warsame, & Pedwell, 1998; Bewley & Li, 2000). These factors are included as controls in this study. The key dependent variable is environmental disclosure, assessed using derivatives of several broad-based disclosure measures used in prior literature.

In our final step we use a measure of environmental performance as the de-

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<sup>3</sup> The Global Reporting Initiative (GRI), a joint initiative of the Coalition for Environmentally Responsible Economies and the United Nations Environmental Program is an alternative disclosure system that we did not use in this study. The objective of the GRI, introduced in 1997, is to develop a globally accepted reporting framework to enhance the quality and rigour of sustainability reporting. Our study period predates the introduction of the GRI. For this reason we do not attempt to assess disclosure using GRI guidelines.

**Table 1**  
**Dependent variable disclosure measure descriptions and mapping to underlying disclosure indexes**

Disclosure measures used as dependent variables	Disclosure characteristics captured by the measure	Index used to create measure	Index items included in measure
W-F	Financial aspects of environmental information	Wiseman disclosure index	W1–W7 and W19–W25
W-NF	General (non-financial) environmental information	<b>(Appendix B)</b>	W8–W18
BMW-F	Superfund related financial disclosure items	Barth, McNichols & Wilson disclosure index	BMW4–BMW13
BMW-NF	Superfund related non-financial disclosure items	<b>(Appendix C)</b>	BMW1–BMW3
M-CF	Information about amounts and timing of future environment-related cash flows	Magness disclosure index	M3, 4, 5, 7
M-UNCERT	Information about uncertainties of environment-related future cash flows	<b>(Appendix D)</b>	M1, 2, 6
M-FOFI	Future-oriented financial information about environment-related cash flows		M4, 5, 7
WORDS	Annual report space devoted to all environmental issues	N/A	N/A (word count)

pendent variable. We follow Al-Tuwaijri, Christensen and Hughes (2004) and Clarkson, Li, Richardson and Vasvari (2008) by choosing *Toxic Release Inventory* emissions volumes as a measure of environmental performance. The TRI was introduced by the US Environmental Protection Agency (EPA) in

1989 under the provisions of the Emergency Planning and Community Right-to-Know Act. The EPA initiated this program in an effort to use "the power of information" as a regulatory instrument (Konar and Cohen 1997). Manufacturing facilities with 10 or more employees that produce or use volumes above a

threshold amount of chemicals on a list of over 300 chemicals must report their emissions of these chemicals to the EPA. This information is provided to the public on an annual basis. Emissions are self-reported, on a site-by-site basis. Companies can have several sites. The TRI measure in this paper is the aggregate emissions of TRI-reportable substances across all sites for each company in each year, scaled by the total assets of the company.

Of the 11 companies considered in this study, we were unable to find TRI data for two of them. Most likely this is because these two companies had measures of toxic emissions that were below the regulatory reporting thresholds. Initially we considered deleting these two companies from our study. However, given that our analysis is already restricted to a small amount of data, we decided to proceed with all 11 companies. The impact of these two companies on the results is assessed in the *Sensitivity Analysis* section of this paper.

### Hypotheses

Our hypotheses are designed to investigate the use of signaling as a disclosure strategy. We look for the disclosure of an immaterial liability as a signal. If some firms used this type of disclosure for signaling purposes, SAB92 would have rendered their strategy ineffective by eliminating the choice to disclose environmental liabilities that are less than five percent of the company's total financial obligations. To re-establish an effective signal these firms would have needed to find a new form of disclosure. We test this argument with the following two hypotheses:

H1: Firms that voluntarily disclosed environmental liabilities pre-SAB92 increased other FOFI disclosure after SAB92 more than firms whose pre-SAB92 disclosures were mandatory. (*FOFI signaling hypothesis*)

H2: Firms that voluntarily disclosed environmental liabilities pre-SAB92 increased general environmental disclosure after SAB92 more than firms whose pre-SAB92 disclosures were mandatory. (*General environmental disclosure - signaling hypothesis*)

In our final hypothesis, we examine whether the basis for signaling behaviour (if any) is environmental performance:

H3: Firms that voluntarily disclosed environmental liabilities pre-SAB92 differ from other firms in their level of TRI emissions. (*Basis of signaling hypothesis*)

### Independent variables

We create two dummy variables, REG and SIGNAL.

REG (H1-H2) is equal to 1 for annual reports prepared after June 1993, the implementation date for SAB92; 0 otherwise. The EPA requires companies to seek expert advice on the quantification of remediation cost. SAB92 clarified the FASB's accounting standard for contingent liabilities (SFAS No.5) by stating that the Securities Exchange Commission will not accept uncertainty of measurement as an argument for failure to disclose an estimate or related material factors. The direction of REG in the signaling hypotheses (H1 and H2) is expected to be tempered by the presence of SIGNAL as discussed below.

*SIGNAL* (H1-H2) equals 1 if the firm disclosed an environmental liability that is less than 5% of total liabilities prior to the enactment of SAB92 in June 1993, 0 otherwise. Disclosure of an environmental liability below the threshold no longer acts as a signal of high quality once SAB92 is introduced. If signaling were the original intent, then those *SIGNAL* =1 firms are expected to renew their “signal” through additional non-financial or future-oriented financial disclosures after SAB92 came into force.

To measure this, *SIGNAL* is interacted with *REG*. There is evidence of signaling behaviour if the coefficient of *SIGNAL \*REG* is positive.

Two control variables are defined to capture company size and financial performance.

*SIZE* (H1-H3) is measured as the log of total assets. In keeping with prior studies (Patten, 1992; Neu, Warsame, & Pedwell, 1998; Bewley & Li, 2000), the co-

**Table 2**  
**Descriptive Statistics - Variable Distributions and Definitions**  
**(n= 11 companies X 6 years, 66 observations)**

CONTINUOUS VARIABLES	Mean	Standard deviation	Median	Minimum	Maximum
<i>WSUM</i>	28.85	10.29	28.00	9.00	51.00
WF	20.46	6.28	20.00	5.50	33.00
WNF	8.40	5.18	8.00	0.00	21.00
BMW-SUM	6.75	1.95	6.50	2.00	10.50
BMW-F	5.65	1.36	5.50	2.00	8.00
BMW-NF	1.10	0.84	1.00	0.00	2.50
MSUM	3.45	1.41	3.50	0.50	6.50
M-CF	2.10	1.05	2.25	0.50	3.50
M-UNCERT	1.50	0.69	1.50	0.00	3.00
M-FOFI	1.66	0.78	1.50	0.50	3.00
WORDS	1145.70	829.71	999.5	178.0	4069.0
SIZE	14.65	1.13	14.4	12.8	17.5
ROA	0.04	0.05	0.04	-10	0.3
TRI	2.03	3.92	0.61	0.00	24.5

  

CATEGORICAL VARIABLES	Yes (%)	No (%)	Total
SAB92 in force (REG=1)	44 (67%)	22 (33%)	66 (100%)
Environmental liability disclosed voluntarily (SIGNAL=1)	42 (64%)	24 (36%)	66 (100%)

The dependent variables are defined as follows for company *i*, year *t*:

WSUM	= total Wiseman disclosure index score
WF	= Wiseman index score, financial information only
WNF	= Wiseman index score, non-financial information only
BMW-SUM	= total BMW disclosure index score
BMW-F	= BMW index score, financial disclosure items only
BMW-NF	= BMW index score, non-financial disclosure items only
MSUM	= total Magness index score - cash flow information
M-CF	= Magness index information items relating to amounts and timing of future cash flows
M-UNCERT	= Magness index disclosures of information about uncertainty of future cash flows
M-FOFI	= Magness index disclosures future-oriented financial information
WORDS	= word count for all environmental annual report discussion
TRI	= aggregate TRI emissions, scaled by total assets
BMW-SUM	= total BMW disclosure index score
BMW-F	= BMW index score, financial disclosure items only
BMW-NF	= BMW index score, non-financial disclosure items only
MSUM	= total Magness index score - cash flow information
M-CF	= Magness index information items relating to amounts and timing of future cash flows
M-UNCERT	= Magness index disclosures of information about uncertainty of future cash flows
M-FOFI	= Magness index disclosures future-oriented financial information
WORDS	= word count for all environmental annual report discussion
TRI	= aggregate TRI emissions, scaled by total assets

The independent variables are defined as follows for company *i*, year *t*:

SIZE	= log of total assets
REG	= 0 if pre SAB92, 1 if post
ROA	= net income/total assets
SIGNAL	= 1 if firm voluntarily discloses environmental liability less than 5% of its total liabilities, 0 otherwise
SIGNAL*REG	= SIGNAL times REG

efficient for the size factor is expected to be positive, as larger firms are observed to provide more extensive disclosures than smaller firms.

*ROA* (H1-H2) is net income divided by total assets. Prior studies are contradictory in their findings with regard to the relationship of environmental disclosure with return on assets. See, for example, the discussion in Gray, Javad, Power, & Sinclair (2001). For this reason there is no prior expectation as to the direction of association.

Descriptive statistics are reported in Table 2. The continuous variables are distributed with their means close to their medians and exhibit reasonable variability between their minimum and maximum values. The categorical variables also exhibit a reasonable degree of variability.

### Empirical Models

The signaling argument presented in H1 and H2 is tested in model [1]:

$$[1] \quad Disclosure_{it} = b_0 + b_1REG_{it} + b_2$$

$$SIZE_{it} + b_3 ROA_{it} + b_4 SIGNAL_{it} + b_5 SIGNAL_{it} * REG_{it} + e_{it}$$

where  $Disclosure_{it}$  is M-FOFI for H1 and WNF, BMW-NF, M-UNCERT, or WORDS for H2.

The following chart shows how the coefficient estimates in the above models relate to the hypothesis tests. Each combination of coefficients corresponds to the calculation of the estimated y-intercept as it would appear in a graphed depiction of the relationship among variables.

	Mandatory Discloser group (SIGNAL = 0)	Discretionary Discloser group (SIGNAL = 1)
Pre-regulation period (REG = 0)	$b_0$	$b_0 + b_4$
Post-regulation period (REG = 1)	$b_0 + b_1$	$b_0 + b_1 + b_4 + b_5$
Difference between pre- and post-regulation periods	$b_1$	$b_1 + b_5$
Hypothesis tests:		
H1: <i>FOFI signaling hypothesis</i>		$b_1 + b_5 > 0$
H2: <i>General environmental disclosure signaling hypothesis</i>		$b_1 + b_5 > 0$

In our final test, we investigate the basis of distinction between the SIGNAL=0 companies and the SIGNAL=1 companies, using the following model:

$$[2] \quad TRI_{it} = c_0 + c_1 SIGNAL_{it} + c_2 SIZE_{it} + e_{it}$$

If the basis for the voluntary environmental liability disclosure is indeed signaling, then  $c_{1t}$  should be statistically significant and negative. If the coefficient is positive, this suggests the motivation for distinctive disclosure is the balancing of political costs, rather than the wish to advertise management expertise.

Our data consist of pooled cross-sectional and time series observations. When there are multiple observations from the same company, ordinary least squares (OLS) regression introduces serial correlation which can result in inefficient estimators. Thus the generalized least squares (GLS) estimation method is more appropriate than OLS

for this study's data because it can provide more efficient regression coefficient estimates. (The OLS results are similar to the GLS results, as discussed in the *Sensitivity Analysis* section of this paper.) Goodness-of-fit for the GLS models is measured using Buse (1973).

Prior to examining our hypotheses we conducted validation tests to assess the comprehensiveness of our alternative disclosure measures, using the model

$$Disclosure_{it} = b_0 + b_1 REG_{it} + b_2 SIZE_{it} + b_3 ROA_{it} + e_{it}$$

We use WF, BMW-F, or M-CF as alternative financial environmental disclosure subscores, and WNF, BMW-NF, M-UNCERT or WORDS for the general, non-financial disclosure. Each of our financial disclosure measures shows a statistically significant increase when SAB92 came into effect, suggesting that our content scores successfully capture the extent of financial disclosure both

before and after the change in regulation. For the general disclosure measures, the REG factor is statistically significant ( $p = 0.05$  or less) when disclosure is measured using both MUNCERT and WORDS, but not when using the WNF or BMW-NF measures. (In the interest of saving space, detailed results of these validation tests are not reported.) Possibly the Wiseman and BMW indices do not lend themselves well to the measure of non-financial information. For example the BMW index is biased toward financial disclosure, and the Wiseman tool is structured in a manner that assigns higher scores to information that is expressed in financial terms. The bias in favour of financial disclosure in two of the four general disclosure scores possibly explains the inconsistent results. (We make additional comment on the non-financial disclosures in the *Sensitivity Analysis* section of this paper.)

## SUMMARY OF FINDINGS

Table 3 reports the results for H1, the first signaling hypothesis. If companies' disclosures are tailored so as to distinguish the company from its peers, and if the signals are adequately captured by the variables in the model, it should be possible to identify distinctive disclosure both before and after the change in reporting guidelines. The results indicate that companies that voluntarily disclosed an immaterial environmental liability before the SAB92 regulation was in force increased their FOFI disclosures after SAB92 came into effect. This is indicated by the statistical significance ( $p < 0.05$ ) and positive sign of the  $b_1 + b_5$  coefficient. Furthermore, the  $b_4$  coefficient is statistically significant and

negative. These findings suggest that these voluntary disclosers provided less FOFI prior to SAB92 (distinctive behaviour) when contingent liability disclosure was their signal, and more FOFI after SAB92 (distinctive behaviour again), when they needed a new signal. Overall, there is reasonable support for the first signaling hypothesis.

We do not find evidence to support H2, the second signaling hypothesis, regardless of the dependent variable used. (These results are not shown.) In other words there is no evidence that companies that are pre-identified according to their disclosure before SAB92 increased their disclosure of non-financial information after SAB92.

In our final test (see Table 4) we examine the relationship of environmental performance with SIGNAL. The goal is to establish whether or not companies that voluntarily disclosed an immaterial liability can be distinguished from other companies on the basis of their TRI emission volumes. Using aggregate TRI emissions, scaled by total assets, we find the voluntary disclosers had higher emissions than other companies. This is indicated by the statistical significance ( $p < 0.05$ ) and positive direction of the SIGNAL factor. It was necessary to drop two of the companies from this part of the analysis because the TRI database had no reports for them. In Table 4 we report the results of our findings using only 54 datapoints as opposed to 66. However we assessed the sensitivity of our earlier results to the omission of these two companies. Those findings are discussed below.

**Table 3**

*H1: Firms that voluntarily disclosed their environmental liabilities before SAB92 increased their FOFI disclosure after SAB92 more than firms whose pre-SAB92 disclosures were mandatory*

**( n = 11 companies X 6 years, 66 observations )**

<i>coefficient (predicted sign)</i>	Coefficient estimates [p-values]							
	REG $b_1$ (+/-)	SIZE $b_2$ (+)	ROA $b_3$ (+/-)	SIG- NAL $b_4$ (-)	SIG- NAL* REG $b_5$ (+)	Inter- cept $b_0$ (+/-)	H3 test: $b_1 + b_5$ (+)	Buse [1973] $R^2$
Dep. Vari- able M-FOFI	-0.04 [.645]	0.16 [.027]	0.62 [.394]	-1.01 [.000]	0.71 [.000]	-0.58 [.579]	0.67 [.000]	.47

The dependent variable is

M-FOFI = Magness index disclosure of future-oriented financial information

The independent variables are defined as follows for company  $i$ , year  $t$ :

SIZE = log of total assets

REG = 0 if pre SAB92, 1 if post

ROA = net income/total assets

SIGNAL = 1 if firm voluntarily discloses environmental liability less than 5% of its total liabilities, 0 otherwise

SIGNAL\*REG = SIGNAL times REG

**Table 4**

*H3: Firms that voluntarily disclosed their environmental liabilities pre-SAB92 differ from other firms in their level of TRI emissions.*

**( n = 9 companies X 6 years, 54 observations )**

$$[2] \text{ TRI}_{it} = b_0 + b_1 \text{ SIGNAL}_{it} + b_2 \text{ SIZE}_{it} + e_{it}$$

<i>coefficient (predicted sign)</i>	Coefficient estimates [p-values]			
	SIGNAL $b_1$ (+)	SIZE $b_2$ (+)	Intercept $b_0$ (+/-)	Buse [1973] $R^2$
Dep. Variable TRI	3.15 [.000]	-0.01 [.944]	0.39 [.779]	0.40

The dependent variable is defined as

TRI = Aggregate TRI emissions (in tons)/total assets

The independent variables are defined as follows for company *i*, year *t*:

SIGNAL = 1 if firm voluntarily discloses environmental liability less than 5% of its total liabilities, 0 otherwise

SIZE = log of total assets

### Sensitivity analysis

We test the robustness of our findings by using alternative measures of financial performance. For example, return on investment (net income divided by market value of equity) and return on equity (net income divided by opening book value of equity) are each used in place of ROA. When return on equity is used, the *p*-value for the coefficient estimates are lower for the financial performance control variable. However, as this sensitivity is restricted to the coefficient estimate for a control variable, this finding does not affect the main conclusion of the study. The other coefficient estimates and goodness of fit measures of the models are not substantially different from those shown in Table 3.

The signaling model used to examine hypotheses 1 and 2 were supplemented with financial variables that prior literature has found to be correlated with disclosure. For example, leverage (total liabilities divided by total assets) was added to the model, along with a measure of changes in long-term debt financing, and changes in equity financing. Tobin's *Q* (market value of common shares, plus book value of preferred shares and total liabilities, all divided by total assets) was also used as an alternative measure of financial performance. Unlike the ROA, ROE and ROI measures, which are derived from historic financial statement data, Tobin's *Q* is an

indicator of investors' perception of the value of the companies' assets and as such brings a more future-oriented perspective. The results of these sensitivity tests did not contradict the earlier finding that companies use FOFI (as opposed to general non-financial information) for signaling purposes.

Each of the analyses was repeated using ordinary least squares regression. The direction of correlation between dependent and independent variables was the same in all models regardless of whether OLS or GLS was used, however the explanatory power of the models tended to be much lower, and the *p*-values higher, when OLS was used. For example, in the examination of H1, the  $b_1+b_5$  coefficient is statistically significant using both OLS and GLS, however the explanatory power is only 0.15 using OLS, as opposed to 0.47 using GLS. Using OLS regression to examine H3, the correlation of emissions with SIGNAL was statistically significant at  $p < 0.05$ , however the explanatory power was 0.10, down from 0.40 using GLS. Finally, our OLS examination of pollution performance versus disclosure (H3) supports the GLS interpretation, however the explanatory power using OLS was only 0.10 down from 0.40 when GLS was used. The OLS results are not reported. When we examined H3, which looked at the relationship of TRI emissions with the decision to make this voluntary disclosure, we dropped two of the 11 com-

panies. Of the two companies deleted, one was a discretionary discloser (SIGNAL=1), the other was not. We wondered whether the inclusion of data from these companies influenced the findings of the earlier parts of the study. For this reason we repeated the earlier regressions using only the data from the

remaining nine companies. We found no change to the findings of our validation tests or to the results reported in Table 3. In other words, the removal of two companies from the analysis had no impact on the findings with regard to the hypothesized change in level of financial, or non-financial disclosure at the

**Table 5**

*H2: Firms that voluntarily disclosed their environmental liabilities before SAB92 increased their general non-financial disclosure after SAB92 more than firms whose pre-SAB92 disclosures were mandatory*

**( n = 9 companies X 6 years, 54 observations )**

[2]Dependent variable= $b_0 + b_1REG + b_2 SIZE + b_3 ROA + b_4 SIGNAL + b_5 SIGNAL*REG + \varepsilon_{it}$

coefficient (predicted sign)	Coefficient estimates [p-values]							
	REG $b_1$ (+/-)	SIZE $b_2$ (+)	ROA $b_3$ (+/-)	SIG- NAL $b_4$ (-)	SIG- NAL*R EG $b_5$ (+)	Inter- cept $b_0$ (+/-)	H2 test: $b_1 + b_5$ (+)	Buse [1973] $R^2$
Dep. Variable								
WNF	-0.34 [.730]	2.62 [.000]	-4.37 [.561]	-3.42 [.001]	1.49 [.188]	- 29.61 [.000]	1.15 [.058]	.62
BMW-NF	-0.11 [.121]	0.35 [.000]	1.63 [.027]	-1.14 [.000]	0.44 [.000]	-3.38 [.001]	0.34 [.001]	.53
M-UNCERT	-0.04 [.537]	0.23 [.000]	1.29 [.042]	-0.398 [.004]	0.14 [.095]	-1.87 [.000]	0.10 [.046]	.52
WORDS	401.01 8 [.017]	201.8 [.001]	4253.6 [.000]	- 472.65 [.100]	-228.0 [.274]	- 1942. 1 [.036]	236.01 [.002]	.51

The dependent variables are defined as follows for company i, year t:

WNF = Wiseman index score, non-financial information only

BMW-NF = BMW index score, non-financial disclosure items only

M-UNCERT = Magness index disclosures of information about uncertainty of future cash flows

WORDS = word count for all environmental annual report discussion

The independent variables are defined as follows for company i, year t:

REG = 0 if pre SAB92, 1 if post

SIZE = log of total assets

ROA = net income/total assets

SIGNAL = 1 if firm voluntarily discloses environmental liability less than 5% of its total liabilities, 0 otherwise

time that SAB92 was implemented, nor did it affect our interpretation with regard to the level of FOFI disclosure before or after the change in regulation. However, our re-examination of H2, the second signaling hypotheses, produced interesting results. For example, we found the Barth, McNichol and Wilson non-financial disclosure score (BMW-NF) and the Magness score reflecting cash flow uncertainty (M-UNCERT) were both disclosed at higher levels by the SIGNAL=1 companies after SAB92 came into effect. Furthermore, in both cases the  $b_4$  coefficient was statistically significant and negative, indicating the voluntary disclosers provide less of this information prior to the introduction of SAB92.

## **SUMMARY, DISCUSSION AND FUTURE DIRECTIONS**

In this paper we examine the disclosure of environmental information by US chemical companies both before and after a change in disclosure regulation. We use the decision to disclose an immaterial environmental liability, which was a voluntary disclosure prior to the implementation of SAB92, to distinguish two types of companies: discretionary versus mandatory disclosers. We explore the following questions: Do companies use disclosure to distinguish themselves from other companies? Our findings suggest they do. When SAB92 made the disclosure of an immaterial liability mandatory, those companies that had previously disclosed this liability voluntarily began to disclose other future-oriented financial information. This is indicative of signaling behaviour, given the costliness of this kind of information. Similar to an environ-

mental liability, FOFI is by nature forward looking in terms of prospective cash flow. FOFI is also more credible than other sorts of information, specifically because management must engage specific expertise in order to obtain it (Toms, 2002). The engagement of specific expertise, however, is costly. The costliness of this information is consistent with the finding that companies disclosed less of it before SAB92 came into effect. The costliness of this information is consistent with signaling theory in that other companies cannot easily mimic the companies that are providing this information.

Is environmental performance the basis for this disclosure strategy? Our evidence suggests it is. We use the volume of toxic release inventory emissions reported to the EPA as a measure of environmental performance, and we find that companies who adopt distinctive disclosure strategy differ from other companies in terms of their pollution levels.

Is the distinctive disclosure strategy motivated by managers' wish to advertise 'high quality'? Our findings do not support this argument. In fact, we find the distinctive disclosers are relatively poor in terms of their environmental performance.

In summary, while we have used the Blacconiere and Patten (1994) and Blacconiere and Northcut (1997) argument to introduce this paper, our findings do not provide the conclusion to the signaling argument they began to put forward. Our evidence shows that companies use environmental disclosure to convey a message to the external audience, and that they do so in a very deliberate manner, however the content of that message is not about company quality, or man-

agement expertise, which is the basis of signaling theory.

Our findings suggest that some other interpretation of management motivation is required.

The magnitude of environmental costs, and the level of public concern directed toward the chemical industry was discussed in an earlier part of this paper. Voluntary disclosure theory argues that disclosure in any industry involves balancing the costs of too much disclosure with too little. Richardson (1998) said that voluntary market forces can elicit a 'disclosure equilibrium' that works as efficiently as one where disclosure is mandated. In this current paper we make no claim to have established that the levels of disclosure made by any of these companies are 'efficient' in terms of providing information that investors or other stakeholders may want. Our findings suggest, however, that company managers reassess their disclosures when there is an external change, which in this case was the introduction of new financial reporting regulation. To withhold information about future costs in a situation where environmental performance is subject to public scrutiny could lead outside observers - that is, investors as well as the other stakeholder groups whose actions can trigger legislative repercussions - to assume that management is withholding bad news. An assumption such as this could trigger a negative share reaction. For this reason high emitters are more forthcoming with information.

The correlation between pollution and disclosure in this paper contrasts the finding of Clarkson, Li, Richardson and Vasvari (2008) and Al-Tuwaijri, Chris-

tensen and Hughes (2004), that low polluters are more forthcoming with environmental information. However Clarkson et al. focused on information in discretionary channels and specifically excluded the financial statements. Al-Tuwaijri et al. (2004) used a voluntary aspect of environmental performance as a measure of environmental performance. We believe that specific aspects of the research design in these two earlier studies, the disclosure medium on the one hand, the environmental performance measure on the other, suggests the authors may have discerned signaling behaviour that actually relates to 'good type' company quality, which is the basis of signaling theory. The research context of our paper may account for the differing results. The earlier studies are centred on the theme that good environmental performers will be more forthcoming with environmental information, and the disclosure measures assess volume and nature of information content. In the current paper, we examine management response over time, to a very explicit change in reporting requirements, and we limit our analysis to one industry. SAB92 focuses on contingent environmental liabilities, an issue that is of primary concern to the public and to companies in the chemical industry. We cannot argue that our findings could be generalized to capture the motivations for disclosure behaviour outside this industry.

The sensitivity of our results to the inclusion of the data from companies that did not make TRI reports adds an interesting nuance to the interpretation of our results. When we used our full dataset, including companies both with and without TRI reports, the 'signaling' behaviour was restricted to the use of financial

information. This finding makes sense given that the change in the regulatory environment was a change in financial reporting regulation. However, when we restrict our analysis to include only companies that made TRI reports, we find evidence that companies use non-financial information as a distinguishing disclosure too. Walden and Schwartz (1997) said that managers use non-financial information to manage stakeholder impression. Our findings suggest that when environmental performance is open to public scrutiny, managers engage in impressions-management more so than when it is not. This is a tentative observation only. Any future examination of this matter would require the study of a much larger number of companies, both with and without TRI reports.

This study has several limitations. First of all we had only a small amount of data to work with. The sample size, however, is more than adequate for valid statistical testing of the study's hypotheses. Secondly, we did not define our disclosure scores in terms of mandatory versus discretionary items. A future study that focuses on impressions-management would be wise to make this distinction. In the initial search phase of this study we looked for other legislative changes (other than SAB92) that may have affected the disclosure decisions of the companies in question. We found Statement of Position 96-1: Environmental Remediation Liabilities (SOP96-1), an environment-related reporting standard introduced in 1996 by the American Institute of Certified Public Accountants (AICPA, 1996). This standard came into effect only for fiscal years after December 15, 1996. As 1996 was the final year in our study period,

the study is not able to assess impacts of later regulatory events so we did not consider whether or not SOP-96 prompted another change in disclosure. Future study of the impact of regulation on disclosure strategy might consider the impact of SOP-96. A study of this sort might also draw upon the enhanced disclosure framework offered by the Global Reporting Initiative, which was first introduced in 1997.

We acknowledge that the datedness of the study period is a limitation for assessing more recent reporting features, such as the above-noted new disclosure guideline or the proliferation of environmental reporting in different formats and media. On the other hand, our study's setting can provide fundamental insights about managers' reporting strategies and responses to regulatory changes in reporting requirements. These insights remain relevant for future regulatory changes and may be of particular interest in developing economies, such as India and China. As developing economies progress, environmental concerns are increasing rapidly while their environmental reporting regulations remain at an undeveloped stage, similar to that of the period studied here (Malarvizhi, 2008).

SAB92 changed the reporting requirements pertaining to the disclosure of an environmental liability in an industry that commands considerable attention in the US. Our findings show that regulation elicits information beyond that required by the regulation itself. In Canada, where there is a more flexible reporting regime, many companies in the mining and oil and gas industry have escaped reporting their full environmental remediation obligations ((Li,

Richardson, & Thornton, 1997) even though this information was recommended by the CICA reporting guidelines. However, more recent CICA accounting standards for asset retirement obligations now require that for years beginning in 2004 or later, these companies must show the fair value of these obligations in their financial statements. Canada has a public reporting requirement for emissions similar to that of the US. The natural resource sector is a large segment of the Canadian economy. A re-examination of our research questions in this new context should yield additional insights. For example, the availability of a larger number of companies to work with should facilitate further exploration of the question of whether companies whose emissions are disclosed to the public, engage in impressions-management more so than competing companies for whom emissions is private information. A study in the Canadian context could also inform the debate as to whether regulation elicits the disclosure of additional information in a discretionary disclosure regime.

### Acknowledgements

Financial assistance from CMA-Canada, provided through the Canadian Academic Accounting Association, is gratefully acknowledged. The authors thank Felicia Jaisaree, Kristie Lester, Yongzhong Ma, and Michael Reznikov for their excellent research assistance.

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**Appendix A**  
**List of companies**

- B F GOODRICH CO
  - CABOT CORP
  - CHEMED CORP
  - DEXTER CORP
  - E I DU PONT DE NEMOURS & CO
  - FREEPORT McMORAN INC
  - M A HANNA CO
  - INTERNATIONAL SPECIALTY PRODUCTS INC
  - PPG INDUSTRIES INC
  - ROHM & HAAS CO
  - WITCO CORP
- 

**Appendix B**  
**Environmental Disclosure Index (Wiseman, 1982)**

**Economic factors:**

- M1. Past and current expenditures for pollution control equipment and facilities
- M2. Past and current operating costs of pollution control equipment and facilities
- M3. Future estimates of expenditures for pollution control equipment and facilities
- M4. Future estimates of operating costs for pollution control equipment and facilities
- M5. Provisions for future site cleanup

**Litigation:**

- M6. Present litigation related to environmental incidents
- M7. Potential litigation related to environmental incidents

**Pollution abatement:**

- M8. Air emission information
- M9. Water discharge information
- M10. Solid waste disposal information
- M11. Control, installation, facilities, and process described
- M12. Compliance status of facilities

**Other environment-related information:**

- M13. Discussion of regulations and requirements
  - M14. Environmental policies and company concern for the environment
  - M15. Conservation of natural resources
  - M16. Awards for environmental protection
-

- 
- M17. Recycling effort
  - M18. Department or offices for pollution control

**Quantitative financial environmental disclosures:**

- M19. Capital expenditure
- M20. Legal expenses
- M21. Fines and penalties
- M22. Land cleanup and reclamation
- M23. Environmental contingency
- M24. Provisions for future land reclamation
- M25. Provisions for environmental litigation

**Rating scale**

- 3 if item described in monetary and quantitative terms
  - 2 if item described specifically
  - 1 if item discussed in general
  - 0 if not mentioned
- 

**Appendix C**

**Environmental Disclosure Index (Barth, McNichols, & Wilson, 1997)**

**Disclosure about firm's affiliation with environmentally impaired sites**

- BMW1 - Statement that a firm is a Potentially Responsible Party (PRP) on one or more sites
- BMW2 - Statement that a firm is a PRP on one or more SUPERFUND sites
- BMW3 - Statement that a firm is a PRP on one or more non-SUPERFUND sites

**Disclosure about remediation-cost estimates**

- BMW4 - Range or qualitative statement about TOTAL remediation-cost estimates
- BMW5 - Dollar amount or other information about current year's remediation-cost estimates
- BMW6 - Range or qualitative statement about FUTURE remediation-cost estimates

**Disclosure about accrual of environmental liabilities**

- BMW7 - Statement that firm accrues environmental liabilities
- BMW8 - Statement about criteria for accrual
- BMW9 - Statement about reasons for not accruing
- BMW10 - Statement that effect on financial position is substantial, immaterial or unestimable or some combination

**Disclosure about insurance applicable to environmental liabilities**

- BMW11 - Statement that insurance is netted against cost estimates
  - BMW12 - Statement that insurance is applicable to environmental liabilities
  - BMW13 - Statement that insurance firm has settled some environmental claims
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**Appendix D**  
**Environmental Disclosure Index (Magness, 2003)**

Quantitative score ranging from 0 to 7, with one point assigned for the appearance of each of the following items:

- M1 Statements on the compliance status or compliance efforts of the company relative to environmental standards. (e.g., Discussion of efforts to keep abreast of operating impacts on the environment and of changing regulation. A claim such as “we attempt to protect the environment as much as possible” is not sufficient.)
- M2 Existence of a board- or executive-level committee responsible for monitoring environmental regulation or impacts.
- M3 \$ Presentation of CURRENT or PAST monetary expenditures relative to environmental control or remediation. This refers to actual cash flows. (e.g., “We spent \$x this year in environmental restoration.”)
- M4 \$ Disclosure of estimated FUTURE cash flows relative to environmental control or remediation. (e.g., “We plan an additional \$y cash outlay next year, or we plan to spend \$z dollars over the next 3 years.”). This includes details of specifically itemized expenditures planned for the near future.
- M5 \$ Disclosure of total estimated FUTURE environmental liability. Must be clear. Should not be lumped in with other items so as to be indistinguishable. Must not be offset with expected recoveries unless full amount is made clear elsewhere in report. This item differs from M4 above, in that it tends to be a much larger aggregate expenditure planned for some undefined future date.
- M6 Statements on current or potential environmental actions or lawsuits against the company.
- M7 \$ Disclosure of other FUTURE cash flow amount related to environmental management issues (e.g., expected recovery of insurance claims, reimbursements by third parties, or unaccrued portion of possible additional contingent environmental liability.)

The Magness index was initially designed for application to the Canadian natural resource sector (Magness, 2006). Item M5 tends to be more applicable to those industries where planned remediation is one of the conditions of the permitting process. The seven-point rating system shown here has been modified slightly from its original form.

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