THE ECONOMIC CONSEQUENCES OF FINANCIAL REPORTING STANDARDS: THE MARKET VALUATION OF ENVIRONMENTAL LIABILITIES

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ABSTRACT

THE ECONOMIC CONSEQUENCES OF FINANCIAL REPORTING STANDARDS: THE MARKET VALUATION OF ENVIRONMENTAL LIABILITIES

This thesis investigates the economic consequences of regulatory intervention on the financial reporting of environmental liabilities. The regulatory intervention is the introduction of new financial reporting standards that relate to managers' and auditors' responsibilities in estimating and reporting environmental liabilities. The research question is whether this regulatory intervention is associated with a change in the market's valuation of environmental liability accruals reported in companies' financial statements. A change in the market's valuation can indicate that market participants perceive the environmental liability information to be more precisely measured when the new financial reporting standards come into effect.

The thesis draws on theory and prior research to generate the testable hypothesis that, as one moves from a regime of low financial reporting standards for environmental liabilities to one of high financial reporting standards, the change in the valuation coefficient on a dollar of reported environmental liability will be negative. More specifically, the valuation coefficient is expected to change from zero, for an imprecise environmental liability measure, to negative one for a precise measure. The research question is studied by using an interrupted time-series design with replications in two settings, Canada and the US. The regulatory interventions occurred at different times in these two countries, 1995 in Canada and 1993 in the US. The impact of the intervention is measured by examining the behaviour of the valuation coefficient on reported environmental liabilities in a multiple linear regression of share price levels on environmental liability book values and other relevant financial statement variables

The empirical analyses indicate that the market places a negative valuation on environmental liabilities. Results for the US sample indicate that this coefficient becomes less negative after the regulatory change in 1993. The Canadian sample also indicates a change to a less negative coefficient, but this change is not significant when 1995 is used as the effective date of the regulatory change, while it is significant when 1993 is used. This suggests that the change in US standards also influenced the companies in the Canadian sample, thus preempting the later change in Canadian standards. These empirical findings indicate that the change in the valuation coefficient is non-negative; this is opposite to the study's ex ante prediction. The potential for reporting bias to be an omitted factor that works in the opposite direction to the hypothesized precision effect is explored as one possible ex post interpretation of these findings.

The thesis presents evidence that changes in financial reporting standards are associated with changes in the market valuation of environmental liabilities, contributing to our understanding of the role of financial reporting standards in the reporting and valuation of environmental liabilities.

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In memory of my grandmother

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This thesis investigates the economic consequences of regulatory intervention on the financial reporting of environmental liabilities. The regulatory intervention is the introduction of new financial reporting standards[1] that relate to managers' and auditors' responsibilities in reporting environmental liability estimates. The research question is whether this regulatory intervention is associated with a change in the market's valuation of environmental liability amounts reported in companies' financial statements. A change in the market's valuation can indicate that market participants perceive the environmental liability information to be more precisely measured when the new financial reporting standards come into effect.

1.2 Motivation for the study

Recent financial reporting standards address the **precision** of accounting information in terms of its measurement uncertainty. These standards acknowledge that measurement uncertainty may vary from item to item in the financial statements, and over time for the same item.[2] This thesis intends to contribute to our knowledge of the factors that relate to

[1] The term 'financial reporting standards' is used in this paper to refer to accounting, auditing and other regulatory standards that govern the reporting of financial information.

[2] For example, CICA Handbook section 1508, ***Measurement uncertainty***, is the Canadian accounting profession's acknowledgment that measurement uncertainty can vary from item to item in the financial

accounting information precision in general, and more specifically to environmental liability estimates, which are characterized by a high level of measurement uncertainty. Prior studies have addressed the quality of accounting information[3], the accounting for environmental liabilities, and the role of standards in the financial reporting of environmental liabilities. This section outlines the existing research and the incremental contribution of this study.

Lev (1989) called for research into how investors adjust for differences in accounting information quality and how accounting measures and valuation techniques might be improved to affect the ability of financial information to help investors predict future cash flows. Along this line, Collins and Salatka (1993) and Bandyopadhyay (1995) addressed the impact of information precision on earnings response coefficients. Considering environmental liabilities more specifically, Shane and Spicer (1983), Barth and McNichols (1994), Blacconiere and Patten (1994), and Blacconiere and Northcut (1997) found information about environmental liabilities to be value relevant to investors. This study extends these lines of research by considering the effect of financial reporting standards on the precision of environmental liability amounts reported in financial statements and the relation between these amounts and share prices. This study differs from prior environmental liability research in that it uses companies' actual environmental liability accruals rather than proxies for these, or other environmental information disclosures. This approach of using actual accruals can reduce the measurement problems

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statements. Many recent accounting standards address the measurement of uncertain amounts (e.g. employee stock options, post-retirement benefits, pension liabilities, derivative financial instruments and loan loss provisions).

that arise from using proxy measures, as pointed out by Holthausen (1994) in his discussion of Barth and McNichols (1994), and may provide results that can be interpreted with less ambiguity. This study differs from the prior earnings response research in that here the market's valuation of environmental liabilities is examined rather than an earnings response coefficient.

Accounting information precision can also be considered in terms of the trade-off between relevance and reliability, a fundamental problem in accounting that is discussed by Scott (1996) and others. Environmental liabilities provide an example of the dilemma facing accountants in attempting to provide relevant information. Costs of future obligations to clean up past environmental damages could have a very material impact on a company's financial position, but attempts to estimate these liabilities involve high levels of uncertainty concerning the amounts and timing of such costs and appropriate discounting methods (see Eckel and Nehlawi (1985) and Barth and McNichols (1994)). Accounting principles tend to favour reliability and require that information included in financial statements be reasonably estimable.[4] Thus, a problem exists in that relevant information may be omitted from financial statements because it is too difficult to estimate.

This problem is exacerbated by the fact that the assessment of what is a reasonable estimate is highly subjective. The accounting rules that apply to the reporting of

[3] In this study, and most of the prior research cited here, information quality is considered only in terms of its precision (the inverse of its variance). Information quality can have other aspects, but these are not the focus of the hypothesis tested in this study.

environmental liability estimates tend to leave considerable discretion to management. Prior research indicates that firms may be less likely to disclose unfavourable news (for example, Clarkson, Kao and Richardson 1994; Scott 1994; Wiseman 1982; Ingram and Frazier 1980). Further, the theory of voluntary disclosure predicts that less disclosure of unfavourable information will occur the higher is information users' uncertainty about whether the firm has any information; a manager may even commit to obtaining no information so that no disclosure needs to be made (Dye 1985; Verrecchia 1990; Li, Richardson and Thornton 1997). Since environmental liabilities are both unfavourable and uncertain, theory and prior research indicate that firms' disclosures of these items may be less than full and fair.

Since the omission of significant liabilities would seriously impair the usefulness and credibility of financial statements, regulators have recently provided new financial reporting standards relating to the reporting and auditing of environmental liability information. These new standards are further discussed in chapter 2.[5] There are two notable implications of these new standards. First, the standards acknowledge that information with varying degrees of measurement uncertainty may have to be included in order for financial statements to be fairly presented. Second, the standards make it clear that managers and auditors have a responsibility to consider the fair presentation of liabilities arising from environmental laws and regulations. Feroz, Park and Pastena (1991) and Stanny (1996) have studied the regulatory costs that such new standards impose on companies. This study considers whether these new financial reporting

[4] For example, CICA Handbook sections 3060 (*Capital assets*) and 3290 (*Contingencies*), and FASB SFAS No.5 and Interpretation No.14 (*Accounting for contingencies*).

standards are likely to result in more effort to reduce the uncertainty of environmental liability estimates, hence leading to more precise environmental liability amounts being reported in financial statements.

There has been considerable debate within the accounting/auditing profession regarding the roles and responsibilities of accountants and auditors in issues of environmental accountability (Canadian Institute of Chartered Accountants (CICA) 1992). Verifiability is essential to the credibility of financial statement information, including accounting estimates (Breeden 1994; Sharav 1995). The auditor's examination of management's estimation process is a factor that may relate to the precision of accounting estimates (DeAngelo 1981; Titman and Trueman 1986). Previous studies have considered the relation between auditor quality, often proxied by audit firm size, and share or bond prices (Beatty 1989; Teoh and Wong 1993; Raman and Wilson 1994). Abdolmohammadi et al (1997) also draw attention to the need for research into the standard-setting process and the role of accountants and auditors in providing assurance regarding environmental accounting. The present study extends this prior research by considering the audit function as a component of the financial reporting standards for environmental liability estimates. These standards are viewed as a factor that may be associated with accounting information precision.

Finally, over time the amount of environmental liability information companies provide has been increasing. This study adds to the existing research by providing a new set of

[5] Also, detailed descriptions of these standards are in Appendix 1.

hand-collected data about Canadian and United States (US) companies' environmental liabilities.

In summary, this study is motivated by the need to understand the factors that relate to the precision of reported environmental liabilities, items that are characterized by a high level of measurement uncertainty. It considers one factor, financial reporting standards, that may have an impact on the effort that is applied to estimating the liability and hence the precision of the information. The study seeks evidence that market participants perceive the environmental liability information to be more precise when these new standards are in place.

1.3 Overview of the research question and design

The research question is whether new financial reporting standards lead to changes in the market valuation of environmental liability accruals, changes that would be consistent with users believing that this information is more precise. The event of interest in the study is a regulatory change, the introduction of new standards that increase managers' and auditors' responsibility to examine environmental liability estimates. Throughout the paper, this event is referred to as an 'increase in financial reporting standards'. It is expected that this event will produce a regime shift from a period of lower effort in estimating environmental liabilities when the standards were lower, to one of higher effort when standards are higher, and that higher effort will produce more precise

estimates. For the purpose of this study, the pre-change period (before the new standards came into effect) is referred to as the 'low standards' regime, and the post-change period (after the new standards came into effect) is referred to as the 'high standards' regime.

The study uses the relation between the market price and the reported environmental liability information as an indicator of the information's precision. This relation is investigated by using a regression model design in which share price levels are regressed on book values of the environmental liability and other value-relevant financial statement variables.[6] The main prediction of the study is based on the expectation that, in this levels specification, there will be a one-to-one relation between book value and market price if the book value is very precise. This expected relation is provided by the valuation framework of Feltham and Ohlson (1995) and the empirical interpretations of the framework set out by Bernard (1995) and others. Thus, in the case of a 'perfect' environmental liability measure, a valuation coefficient of negative one would be expected.

Relying on the basic insight provided in Holthausen and Verrecchia (1988), chapter 3 develops the theoretical prediction that the valuation coefficient of the environmental liability will be closer to negative one when financial reporting standards are higher, implying that market participants believe that more precise information has been produced under the higher standards. In contrast, if investors believe the estimate is very imprecise, then the expected coefficient would be zero. Thus, the change in the valuation

[6] The other financial statement variables used are book values of assets and liabilities other than the environmental liability, and abnormal earnings. This is further explained in chapter 5.

coefficient going from the low standards regime to the high standards regime is hypothesized to be negative (from zero to negative one).

The main difficulties that must be overcome in the levels regression research design are to identify and control for other factors that may be influencing share prices, and to provide the conditions necessary to infer causation. As further described in chapter 4, the research design is an interrupted time series with replications in two settings, Canada and the US. This experimental design can provide control against validity threats such as history and maturation.

1.4 Organization of the thesis

The remainder of the thesis is organized as follows. Chapter 2 reviews the institutional background of financial reporting standards for environmental liabilities in Canada and the US. Chapter 3 reviews the prior research on estimation effort, information precision and the price-to-book relation. Chapter 3 develops the theoretical prediction and the research hypothesis. Chapter 4 discusses the research design, the experimental manipulation, the potential outcomes resulting from the manipulation, and a quasi-experimental design that addresses inference validity concerns. Chapter 5 describes the data collection method, the empirical model and econometric specification issues. Chapter 6 presents the empirical analysis and discusses the results. Chapter 7 concludes the thesis and discusses its limitations and possible future research directions.

CHAPTER 2

INSTITUTIONAL BACKGROUND

2.1 Introduction

This chapter outlines the institutional background of the study. Since both Canadian and US companies are included in the research design, the institutional backgrounds of both countries are relevant to the study. The chapter describes the financial reporting standards that relate to environmental liabilities.

2.2 Financial reporting standards in Canada and the US

In recent years environmental laws and social expectations in both countries have increased the obligations of firms that pollute to incur present and future costs to remediate their operating sites. A firm's operations may generate future obligations to clean up or restore sites that it has polluted. In this paper these obligations are referred to as environmental liabilities.

Formerly, these clean-up costs were not required to be paid by polluting firms; they were externalities in that the firm's impact on other users of the environment were not included in its costs. With social intolerance for environmental degradation increasing in recent years, governments have introduced regulations to attempt to internalize some of the

environmental externalities by forcing clean-up costs onto polluting firms. These laws create an obligation for a firm to give up resources in the future that arises from past events, thus meeting the accounting definition of a liability (for example, CICA Handbook section 1000).

Accounting standards require that significant known liabilities be included in the financial statements. However, environmental liabilities are subject to considerable uncertainty. This is because, for example, the regulatory enforcement may not be certain and the clean-up technologies are relatively new. Still, the extent of environmental damage would indicate that, for some firms, these liabilities could be large enough to have a significant impact on the firm's financial position and future cash flows.

In the accounting standards, the uncertainty concerning liabilities is considered to have two aspects: the uncertainty regarding whether or not a material liability will arise; and the uncertainty about the amount of the liability if it does in fact arise. This discussion of environmental liability accounting focuses only on the second of these two aspects, the measurement uncertainty concerning the amount of the liability. The view is taken here that all companies will have some potential environmental liability and only its amount is uncertain. A very small, immaterial liability is considered the same as a liability of zero because the study is concerned with observable, reported information and immaterial liabilities may not be reported.

Three accounting standards can be applied to this environmental liability situation in Canada: the recommendations for accounting for contingent liabilities in *Contingencies*, CICA Handbook section 3290 (effective August 1978); the recommendations for accounting for site restoration costs in *Capital assets*, CICA section 3060 (effective December 1990); and the accounting recommendations for the measurement uncertainty aspect of environmental liabilities in *Measurement uncertainty*, CICA section 1508 (effective July 1995).[7] These are further discussed below.

CICA section 3290 defines a contingency as 'a situation involving uncertainty as to possible...loss to an enterprise that will ultimately be resolved when one or more future events occur or fail to occur. Resolution of the uncertainty may confirm the...loss or impairment of an asset or the incurrence of a liability.' (CICA section 3290.02). The accounting required for a contingent liability depends on whether the probability range of uncertainty is 'likely', 'unlikely', or 'not determinable'. If likely, the liability should be accrued in the financial statements, but only if the amount can be 'reasonably estimated'. If the estimate of the amount is a range, accrue either the best estimate in the range, or if no estimate is better than any other, accrue the minimum amount in the range. If the contingent loss is likely but the amount is not 'reasonably estimable', or if a loss in excess of the accrued amount is possible, disclosure of the relevant facts should be made in the financial statement notes. If the likelihood is not determinable, and a contingent loss would be material if it occurred, disclosure of the relevant facts should be made in the

[7] The standards discussed here are recommendations of the Canadian Institute of Chartered Accountants. US requirements, primarily FASB's SFAS No.5 and Interpretation No.14, are similar. Further details of the Canadian and US standards are provided in Appendix 1.

financial statement notes. By implication, if the contingent loss is 'not likely' no disclosure or accrual is required.[8]

CICA section 3060 concerns capital assets and specifically addresses future site restoration costs. It requires that these be provided for when 'reasonably estimable', in a rational and systematic manner by charges to income (CICA section 3060.39).

CICA section 1508 addresses the measurement uncertainty aspect of environmental liabilities. Measurement uncertainty exists when there is a difference between an amount recognized in the financial statements and another reasonably possible amount. The nature of a material measurement uncertainty should be disclosed, and its extent should be disclosed when it is reasonably possible that the recognized amount could change by a material amount within the next year (CICA sections 1508.06 and .07). When such disclosures are made, the amount recognized should also be disclosed unless it would have an adverse effect on the enterprise.

Financial statements issued for public use must be audited. The stated purpose of an independent financial statement audit is for the auditor to gather and evaluate evidence so as to form an opinion on whether the financial statements are fairly stated (for example, CICA Handbook section 5100). Auditors historically took the position that they were not responsible for financial presentation of liabilities arising from laws other than income

[8] An Exposure Draft (ED) of a revised set of recommendations for contingencies was issued by the CICA in February 1993. The main change in the ED was to specify the probability range definitions as mutually exclusive ranges. The ED was withdrawn in 1996, but while it was outstanding it may have had an

and commodity tax laws.[9] With the rise of social concerns and regulation regarding environmental problems, the standard setters that regulate auditors' activities have intervened in this status quo, as described below.

In Canada, the auditing profession is regulated by the CICA. Two new CICA Handbook auditing standards, section 5136: *Misstatements-Illegal acts* and Audit Guideline 19: *Audit of financial statements affected by environmental matters*, were introduced in 1995[10]. Among other things, these new standards expanded the auditor's responsibility to consider environmental matters and, in particular, the auditor's responsibility to search for violations of environmental laws that would give rise to liabilities. The standards require auditors to consider environmental risks when planning an audit, to make enquiries of management and to obtain managers' written representations concerning violations of environmental laws that would give rise to liabilities. Auditors' expressed concerns at the introduction of these standards provide evidence that the standards were viewed as risk increasing by many members of the auditing profession (Murusalu 1995).[11]

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influence on some companies' accounting methods. Notably, the ED was more similar to the US standard FAS No.5 than is the current s.3290.

[9] This viewpoint was provided by a senior partner in a large Canadian accounting firm. This view is consistent with the absence of auditing standards relating to legal matters prior to the issue of CICA section 5136, *Misstatements – Illegal Acts* in 1995, and with auditors' objection letters in response to the Exposure Draft for CICA s.5136 (Murusalu 1995).

[10] An earlier version of this Audit Guideline was available in 1994 but in 1995 this was revised and reissued to be linked to the Handbook section 5136. A Handbook section is authoritative, while an Audit Guideline is only advisory. Therefore, in this study 1995 is considered to be the effective date of the new standards for Canada. However, the effect may have begun earlier or later for some companies. For both Canada and the US, it is difficult to pinpoint an effective date for this type of process-oriented financial reporting standard; this is a limitation of the study.

[11] In her summary of responses to the exposure draft of the CICA s.5136 material, Murusalu (1995) reports that respondents were concerned that the illegal acts standard would increase the auditors' exposure to legal liability. Some respondents suggested the standards should limit the auditor's responsibility only to those laws and regulations that have a direct and material effect on the determination of financial statement amounts, such as certain provisions of the Income Tax Act. Respondents expressed the view that auditors should not be responsible for identifying and designing audit procedures for other types of laws, such as environmental laws.

Investors would also have been aware of these new standards through reports in the business press (for example, St. Onge 1994).

In the US, the American Institute of Certified Public Accountants (AICPA) sets auditing standards. Two regulatory events in the US would have had an impact on auditors' activities similar to that of the Canadian events noted above. First, in 1988 the AICPA issued the Statement on Auditing Standards no. 54: *Illegal Acts by Clients.* This standard directly required auditors to consider a client's compliance with laws and regulations, such as environmental laws, during an audit. Second, in 1993, the Securities and Exchange Commission (SEC) issued *Staff Accounting Bulletin No. 92*, a document that clarified the Commission's expectations regarding the financial reporting of environmental liabilities. These expectations include the requirement to accrue the best estimate of a contingent environmental liability, even if it is uncertain. The SEC regulates actions of SEC registrants' managers directly; it would also influence auditors indirectly through its oversight of the financial reporting process. Investors would have been aware of the impact of SAB No. 92 through news reports (for example, Bukro 1994; Harting 1994; Shi and Cooper 1994).

To summarize, the Canadian financial reporting standards discussed above point to 1995 being the point in time when new standards were in place in Canada. In the US, the publication of SAB No.92 points to 1993 as the time when the standards changed. There are no prior studies of these new Canadian financial reporting standards, but there are several indicators that 1993 was a pivotal point in the U.S. financial reporting regulatory

framework relating to environmental liabilities. The AICPA Roundtable in January of 1993 highlighted the accounting and auditing profession's role (see Appendix 1). The issue of the SEC's SAB No. 92 in June indicated that SEC registrants' financial reporting was substandard and the SEC would be enforcing a much higher level of compliance. (Further details are in Appendix 1). The results of prior studies of US standards by Feroz, Park and Pastena (1991), Barth, McNichols and Wilson (1997), Stanny (1996) and Ely and Stanny (1997) provide empirical evidence of higher regulatory enforcement after 1992.[12] The earlier 'fraud-on-the-market doctrine' of 1988 might be used as an earlier regulatory intervention for the U.S. setting.[13] However, there were too few companies reporting environmental liabilities at that time to support an empirical enquiry.

If these higher financial reporting standards resulted in more effort by managers and auditors to estimate environmental liabilities, this might have the effect of increasing the precision (reducing the uncertainty) of the liability estimates reported in audited financial statements. This would have implications for the market valuation of reported environmental liabilities. Prior research (Holthausen and Verrecchia 1988, Swaminathan 1991, Dharan and Lev 1993, Collins and Salatka 1993) indicates that a potential change associated with more precise accounting information would be an increase in the magnitude of the market price response to a dollar amount of environmental liability reported in firms' audited financial statements. The next chapter outlines a model that

[12] In the Barth et al (1997) study of factors influencing firm's environmental liability disclosures, the proxy for regulatory influence was largest and most significant for 1993 relative to proxies for the years 1990 to 1992. The years 1990-1992 were also significant, which may indicate a gradual rather than a sudden shift.
[13] The 'fraud-on-the-market' doctrine first arose in the 1970's and culminated with a Supreme Court decision in 1988; it might be used as a second intervention for the U.S. setting, but sufficient data back to that period are not available. In any case, the fraud-on-the-market doctrine represents a change in the U.S.

adapts this theory to the case of environmental liability accruals and develops the predictions of the study.

2.3 Chapter summary

This chapter has provided details of the financial reporting standards that relate to environmental liabilities for both Canadian and US companies.

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legal climate that would be consistent with the expectation that the 1993 SEC intervention increased managers' and auditors' effort. (See Dutta and Nelson 1995; Shulman 1989; Arlen and Carney 1992)

CHAPTER 3

LITERATURE REVIEW - THEORY AND HYPOTHESIS DEVELOPMENT

3.1 Introduction

This study examines changes in financial reporting standards for environmental liabilities. These standards relate to managers' responsibility for reporting environmental liabilities in financial statements and auditors' responsibility to consider environmental matters during a financial statement audit. This chapter discusses how these changes might be associated with a change in the market's valuation of the environmental liabilities reported in companies' audited financial reports. The study is focused on accrued environmental liabilities, rather than other environmental information that may be disclosed in companies' financial reports.

The chapter outlines prior theoretical research relating to the reporting and auditing of environmental liability information in three components: the impact of financial reporting standards; the precision of accounting information (including environmental liability estimates); and the relation between market values and accounting information. These three components are linked to generate the prediction that increases in standards for the financial reporting of environmental liabilities will be associated with a change in the valuation coefficient on the reported environmental liability estimate. As standards increase, the valuation coefficient is expected to move from zero to negative one,

indicating that investors believe the environmental liability accrual is more precise when standards are higher.

Chapter 3 is organized as follows. Section 3.2 discusses the relation between standards and estimation effort. Section 3.3 discusses the relation between effort and the precision of accounting information to support the maintained assumption that estimation effort and hence information precision will increase as a result of the identified regulatory intervention in the financial reporting process. Section 3.4 discusses the relationship between the precision of the environmental liability information and market valuation, and then develops the research hypothesis. Section 3.5 is a summary of the chapter.

3.2 Financial reporting standards and estimation effort

As discussed in chapter 2, the regulatory intervention of interest in this study is the introduction of new standards that increase managers' and auditors' responsibility regarding environmental liability estimates. In Canada, CICA auditing standards that clarified auditors' responsibility for detecting and evaluating environmental liabilities were introduced in 1995. In the US, a corresponding regulatory intervention occurred in 1993, when the SEC's SAB No. 92 set out guidelines for companies' financial reporting of environmental liabilities. This section discusses how these new standards would be expected to produce a regime shift from a period of lower effort in estimating environmental liabilities to one of higher effort.

These new standards would be expected to affect the actions of both managers and auditors in reporting environmental liabilities. In order to focus on the precision of the information reported, this discussion is based on the assumption that there is no information asymmetry between the manager and the auditor. This view is consistent with the auditor-client negotiation model provided by Antle and Nalebuff (1991). They show that information asymmetry initially makes the auditor take a conservative stance, mainly to offset potential unconservative biases in the manager's report. The evolution of the final report involves negotiation and risk sharing between the manager and auditor. Antle and Nalebuff show that this negotiation process removes the information asymmetry and leads to the audited report being a joint statement of the manager and auditor. While the model is simplified, it provides the insight that the manager and auditor will co-operate to produce the audited financial statements. It is possible that the manager and auditor do not share all available information, but the dynamics of the auditor-manager interaction under information asymmetry are beyond the scope of this study.

Regarding the impact of the new standards on auditors, the audit literature (for example, Scott and Zhang 1995; Pae 1995; Dye 1993) shows that an audit has value for two reasons. One, the audit effort increases the usefulness of the information for investors' decision-making purposes. Two, if the information is wrong the investors can sue the auditor for any resulting losses. In this theory, the auditor rationally anticipates the total cost function, including legal liability, in determining the optimal audit effort level. Audit

effort is also referred to as audit quality in this literature. While a higher standard implies an increased probability of liability for a given effort level, how the auditor's effort level changes in response to increased standards depends on factors such as the costs of audit procedures, the probability of auditor liability, the potential loss, and legal costs.

Dye (1993) presents a one-period model that considers the relationship between standards and quality (effort) specifically. In the Dye model, the auditor's effort choice is linked to the auditor's wealth, which acts as a ceiling on the auditor's expected litigation costs. The auditor's effort level choice is decided by minimizing the sum of the direct audit costs and the expected negligence liability. The auditor's potential loss is the lesser of the post-audit wealth and the negligence liability. The Dye model suggests that audit effort will increase when standards are increased unless auditors with marginal wealth are predominant in practice, in which case the average audit effort may decrease when standards are raised.[14]

To assess how prevalent this decreasing case might be in practice one would need to know auditors' private wealth levels, but this information is not publicly available. Therefore, in the one-period setting of Dye (1993), auditors must have, on average, substantially more wealth at stake than their potential negligence liability in order for

[14] More specifically, the Dye (1993) analysis suggests that the decreasing case arises because the cost of the best negligent audit does not vary with the standard. An auditor with marginal wealth is indifferent between complying with the higher standard or deviating to a strictly lower quality. All auditors with wealth near the marginal auditor's would also revert to negligent audits when the standard increases. In other words, for complying auditors whose wealth is only marginally more than the expected litigation cost, a higher compliance cost may shift the balance such that they are now better off not to comply, since in either case they cannot lose more than their (fixed) wealth. This decreasing effort case of Dye (1993) would provide theoretical support for the null hypothesis that increased standards have no effect if, on

average audit effort to increase when standards are increased. In support of this assumption note that, in a multi-period setting, non-compliance would be expected to increase the auditor's costs of insurance, reputation loss and professional sanctions; these increases may make complying the optimal choice. Also, this empirical study will include only public companies. It seems unlikely that the auditors of public companies would have 'marginal' wealth given that they are likely to have continued in existence over a long period, and have settled some very large law suits. Moreover, prior empirical studies generally support the assumption that higher standards (or risk) are associated with higher audit effort (for example, Palmrose 1988; O'Keefe, Simunic and Stein 1994; Hackenbrack and Nelson 1996).

Further, court decisions regarding environmental liabilities have been trending toward recognizing the difficulty of estimating environmental liabilities and using the managers' efforts to understand and control environmental problems as a positive factor in assessing negligence (for example, Bata Industries 1993[15]). For auditors, the common law defence against negligence has generally been to show that they have met the expected performance standards of the average, prudent auditor, such as the auditing standards established by the accounting profession (Girvan et al 1995; Gunz 1995). Thus, taking the view that more specific standards regarding environmental liabilities correspond to a more certain legal standard of care, it is expected that managers and auditors will comply with the new standards and increase their efforts to estimate this information.

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average, auditors operate with marginal wealth at risk. Since auditor wealth is not included in the study, this could be a limitation in interpreting a null result.

[15] In the Bata Industries (1993) case, the Supreme Court of Canada upheld the company managers' individual liability for the company's environmental damages on appeal of the convictions and sentences

Managers can be expected to respond to higher costs of regulatory scrutiny by increasing their efforts to obtain information with which to estimate the environmental liability. The empirical findings of Feroz, Park and Pastena (1991) support this expectation. The manager can be viewed as an information source from which the auditor can obtain any information he or she believes is relevant to forming an audit opinion. If the manager already has this information, it would be efficient for the manager to provide it to the auditor, rather than for the auditor to reproduce it. This avoids the cost of producing duplicate information and of delay in issuing the audit report (as audits typically must be completed by certain statutory deadlines). It also avoids the cost of a qualified audit report, which could result if relevant information were not provided, and which could have negative employment consequences for the manager.

It is assumed that, on average, the above trade-offs will be made such that the higher standards result in higher effort by both the manager and auditor to produce and verify the information used to estimate the environmental liability. Viewing the financial statements as the joint product of the manager and auditor, as discussed above, they both would be expected to produce the information in the way that minimizes their joint information production costs.[16]

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decided in a 1992 trial. Failure to take reasonable action to prevent the damages was a factor used in establishing the managers' liability.

[16] A joint minimization of audit information production costs could be expected at any level of standards, thus the new financial reporting standards would not necessarily affect this. Still, these higher standards would increase the scope of the audit examination, so that new information must be produced by the auditor, or by the manager to be verified by the auditor. Similarly, without the regulatory costs imposed by the new standards, the manager would not incur the cost of producing information. Thus the new financial reporting standards can be expected to increase the manager's and auditor's joint effort to estimate environmental liabilities.

It is possible that the manager and auditor may not act jointly. In particular, the manager may be able to conceal information about environmental problems because the auditor is uncertain about whether such problems exist. While the intent of the new financial reporting standards is to reduce this type of uncertainty, and thus make such concealment less likely to succeed, this is not necessarily the case for every manager/auditor pair. One situation that might lead to this result is if the auditor lacks the power to demand more information or changes to the financial report. This concern is lessened somewhat in this empirical study because all the sample companies are publicly listed and all auditors are Big Six firms, making it reasonable to assume that auditors will have reasonable power to obtain the necessary audit evidence and require that the environmental liability estimates reported are consistent with this evidence.

While the information asymmetry discussed in the previous paragraph may be a realistic aspect of the environmental liability reporting problem, and one that has a richly developed theoretical base, this study's theoretical predictions assume that there is no hidden information. The predictions are based on the uncertainty aspect of reported environmental liability information only, so that any relevant private information that a manager might have is revealed truthfully through the audit testing process. The manager and auditor are viewed as joint agents who generate information regarding environmental liabilities[17] and share it with investors as soon as it becomes known. This view allows the

[17] This requires that the manager's and auditor's objectives are effectively aligned regarding reporting of the environmental liability estimate.

study to be focused more directly on the role that financial reporting standards may play in the precision of the reported environmental liability information.

To conclude, the theory outlined in this section indicates that when standards for the financial reporting of environmental liabilities are raised, managers and auditors can be expected to apply more effort to estimating these liabilities.

3.3 Precision of reported environmental liability estimates

This section discusses the impact of more estimation effort on the precision of reported environmental liability amounts. The environmental liabilities reported under the standards discussed in Chapter 2 must be estimated in the face of considerable uncertainty.[18] The precision of these estimates can be affected by the amount of effort applied to the estimation process. The following discussion assumes that other factors, besides estimation effort, which may affect the underlying uncertainty of environmental liability measures (for example, environmental laws or technology) are not changing. If a manager obtains little information with which to assess environmental problems, the estimate of the environmental liability will be diffusely distributed. In a Bayesian

[18] Examples of this estimation uncertainty are as follows. The activities to which environmental regulations apply and timing and extent to which they will be enforced may be uncertain. The clean-up costs themselves may also be highly uncertain if little or no information about them has been collected. Further, the data required for environmental liability estimation would be different than that which a company uses for its more traditional accounting and management information. For example, the appropriate discount rate to use for the future costs is not well established (Eckel and Nehlawi 1985) and scientific data may need to be used. Note also that only pollution that can be identified as coming from a specific firm is considered here; pollution whose source cannot be specifically identified would introduce even greater uncertainties.

framework, this amounts to the manager having diffuse priors concerning the probability distribution of the environmental liability amount. The existence of an auditor with no responsibility to verify environmental liability information would have little impact on the estimate's precision. In contrast, as discussed above in section 3.2, if the manager and auditor are required to do more work because of an increase in financial reporting standards, this may have an impact on the estimation process. The work could involve reviewing more information about the details of environmental laws and regulations, the costly remediation actions these mandate, and the penalties, fines and prosecutions these provide for.

Using a Bayesian analysis, when new information about an unknown amount is obtained, a decision maker can form more precise posterior beliefs about the probability distribution of the unknown amount. In this study, as a result of higher estimation effort, the estimate of the environmental liability is expected to become more precise.[19] Combining the analysis of this section and the previous section 3.2, the expected impact of the increase in standards is an increase in the effort to estimate environmental liabilities resulting in more precise estimates. Also, the information must be reported truthfully or the expected negligence liability would not be reduced. In conclusion, more effort to estimate environmental liabilities is expected to produce more precise estimates of these amounts.

[19] In a static Bayesian analysis this can be viewed as obtaining a sample from the true population and using the sample information to revise one's beliefs about the population. It is a well-established result in Bayesian statistics for normally distributed distributions that, when a sample is taken from the true

3.4 Market valuation of reported environmental liability accruals and hypothesis development

This section discusses the impact of more precise estimates on the market's valuation of accrued environmental liabilities. The section also develops the research hypothesis.

Holthausen and Verrecchia (1988) use an intertemporal, multi-asset model to show that the magnitude of a share-price response relates to the precision of the (noisy) information signal, and to the prior investor uncertainty regarding the underlying value of the firm.[20] This model indicates that, the higher the precision of the company's information report, the higher will be the weighting placed on the information in the market's revision of its beliefs about the final liquidating dividend of the firm and hence the current market value of its shares.

The insight provided by Holthausen and Verrecchia (1988) has been the basis for the predictions in studies of the impact of the precision of earnings on the earnings response coefficient, for example, Collins and Salatka (1993); Teoh and Wong (1993); and Bandyopadhyay (1995). These studies used a simplified, single-period, single-signal version of the Holthausen and Verrecchia (1988) model to characterize the share price response to varying levels of both the noise in the information signal (earnings report) and the prior investor uncertainty regarding the underlying value of the firm. This prior

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population, the beliefs will be revised such that the posterior distribution has a smaller variance than the prior distribution (for example, Winkler and Hayes 1975).

[20] More specifically, in Holthausen and Verrecchia (1988) the potential usefulness of the report, referred to as its precision, is determined by the variance of its error term. The variances of the price changes of the

research implies that, if a one dollar profit is reported precisely there will be a larger increase in price than if the profit report were imprecise. In other words, one can view Holthausen and Verrecchia (1988) as a theory that predicts how the precision of reported accounting information relates to changes in the market value of equity (share price change).

In contrast to the earnings response coefficient studies noted above, this study considers a liability accrual rather than an earnings report and looks at how the **level** of the environmental liability (a component of the book value of equity) relates to the **level** of share price, rather than the change. In this study, the insight of the Holthausen and Verrecchia (1988) model can be interpreted as relating the precision of the reported environmental liability estimate to its market valuation. This interpretation is discussed next.

The theory outlined above indicates that high (low) financial reporting standards can be expected to produce precise (imprecise) environmental liability estimates. In this context, the insight of Holthausen and Verrecchia (1988) would imply that a more precise environmental liability amount should attract a valuation coefficient that is closer to what would be expected for a precisely measured liability (such as a bond payable with a fixed term to maturity and a fixed interest rate, for example). The valuation framework of Feltham and Ohlson (1995) indicates that the theoretical valuation coefficient for a precisely measured liability will be negative one. In contrast, if the reported liability was

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risky assets are increasing when the precision of the report increases under various assumptions regarding cross-sectional (between assets) and intertemporal (between signals) correlations.

very imprecise the market valuation would be expected to be closer to zero since the estimate would be indistinguishable from noise. As Skinner (1996) points out, the Feltham-Ohlson (1995) valuation framework requires a strong assumption of market efficiency. Also, both the Holthausen and Verrecchia (1988) model and the Feltham-Ohlson (1995) valuation framework maintain an assumption of complete information.

Besides the precision of the report, a second aspect of the Holthausen and Verrecchia (1988) theory is the role of investors' prior beliefs about the true distribution. The theory predicts that if these priors are precise the report matters less than if they are imprecise. However, the discussion in the following paragraphs establishes that a more precise environmental liability report would be valued closer to negative one than would an imprecise report, regardless of the precision of the investors' prior beliefs. Holthausen and Verrecchia (1988) do not consider the possibility that the information is biased, or that investors have priors that information is biased. So, the following discussion is based on the fundamental insights of Holthausen and Verrecchia (1988) concerning the precision of reported information and the features of the situation being studied here.[21]

There are four possible cases to consider. First, suppose the investors' priors are imprecise in both the high standards and the low standards regimes, since environmental liabilities

[21] Conventional wisdom might suggest that managers could provide biased (for example, understated) environmental liability estimates. Consistent with Holthausen and Verrecchia (1988) and other theoretical work available when the present study was conducted, the prediction developed in this section relies on the assumption that bias has no effect. Recent work by Fisher and Verrecchia (1998) explains that this no-bias-effect assumption rests on the assumptions of rational expectations of report users and users' perfect knowledge of the preparer's objective function. Fisher and Verrecchia (1998) show that it may be rational for managers to provide biased information if users have some uncertainty about the preparer's objective function. This thesis reports the development and execution of this study in chronological order, so this

are subject to a great deal of uncertainty. In this case, a precise report would result in the liability being valued at negative one. If the report is imprecise, the liability could not be assessed from the report or the priors, and it would be valued at zero.

Second, suppose the priors are precise in the high regime and diffuse in the low regime. The environmental liability report will matter less in the high regime, but as long as the report is precise, the investors with precise priors will still value the liability at close to its theoretical value of negative one. In this case, though, they would be doing this on the basis of their priors rather than the report. If the report is very imprecise, the investors' valuation will be based on the priors and not strongly related to the imprecise report. Thus, even if investors' priors are more precise in the high regime than in the low, a valuation coefficient closer to negative one in the high regime would still be consistent with the report being more precise.

Third, if investors' priors are precise in both the high and low regimes, a similar conclusion results as for the previous cases. If the information is more precise in the high regime, the liability's valuation coefficient will be closer to negative one than it would have been in the low regime when the information was imprecise. Fourth, if investors' priors are less precise in the high regime than the low, the coefficient would still be closer to negative one if the information is more precise. In this case investors would rely on the report, not their priors. Thus, regardless of the precision of the investors' priors in the high and low regimes, if the liability information reported is more precise, the valuation

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new theoretical work is discussed more fully later in the thesis, where it is useful in interpreting the study's results, ex post.

coefficient can be expected to be closer to negative one. By similar arguments, if the report is imprecise, the valuation coefficient can be expected to be closer to zero.

These four cases illustrate the point that, with valuation models in the levels, the researcher can infer that the reported environmental liability is correlated with information already being used by investors, but inferences about whether the report provides new information given priors are not possible. Thus, the methodology permits only association tests of the information content of the reported environmental liability.

The above discussion leads to the following prediction. If higher financial reporting standards for environmental liabilities result in more precise environmental liability estimates, the valuation coefficient on a dollar of reported environmental liability is expected to be closer to zero when standards are low, and closer to negative one when standards are high. Thus, in the empirical study we would expect the contrast between the pre-period and the post-period valuation coefficients to be negative. This prediction leads to the following directional research hypothesis, in alternate form:

H_1: As one moves from a regime of low financial reporting standards for environmental liabilities to one of high financial reporting standards, the contrast in the valuation coefficient on a dollar of reported environmental liability will be negative.

The null hypothesis is, therefore:

H_0: As one moves from a regime of low financial reporting standards for environmental liabilities to one of high financial reporting standards, the contrast in the valuation coefficient on a dollar of reported environmental liability will be non-negative (zero or positive).

3.5 Chapter summary

This chapter has drawn on theoretical research to show links among financial reporting standards, estimation effort, the precision of reported information and market valuation. The increase in the financial reporting standards is expected to increase the manager's and auditor's effort to estimate environmental liabilities. This would increase the precision of the environmental liability information reported in audited financial statements, as indicated by the market's valuation of the liability. Theory and prior research have been drawn upon to generate the testable hypothesis that, as one moves from a regime of low financial reporting standards for environmental liabilities to one of high financial reporting standards, the change in the valuation coefficient on a dollar of reported environmental liability will be negative.

CHAPTER 4

RESEARCH DESIGN

4.1 Introduction

The theory outlined in the previous chapter provides the prediction that a regulatory intervention increasing financial reporting standards for environmental liability information will lead to more precise environmental liability reports. More precise environmental liability information can be expected to lead to more frequent environmental liability disclosures and accruals, as prior research has documented, but these changes could also be attributed to legal and societal changes other than the regulatory intervention of interest. The main inference in this study is that, if higher financial reporting standards resulted in a perfectly precise environmental liability estimate, its market valuation would be negative one. For example, an additional dollar of environmental liability would result in the market value of the shares being one dollar lower. In contrast, if the estimate were totally imprecise, its valuation would be expected to be zero. Viewing this in terms of a regression model, if reported environmental liability estimates become more precise, the valuation coefficient on one dollar of reported environmental liability would be expected to change from zero, for a noisy estimate, toward negative one, for a precise estimate. This chapter discusses how such a change in market valuation is more likely to be attributable to the change in financial reporting standards than to other factors.

This chapter develops the research design. This design uses a regression of share price levels on environmental liability book values, and other relevant financial statement variables, in a quasi-experimental setting. To isolate the economic consequences of the regulatory intervention, the design attempts to control for other possible reasons that the market valuation would change. A key challenge in accomplishing this in a quasi-experimental setting is to separate the effects of the 'treatment', new standards, from the effects of other causal forces. By using a replicated, interrupted time series as the research design, experimental control against potential omitted explanatory variables can be increased (Cook and Campbell 1979).

4.2 Experimental manipulation and potential outcomes

The main question of interest in this study is the impact, if any, that new financial reporting standards have had on the market's valuation of reported environmental liabilities, which the study uses as an indicator of investors' perceptions of the information's precision. In this study, the higher standards are expected to result in more effort to estimate environmental liabilities. This higher effort is expected to reduce the measurement uncertainty and increase the precision of environmental liability estimates.

Several outcomes of more precise environmental liability estimates may be expected given the existing accounting standards for environmental liabilities. Three such outcomes are: more frequent environmental liability accruals since reasonable estimation

can be achieved; more contingent liability and measurement uncertainty disclosure since more potential, if unestimable, environmental risks may be exposed; and more management discussion and analysis (MD&A) of financial aspects of environmental risks. While prior studies have documented that these increasing trends are occurring (for example, Buhr 1994; Gamble et al 1995; Stanny 1996; Li, Richardson and Thornton 1997), a study designed to attribute these increases to higher financial reporting standards would suffer internal validity problems. This is mainly because these observed increases may also be due to changes in other variables that cannot be observed or measured reliably in the study (for example, changes in social expectations, changes in environmental laws, and changes in operations and systems). On the other hand, a change in the valuation coefficient is less likely to be due to factors other than a change in the precision of the environmental liability measure. Thus, as discussed in chapter 3, a fourth potential outcome is provided by the theory of Holthausen and Verrecchia (1988) who show that an earnings announcement with more precision will be associated with a stronger share price response.

Adapting the Holthausen and Verrecchia (1988) theory to the case of environmental liabilities, one can form the prediction that, if the environmental liability estimate were perfectly precise, its market valuation would be negative one (for example, one more dollar of environmental liability would result in the market value of the shares being one dollar lower). In contrast, if the estimate were totally imprecise, its valuation would be expected to be zero. This expectation will be tested by studying the coefficient on the environmental liability in regressions of share price levels on the environmental liability

levels, and other relevant independent variables, for a cross-section of companies over time. [22]

As noted above, increasing environmental legislation, societal expectations and other omitted factors are likely to result in an increase in the frequency of environmental liability accruals and disclosures. However, these factors are less likely to result in an increase in the precision per dollar of environmental liability reported; the precision of the reported liability point estimate is more likely to be affected by the actions of the manager and auditor who produce the reported information. Thus, observing a valuation coefficient that is closer to negative one per dollar of environmental liability accrual after the new standards are issued is more likely to be due to increased financial reporting standards and estimation effort. Thus, this design increases our ability to assess the existence of a relation between standards and information precision beyond what is possible by studying only trends in the accruals and disclosures.

To summarize, the experimental manipulation is an increase in financial reporting standards that is expected to be associated with higher effort to estimate environmental liabilities. Precision of the environmental liability estimates is expected to be higher when financial reporting standards are higher.[23] This manipulation is accomplished by dividing the sample into pre-period and post-period groups at the point when the new standards would become effective. As discussed above, the change from pre-period to post-period will be 1995 for the Canadian sample and 1993 for the US sample.

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[22] This empirical model is based on the earnings response coefficient model and the Feltham and Ohlson (1995) valuation model. See Bernard (1995) and Johnson (1995). This model is set out in chapter 5.

The main outcome of interest is the behaviour, at higher and lower levels of standards, of the valuation coefficient on the booked environmental liability in a multiple linear regression of share price on the environmental liability and other financial statement variables. Changes in the valuation coefficient can be interpreted as an indication that investors perceive the precision of the reported environmental liability information to have changed. This study's hypothesis is that the change in the valuation coefficient between the pre-period and post-period will be negative.

4.3 Validity issues and experimental design

Evidence that would support the study's predictions can be obtained by using an interrupted time-series design, in which the valuation coefficient on the environmental liability would be measured before and after the standards change. This design would provide information about whether the valuation coefficient covaries with standards. If it were observed that valuation coefficients change when standards change, this would strengthen our ability to infer that the two factors are related. A threat to inference validity in this design is that an observed change in valuation coefficient may be due to other historical events occurring at the time of the intervention. Another threat is that an observed change is simply due to maturational changes over time in the characteristics of the sample companies or in the market participants.

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[23] As discussed above, this assumes that the underlying uncertainty of the estimates is not changing.

Ideally, to address such threats as those noted above, there would be a control group that did not receive the treatment of increased financial reporting standards and an experimental group of companies that did (Cook and Campbell 1979: 214). The valuation coefficient would be measured before and after treatment for both groups and the results compared to see if there are differences between groups. If the two groups were similar enough that they would be expected to be affected similarly by history or maturation factors, and the experimental group exhibited a change at the time of the intervention while the control did not, the probability that the observed change was related to the change in standards would be increased.

This ideal design would not be possible in a Canadian setting alone because all companies with publicly-available financial statements would have been subject to the same CICA regulatory intervention. While the US setting can't be used as a non-treatment control group because it experienced a similar regulatory intervention, it is still useful because the regulatory intervention occurred in the US at a different time (that is, 1995 in Canada and 1993 in the US). In this study, we would therefore look for evidence of a change in the valuation coefficient in the US about two years earlier than in Canada.

Observing a similar association between regulatory change and valuation coefficients in two settings at two different times can reduce the chance that the observed effect is due to some other history or maturation factor that would cause standards and valuation coefficients to covary even though they were not causally related themselves. This design, referred to as an interrupted time-series with replication (Cook and Campbell

1979: 223) would reduce the threats posed by history and maturation since it is less likely these would produce an observed effect at the same time as the intervention in both settings. In this design, when one group receives the treatment the other acts as a control against internal validity threats.[24] This design can also enhance external validity if a similar outcome can be observed in two different settings at two different points in time. This research design is shown in the diagram below.

Year	1991	1992		1993	1994		1995	1996
Canada	O_i	O_i		O_i	O_i	X_1	O_i	O_i
US	O_i	O_i	X_2	O_i	O_i		O_i	O_i

where:

$X_{1,2}$ is the treatment, increased standards, in each of the two countries,

O_i is the observed relation between share price level and environmental liability level for sample companies at each year end.

Construct validity can also be enhanced in the replicated, interrupted time series design. The treatment construct is a regulatory intervention in financial reporting standards that is expected to result in more precise estimates of environmental liabilities. Other omitted factors may affect how quickly new standards take effect, but such factors would likely be different in the two settings, so the chance that observed effects are related to such

[24] Two such internal validity threats reduced are history (events other than the treatment causing the observed effect) and maturation (subjects change due to internal maturation factors, not the treatment). Selection is still a threat, because subjects are not randomly assigned to groups. In particular, selection-history or selection-maturation interactions may be contributing to the observed effect. For example, the

other factors can be reduced if similar effects are observed in both settings coincident with the times of the interventions in the two settings (Cook and Campbell 1979: 223).

The sample selection method was designed to find as many companies as possible that reported environmental liabilities in the study years. This resulted in a pooled cross-sectional time-series sample in which the sample firms are heterogeneous from year to year. In this case there is a threat that any noted effect may be due the heterogeneous sample picking up the influence of omitted correlated variables on the price-to-book relationship, as noted by Beatty, Chamberlain and Magliolo (1995). As discussed in detail in Chapter 5, further experimental control is brought into the research design by identifying a sub-sample of companies that appear in every year of the time series (that is, a panel data sample). This panel sample allows each firm to act as its own control, thus reducing the threat posed by comparing heterogeneous samples.

In addition to the replicated time-series experimental design, further evidence that the financial reporting standards have an effect can be obtained by dividing the Canadian sample companies into two groups, one group that is only listed on Canadian stock markets and another group that is cross-listed on Canadian and US stock markets. The cross-listed group could be expected to change at the time of the US intervention while the Canada-only group would change at the time of the Canadian intervention, and potential between-country omitted variables would not be a factor. This comparison is studied as a further robustness check on the results of the replicated time series study.

Canadian companies may differ from the US and therefore be exposed to different history or maturation factors. These selection interactions cannot be addressed in this study, given the data available.

This robustness check also addresses a limitation that arises because the Canadian sample contains a mixture of firms that may be affected by the new standards at two different times, one group when the Canadian standards were issued and the other when the US standards were issued. If the cross-lister subsample changed at an earlier time it may be difficult to find a significant change in this mixed Canadian sample at the later time when the Canadian standards were introduced. This is because any notable change in the non-cross-listed subsample at the time when Canadian standards change may be diluted by the cross-listed subsample, which exhibited a change earlier.

The use of two settings can enhance the validity of the study, but it can also strain the ceteris paribus assumption underlying the research design. The threat that the regulatory changes are different in the two countries may be a limitation of the study. It is also possible that there are differences in investors between the two countries; it may be that one market is less efficient than the other. Since market efficiency is an important assumption underlying the valuation predictions, this is also a limitation of the study. [25]

4.4 Chapter Summary

This chapter has described the study's research design. The experimental manipulation, a change in financial reporting standards for environmental liabilities, is studied by using an interrupted time-series design. Since this manipulation occurred at different times in

[25] Note that the potential for market efficiency to differ across observations within each country's sample is reduced somewhat by only selecting sample companies from the same (and the largest) stock market for each country, that is, the TSE in Canada and the NYSE in the US. The relative efficiency of these two stock markets has not been studied here, however.

Canada and the US, the time series is replicated in these two settings to increase experimental control over possible omitted factors. The impact of the manipulation is measured by examining the behaviour of the valuation coefficient on reported environmental liabilities in a multiple linear regression of share price levels on environmental liability accruals and other relevant financial statement variables. Experimental validity issues and possible limitations of the research design were discussed.

CHAPTER 5

SAMPLE DATA AND EMPIRICAL MODEL

5.1 Introduction and overview

This chapter outlines the sampling method, the data collected and the econometric model used to study whether there is a change in the market valuation of accrued environmental liabilities associated with new financial reporting standards for environmental liabilities.

The chapter is organized as follows. Section 5.2.1 describes the sample selection process and data sources. In total, 1467 company-year observations have been collected, representing 767 Canadian and 700 US public companies' annual reports. Canadian and US samples were used to provide experimental control, because the changes in financial reporting standards occurred at different points in time in these two countries. This total sample contains a sub-sample of 468 observations that have complete panel properties, comprising 78 companies (37 Canadian and 41 US) for the six-year period 1991 to 1996. This sub-sample, referred to as the 'panel sample' throughout, is described in section 5.2.2. The assessment of the extent to which the panel sample is representative of the full sample is described in section 5.2.3.

Section 5.3 describes the main econometric model of the study and the process of selecting the model and estimation method. The econometric model uses the coefficient on the environmental liability variable in a multiple regression of market value on book

value and abnormal earnings (the Feltham and Ohlson (1995) valuation model) to assess the market's valuation. Next, the results of investigating data problems and econometric specification issues such as heteroskedasticity and serial correlation are described and descriptive statistics of the sample data are presented. The model selection process suggested that a pooled generalized least squares (GLS) estimation method on the panel sample provides a better specification than ordinary least squares (OLS). This conclusion is based on the observation that pooled GLS estimation resulted in more efficient and plausible coefficient estimates than OLS estimation for the study's cross-sectional time-series data. Based on these investigations, the rest of the analysis has been done using pooled GLS on the panel sample data.

5.2.1 Selection criteria and data collection

The sample selection involved seeking out as many company annual reports as possible that contain environmental liability accruals. The selection of sample companies included the following criteria for the Canadian (US) sample:

- it is a public company with shares listed on the Toronto Stock Exchange (New York Stock Exchange).
- its annual financial filings with the Ontario Security Commission (Securities and Exchange Commission) are available for 1996 or earlier years, including balance sheet, income statement, and financial statement notes on environmental liabilities.

- it has an accrued environmental liability amount reported in at least one year's financial statements.
- its primary standard industry classification code (SIC) is in the range 1000 to 3999; this range includes resource, manufacturing and processing industries.
- other information required is available for each year in which it reports an accrued environmental liability in its financial statements (for example, SIC and share prices)

These criteria were intended mainly to ensure that all the required information for the study would be readily available. The SIC criterion was used to limit the search to companies in industries that are more likely to have environmental liabilities to report.

For the Canadian sample, data were obtained from Ontario Security Commission (OSC) filings, primarily from the microfiche published by Micromedia Inc. and also from Disclosure Select and Lexis-Nexis (Cancorp library). The Lexis-Nexis data base includes annual reports for only a few Canadian companies, mostly those that are listed on US markets, but it is a comprehensive source for annual reports of US public companies. So, for the US sample, all the annual reports were obtained from Lexis-Nexis (SEC On-Line or NAARS libraries). In both the Canadian and the US data collection, the annual report was reviewed and extracts were obtained, including the financial statements and the portions of notes, MD&A or other discussion relating to environmental matters. Share prices were obtained from CRSP, NYSE reports and TSE reports.

For the Canadian sample, the search strategy started from a list of companies reporting environmental liability accruals in 1993 that were identified in the CICA's *Environmental*

Reporting in Canada: A Survey of 1993 Reports (CICA, 1994). For each company on this list, the annual reports for every available year from 1996 back were reviewed to identify years in which an environmental liability was reported.

For the US sample it was possible to do a key-word search in Lexis-Nexis, using a search string that selected annual reports with 'environment' near to 'liability' (or similar words). The current annual reports library was searched, and the list of companies obtained formed the starting point for searching the years prior to 1996. An additional key-word search of the 1991 NAARS library was done, with a forward search of other years, to maximize the sample of companies with panel properties over the period 1991 to 1996. The searches were based on 1996 and 1991 for efficiency in obtaining the largest possible sample with panel properties over the period 1991 to 1996. Additional searches based on other years were not done because this could only increase the sample of incomplete panel data.

Table 1 below shows the number of annual reports obtained by the search exercise. In total 1467 company-year observations were collected, made up of the annual reports of 767 Canadian and 700 US companies. The breakdown of annual reports for each fiscal year from 1996 to 1990, and for 1989 and earlier years is presented. These annual reports come from 364 different companies in total (177 Canadian and 187 US companies). On average, there are approximately 4.33 years of annual reports per Canadian company and 3.74 per US company.

Table 1

Annual Reports Obtained
Containing Accrued Environmental Liabilities

	Canadian	US	Total
Total annual reports (company-year observations)	767	700	1,467
1996 annual reports	107	174	281
1995 annual reports	129	118	247
1994 annual reports	140	107	247
1993 annual reports	150	94	244
1992 annual reports	109	64	173
1991 annual reports	68	55	123
1990 annual reports	23	44	67
1989 and earlier	41	44	85
Total companies	177	187	364
Average number of annual reports per company	4.33	3.74	4.03

A limitation of the Canadian data search is that it is based on the companies for which the CICA obtained 1993 annual reports. To investigate this issue, the author discussed the CICA data collection methodology with the CICA's Director of Research. He related that, while their sample was not randomly collected, neither was it systematically biased toward companies with any particular characteristics. The annual reports were mostly sent to the CICA as a part of each company's routine annual report mailing. Companies would not have known their annual reports were to be used for a study of environmental reporting, or any other particular purpose. Thus, selection bias does not appear to be likely. To mitigate this limitation further, the search was augmented by a search for any Canadian annual reports available in Lexis-Nexis. The sample is also limited by data that are missing from the microfiche collections. This may be random, but it is also possible that the documents of smaller companies are more likely to be missing. For example, smaller firms may lack the resources to comply with every filing requirement, and the OCS may be less likely to overlook missing filings of larger firms than smaller firms. Further, the sample includes only TSE-listed companies.

The limitations of the US search are as follows. The search will only find annual reports where the company's narrative fits the key-word search parameters. For example, if a company's annual report used many non-searched words in-between mentioning 'environment' and 'liability', or used very obscure wording to describe its environmental liability, it might not be detected. Using a very general search string and reading through all the text surrounding the selected search words should have mitigated this deficiency. The sample also will not include annual reports that are missing from the Lexis-Nexis

database for whatever reason, and by design will only include NYSE-listed companies with SICs of 1000-3999. Because the search was based on the 1991 and 1996 databases, it would not find firms that reported environmental liabilities in other years but not in these two years. Such firms would not have altered the results of this study, however, since the main analyses use a panel sub-sample that includes only firms with observations in all six years from 1991 to 1996.

5.2.2 The Panel sample

From the total 1467 observations, a sub-sample of companies with panel data properties for the period 1991 to 1996 was identified (that is, observations are available for every company in every one of the six years). This six-year period was chosen because it would provide at least two years before and two years after the point in time when the identified regulatory changes occurred for both the Canadian and the US settings. Of the 1467 observations, 468 were contained in complete panel data for 1991 to 1996 and 999 were not. The 468 panel sample observations represent 6 years for 78 companies, made up of 37 Canadian companies and 41 US companies. Incomplete panels occur because the company did not report an environmental liability in each of the six years, or it was first formed after 1991, or it was taken over before 1996, or the annual report document was missing from the databases searched.

Panel data are desirable because each company can be used as its own control from period to period. This can reduce the threat of selection bias and increase internal validity, as discussed in chapter 4. As further discussed below in section 5.3, panel data can be analyzed using pooled generalized least squares (GLS) estimation to make use of the information contained in the within-company observations. This can provide a more efficient estimation than OLS on pooled cross-sectional time-series data.

While somewhat small, the panel sample is a reasonable size for running a pooled GLS analysis, which is desirable given the greater efficiency of this technique compared to OLS. The panel sample was initially intended to be used to diagnose whether OLS would provide similar results to pooled GLS, thus implying that an analysis of the full sample of incomplete panels using OLS would be appropriate. Based on the results of this initial analysis, however, it appeared to be advantageous to use the pooled GLS technique on the panel sample rather than OLS on the full sample.

The reasons for choosing to use pooled GLS were as follows: OLS exhibited considerably more serial correlation in the residuals than pooled GLS; OLS did not provide reasonable estimates for some of the coefficients in the model; and OLS generally provided less significant estimates than pooled GLS. While there are these advantages to using pooled GLS estimation, a disadvantage is that the data must be in complete panels. Only a subset of the data obtained have this property. Basing the analysis on this panel-sample subset is appropriate only if it is reasonably representative

of the full sample; this assessment is described next in section 5.2.3. Based on the results of these investigations, the panel sample has been used for all the analyses that follow.

5.2.3 Representativeness of the panel sample

To assess how representative the panel sample is of the total population of firms obtained in the data collection exercise, the full sample was used to form a profile against which to compare the panel sub-sample. This comparison is based on industry membership and three financial profile variables: total assets, book value of shareholders' equity and return on equity. These variables are used to capture size and industry effects that prior research has shown to be important for addressing selection validity threats (for example, Collins and Salatka 1993). For the Canadian sample, the number of firms that are cross-listed on US stock markets was also studied.

Table 2 shows the breakdown of the samples by industry groups, comparing the panel sample to the profile sample for the US and Canadian data. Table 3 compares the distributions of the panel and profile samples for the three financial profile variables. To be comparable to the data and analyses that follow, the samples in tables 2 and 3 are shown after deleting influential and unusual observations that have been identified in section 5.3.2 below.[26] One company (six observations) has been deleted from the Canadian panel sample, and three companies (18 observations) from the US panel

[26] 'Unusual' observations are those for which the book value of shareholders' equity is negative, as further discussed in section 5.3.2.

sample, leaving a panel sample of 36 companies (216 observations) for Canada and 38 companies (228 observations) for the US. Correspondingly, the same company (6 observations) has been removed from the Canadian profile sample, and the same three companies (with their 24 observations) have been removed from the US profile sample, leaving a profile sample of 176 companies (761 observations) for Canada and 184 companies (676 observations) for the US.[27] A listing of all the sample companies is in Appendix 2.

For the industry membership comparisons, the differences between the profile and panel samples are minor for the Canadian data. For the US, the panel sample has somewhat more petroleum refiners and somewhat fewer manufacturers compared to the profile sample but overall the industry membership proportions are similar. For the financial variables comparison, both countries' panel samples include larger companies than the respective profile samples; this being more so for the Canadian data. For the Canadian data, the panel sample contains 11 out of 36 (32%) cross-listed companies, while the profile sample contains 49 out of 176 (28%). These proportions are reasonably similar.

Overall, the panel sample for each of the countries appears to be reasonably representative of its profile sample, except that the panel samples contain somewhat larger companies.

[27] The Canadian (US) profile sample contains a further 12 (23) unusual observations for companies that are not in the panel sample. These have not been omitted from the data presented in tables 2 and 3; doing so makes very little difference to the results presented in tables 2 and 3 and would not change the conclusion of the representativeness analysis.

Table 2

Panel Sample versus Profile Sample Companies
Industry Membership Comparison
Canadian and US Samples[a]

Part A: Canadian sample

Industry	PANEL #companies (% of total)	PROFILE #companies (% of total)
Mining	9 (25%)	43 (24%)
Oil and gas	20 (56%)	111 (63%)
Food,textile,wood, paper, printing	5 (14%)	12 (7%)
Petroleum refining	2 (5%)	2 (1%)
Plastics	0	1 (1%)
Metal refining	0	2 (1%)
Equipment manufacturing	0	5 (3%)
TOTALS	36(100%)	176(100%)

Note a
Certain influential and unusual observations have been omitted from the data shown here to be consistent with the analyses that follow (see chapter 5, section 5.3.2).

Table 2 (cont.)

Panel Sample versus Profile Sample Companies
Industry Membership Comparison
Canadian and US Samples[a]

Part B: US sample

Industry	PANEL #companies (% of total)	PROFILE #companies (% of total)
Mining	5 (13%)	20 (11%)
Oil and gas	0	10 (5%)
Food,textile,wood, paper, printing	0	10 (5%)
Chemicals	8 (21%)	31 (17%)
Petroleum refining	7 (18%)	15 (8%)
Plastics	4 (11%)	14 (8%)
Metal refining	7 (18%)	21 (12%)
Metal fabrication	2 (6%)	17 (9%)
Equipment manufacturing	5 (13%)	46 (25%)
TOTALS	38(100%)	184(100%)

Note a
Certain influential and unusual observations have been omitted from the data shown here to be consistent with the analyses that follow (see chapter 5, section 5.3.2).

Table 3
Panel Sample versus Profile Sample Companies
Financial Variables Comparison:
Descriptive Statistics for Total Assets, Book Value of Shareholders' Equity, and Return on Equity
Canadian and US Samples[a]

Part A: Canadian sample

	PANEL n=216	PROFILE n=761
Total assets [$millions]		
Mean	1,515	883
Minimum	4	2
Quartile 1	65	44
Median	302	140
Quartile 3	1,681	627
Maximum	13,532	16,038
Book value of shareholders' equity [$millions]		
Mean	746	433
Minimum	2	-33
Quartile 1	33	26
Median	154	84
Quartile 3	930	314
Maximum	6,790	7,451
Return on equity		
Mean	0%	14%
Minimum	-280%	-599%
Quartile 1	1%	-2%
Median	6%	5%
Quartile 3	10%	10%
Maximum	254%	8871%

Note a
Certain influential and unusual observations have been omitted from the data shown here to be consistent with the analyses that follow (see chapter 5, section 5.3.2).

Table 3 (cont.)
Panel Sample versus Profile Sample Companies
Financial Variables Comparison:
Descriptive Statistics for Total Assets, Book Value of Shareholders' Equity, and Return on Equity
Canadian and US Samples[a]

Part B: US sample

	PANEL n=228	PROFILE n=676
Total assets [$millions]		
Mean	6,548	5,746
Minimum	40	13
Quartile 1	618	415
Median	1,669	1,356
Quartile 3	7,475	5,456
Maximum	46,808	81,132
Book value of shareholders' equity [$millions]		
Mean	2,307	1,988
Minimum	17	-4,129
Quartile 1	269	164
Median	684	556
Quartile 3	2,475	1,652
Maximum	19,072	23,413
Return on equity		
Mean	3%	11%
Minimum	-586%	-872%
Quartile 1	4%	3%
Median	10%	10%
Quartile 3	15%	17%
Maximum	105%	3229%

Note a
Certain influential and unusual observations have been omitted from the data shown here to be consistent with the analyses that follow (see chapter 5, section 5.3.2).

5.3 Selection of econometric model and estimation method - overview

The discussion of the econometric model selection process is presented in this section. The model selection process involved assessing several specification issues simultaneously. These issues included multicollinear data, influential and unusual observations in the data, misspecification due to scale-related heteroskedasticity, and autoregression arising from using cross-sectional time-series data. The conclusion after examining these issues was to use pooled GLS on the panel sample, after removing influential and unusual observations, and to deflate the Canadian data by a scale factor to mitigate heteroskedasticity.

This section is organized as follows. Section 5.3.1 describes the main econometric model of the thesis. In section 5.3.2, data problems due to multicollinearity and influential or unusual observations are addressed and descriptive statistics for the panel sample, after removing influential and unusual observations are provided. In section 5.3.3 the econometric specification of the model relating to scale effects, cross-sectional dependencies and autoregression is examined. The robustness of the estimation using OLS as compared to pooled GLS is studied, paying particular attention to the estimation of the other coefficients in the model besides the environmental liability coefficient. Potential effects of heteroskedasticity due to scale differences are also studied. Section 5.3.4 summarizes the model selection exercise.

5.3.1 Econometric model

To develop the econometric model, the study uses the basic valuation framework presented in Ohlson (1995) and Feltham and Ohlson (1995). In this framework, firm value is expressed as a function of book value plus discounted future abnormal earnings, without reference to expected dividends. The only assumption required in this valuation model is the clean surplus relation in which all changes in book value are reported either as income or dividends. The basic Ohlson (1995) valuation model is:

$$MV_{it} = a_0 + a_1 BV_{it} + a_2 AE_{it} + e_{it}$$

The econometric model uses the firm's balance sheet and abnormal earnings to represent the information released to market participants. To isolate the valuation on the environmental liability for the purpose of this study, the accrued environmental liability is disaggregated from the book value to give model [1], the main model of the thesis:

$$[1] \quad MV_{it} = b_0 + b_1 BVX_{it} + b_2 EL_{it} + b_3 AE_{it} + e_{it}$$

where, for company i,

MV_{it} = Market value of equity three months after year end t

BVX_{it} = Book value of equity excluding the accrued environmental liability at year-end t

$= BV_{it} + EL_{it}$

EL_{it} = Accrued environmental liability at year-end t

AE_{it} = Abnormal earnings for the year t

= Net $Income_{it}$ - (13% * $BookValue_{i,t-1}$)[28]

e_{it} = Residuals, assumed to be independently, identically distributed (i.i.d.)[29]

To compute AE, Bernard (1995) used 13% in his empirical study of the Feltham and Ohlson (1995) model. Other researchers have found the specification to be insensitive to rates ranging from 9% to 13%, or to whether one year's AE or several are used to proxy for the stream of future AE (for example, Dechow, Hutton and Sloan 1997; Tse and Yaansah 1997). Since AE is not the focus of this study, the above measure is used as a reasonable approximation of the company's expected future abnormal earnings.[30]

5.3.2 Data problems: Multicollinearity, influential and unusual observations

The panel data were examined for highly influential observations using the DFFITS statistic described in Belsley, Kuh and Welsch (1980). This analysis indicated that most of the Exxon observations were highly influential. This may be because Exxon's MV and

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[28] To specify how expectations about future abnormal earnings are formed, Bernard (1995) and Johnson (1995) suggest a model in which abnormal earnings follow a simple autoregressive process, such that:
AE_{it} = Abnormal earnings = Net $income_{it}$ - r_{it}*Book value of $equity_{i,t-1}$
r_{it} = $R_f + \beta(R_m - R_f)$ where equity beta (β) is derived from a daily market model regression of firm returns (R_f) on market returns (R_m).
Prior research has indicated that simpler definitions of AE can be used, and will lead to similar results to the AE measure shown above (for example, Tse and Yaansah 1997). This study uses a simpler definition, consistent with this prior research.

[29] It should be noted that, in addition to i.i.d. error terms, the model assumes that the parameters are constant across both cross-sectional and time-series units. These are strong, restrictive assumptions that are likely to be violated by the data, and thus various tests have been used to assess these model specification concerns.

BVX balances were twice as large as the next largest observations. To retain the panel properties, all six Exxon observations were removed from the panel sample, representing approximately 2% of the US observations. This approach is similar to that used by Dechow, Hutton and Sloan (1997).

The panel data also included three companies (one Canadian and two US) that had negative book values of equity in one or more periods. The model [1] levels specification may not be well defined when BV is negative since MV will never be negative. Consistent with other studies of level specifications (for example, Barth 1994, Dechow, Hutton and Sloan 1997) the observations for the three firms with negative book values were omitted.[31]

In total, one Canadian and three US company panels were removed, leaving a panel sample of 216 Canadian observations (36 companies times six years) and 228 US observations (38 companies times six years). Tables 4 and 5 provide descriptive statistics of the main variables for the panel sample after influential and negative book value observations have been removed. The tables include information for both raw variables and variables after deflation by a scale factor (total assets) since both are considered in the analysis that follows.

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[30] Sensitivity analyses for this study using rates ranging from 7% to 16%, and using net income instead of AE, are described in chapter 6. These analyses indicate the results are not sensitive to the AE measure.

[31] These prior studies also omitted observations with negative AE, but in this study many of the sample companies suffered losses, especially in 1992 and 1993, so too much data would be lost if these were excluded from the analysis. Removing negative AE observations from the panel sample would leave a total of 162 incomplete panel observations for the Canadian and US samples combined.

Table 4 shows the distributions of the four main variables, MV, BVX, EL and AE and the scale factor, TA. The table shows that the means are several times larger than the medians for all four of the raw variables. This indicates that the distributions are skewed, with smaller values being more numerous. This is less pronounced for the scaled variables.

Table 5 reports the correlation matrices for the raw variables in Part A, and for the deflated variables in Part B. For both Canadian and US samples, the correlations are relatively high (>0.80) for the raw measures of BV and EL, BV and TA and TA and EL. The correlations between deflated independent variables are all less than 0.40. For the Canadian variables the correlations between AE and EL and AE and BVX are both negative. This is probably because AE often has a negative value. For example, the first quartile of the AE distribution for the raw Canadian variables is -$3,333,000.

In view of some high correlations between raw independent variables, the potential for multicollinearity to be affecting the results was considered. The extent to which multicollinear data are harming regression estimates may be indicated by condition indices, with indices of 30 to 100 indicating strong dependencies in the data (Belsley, Kuh and Welsch 1980). Computation of condition indices for these variables resulted in no condition index greater than 19 for the Canadian and the US data, leading to the conclusion that multicollinearity problems are not severe.[32]

[32] These condition indices are for the deflated Canadian data and the raw US data since these are used in the subsequent analyses of the thesis. Condition indices indicate multicollinearity may be a problem for the raw Canadian data, however raw Canadian data are not used for the subsequent analyses. This is because, based on the model specification investigation below in section 5.3.3, data problems in the Canadian sample appear to be lessened by using deflated data.

Table 4
Descriptive Statistics
Distributions of the Variables: Raw and Deflated
Canadian and US Panel Samples[a]

Variables [$millions]	Canadian Sample (n=216)		US Sample (n=228)	
	RAW	DEFLATED	RAW	DEFLATED
MV, Market value of equity				
Mean	1,391	1.29	5,674	0.84
Minimum	2	0.17	22	0.16
Quartile 1	66	0.65	484	0.53
Median	324	0.95	1,460	0.76
Quartile 3	1,293	1.50	5688	1.05
Maximum	14,870	8.75	59,834	2.66
Standard deviation	2,481	1.11	10,504	0.46
BVX, Book value of equity excluding environmental liability				
Mean	780	0.57	2,536	0.44
Minimum	2	0.11	23	0.02
Quartile 1	34	0.47	272	0.34
Median	160	0.58	721	0.43
Quartile 3	955	0.68	2,728	0.50
Maximum	7,110	0.97	20,396	0.92
Standard deviation	1,361	0.17	4,365	0.15
EL, Environmental liability				
Mean	34	0.02	229	0.03
Minimum	<1	0.00	0.4	0.00
Quartile 1	1	0.01	14	0.01
Median	5	0.01	39	0.03
Quartile 3	30	0.03	197	0.04
Maximum	490	0.18	2,934	0.20
Standard deviation	80	0.02	430	0.02

Table 4 (cont.)
Descriptive Statistics
Distributions of the Variables: Raw and Deflated[a]
Canadian and US Panel Samples[a]

Variables [$millions]	Canadian Sample (n=216)		US Sample (n=228)	
	RAW	DEFLATED	RAW	DEFLATED
AE, Abnormal earnings				
Mean	-51	-0.06	-27	-0.02
Minimum	-937	-1.06	-1,201	-0.53
Quartile 1	-3	-0.01	1	0.00
Median	3	0.02	34	0.03
Quartile 3	19	0.04	144	0.05
Maximum	279	0.29	2,509	0.13
Standard deviation	145	0.1581	338	0.67
TA, Total assets				
Mean	1,515	n/a	6,548	n/a
Minimum	4	n/a	40	n/a
Quartile 1	63	n/a	618	n/a
Median	302	n/a	1,669	n/a
Quartile 3	1,681	n/a	7,475	n/a
Maximum	13,532	n/a	46,808	n/a
Standard deviation	2,661	n/a	10,505	n/a

Note a
Influential and negative book value observations omitted.
Total assets is the deflation factor.

Table 5
Descriptive Statistics
Correlation Matrices of the Variables: Raw and Deflated
Canadian and US Panel Samples[a]

Part A: Canadian sample (n=216)

Raw Variables

	MV	BVX	EL	AE	TA
MV	1.0000				
BVX	0.8456	1.0000			
EL	0.7069	0.8706	1.0000		
AE	-0.3256	-0.5696	-0.5863	1.0000	
TA	0.7870	0.9779	0.8441	-0.5746	1.0000
	MV	BVX	EL	AE	TA

Deflated Variables

	MV/TA	BVX/TA	EL/TA	AE/TA
MV/TA	1.0000			
BVX/TA	0.4491	1.0000		
EL/TA	-0.1130	0.0674	1.0000	
AE/TA	0.1433	-0.1013	-0.1375	1.0000
	MV/TA	BVX/TA	EL/TA	AE/TA

Note a Influential and negative book value observations omitted.
Total assets is the deflation factor.

Table 5 (cont.)
Descriptive Statistics
Correlation Matrices of the Variables: Raw and Deflated
Canadian and US Panel Samples[a]

Part B: US sample (n=228)

Raw variables

	MV	BVX	EL	AE	TA
MV	1.0000				
BVX	0.9179	1.0000			
EL	0.7702	0.8618	1.0000		
AE	0.2427	0.0271	-0.0191	1.0000	
TA	0.9439	0.9751	0.8274	0.0885	1.0000
	MV	BVX	EL	AE	TA

Deflated Variables

	MV/TA	BVX/TA	EL/TA	AE/TA
MV/TA	1.0000			
BVX/TA	0.4041	1.0000		
EL/TA	0.1169	0.3936	1.0000	
AE/TA	0.1099	-0.2041	-0.3277	1.0000
	MV/TA	BVX/TA	EL/TA	AE/TA

Note a Influential and negative book value observations omitted.
Total assets is the deflation factor.

5.3.3 Model specification: Scale effects and estimation method

The following analyses assess econometric estimation methods and scaling factors simultaneously to determine the optimal econometric approach for the study. The assessment is intended to find the model that is least subject to misspecification problems and has reasonable statistical power. Optimizing the specification is an important consideration in this study because the EL values are small relative to the other variables in the model, and the impact of the changes in standards on the valuation of EL may be subtle.

Scale differences in cross-sectional market values can produce misspecification due to heteroskedasticity. Intuitively, as described in Barth and Kallapur (1996), the observable values of variables of interest may be affected by the unobservable scale factor, but a researcher is interested in the relation between the 'true' variables after controlling for scale differences. The researcher's challenge is to purge the scale factor's effect from the observed variables without purging the effect of the true independent variable.

Barth and Kallapur (1996) suggest that heteroskedasticity can be detected by comparing the standard OLS t-statistic to the White heteroskedasticity consistent t-statistic. If the White t-statistic is lower then this may indicate heteroskedasticity is present.[33] Preliminary analyses for this study indicated a large drop in significance when the White

[33] The White t-statistics may have poor properties in finite samples (e.g. less than 400 observations). The MacKinnon-White jackknife version of the heteroskedasticity consistent covariance matrix estimators may be more reliable in finite samples such as those in this study. In view of this, the analysis was redone using the MacKinnon-White approach, as described in White (1993). None of the conclusions would be different because there is very little difference in the significance levels of the estimates obtained under these two approaches.

t-statistic was used for the Canadian sample. For the US sample the White t-statistic was also less significant but the decrease was smaller than for the Canadian data. In view of this result, various methods of addressing potential scale-related heteroskedasticity in the data were undertaken.

Proxies for the scale factor that have been used in prior research include total assets, number of shares outstanding, book value of equity, net income, or sales (for example, Demers 1997, Johnson 1995, Sougiannis 1994, Amir, Harris and Venuti 1993). Given the data and the variables used in this study, total assets and number of shares outstanding were potential scale factors. Preliminary analysis comparing these two scale factors indicated that number of outstanding shares produced implausible coefficient estimates, and consequently year-end total assets balance was used as a scale factor in subsequent specification analyses.

In most of the prior studies, the scale factor is used as a deflator of the raw variable measures. Barth and Kallapur (1996) suggest that including the scale factor as an independent variable may be superior to deflation, for certain forms of heteroskedasticity. In consideration of this, the following three alternate specifications of the main model [1] using total assets as a scale factor were examined:

1) 'Raw' is model [1] as above,
2) 'Raw plus total assets as an independent variable' is model [1] above with the scale factor used as a right-hand-side variable, and

3) 'Raw deflated by total assets' is model [1] with all variables divided by the scale factor.

These three models have been estimated by two different estimation methods. The first method is OLS (with White t-statistics) on the pooled cross-sectional time-series data. The second method is a pooled GLS estimation program.[34] In a cross-sectional time-series sample, the OLS assumption that all the observations are independent can lead to misspecification due to serial correlation of the error terms for observations from the same company. Intuitively, autoregressive residuals result in inefficient OLS estimators because the dependence among the residuals reduces the effective number of independent pieces of information in the sample. (Kmenta 1971: 274-275).

The pooled GLS technique follows the method described by Kmenta (as described in White (1993)). This estimation technique assumes cross-sectional heteroskedasticity[35] and time-wise autoregression. The Kmenta method provides a better specification than OLS, by using the within-company correlation coefficients as estimates of the autoregressive parameters, ρ_i, for each cross-sectional unit, with the estimate of ρ_i confined to the interval [-1, +1]. The estimated ρ_i are then used to transform the observations and obtain more efficient estimators.

[34] This study uses the pooled GLS routine that is pre-programmed in the Shazam statistical program (the 'POOL' routine, as described in White (1993)). The pooled GLS technique requires complete panel data, so only the panel sample could be used. The full sample does not have panel properties, so it would need to be analyzed with OLS. Advanced econometric techniques that address serial correlation in incomplete panel data have been described in theory (e.g. Hsaio 1993; Greene 1997) but developing a program to execute these is left to future research.

[35] Cross-sectional independence is assumed in this estimation technique.

Comparative results for these analyses for the Canadian and US samples are in table 6. Regarding the choice between the OLS and the pooled GLS estimation methods, table 6 shows that the pooled GLS estimates are as, or more, significant than OLS estimates for all the model coefficients. This is the case for both the Canadian and the US samples. This is consistent with the pooled GLS estimators being more efficient.

To assess whether there are scale-related problems in the data, the coefficient estimates were considered in light of the expected coefficient values indicated by the Feltham-Ohlson valuation framework. This theoretical framework indicates that a precise measure of BV would have a coefficient of one, a precise liability would have a coefficient of negative one, and AE would have a positive coefficient of indeterminate magnitude[36].

For the US estimates shown in table 6 - part B, the 'Raw' specification produced reasonable coefficients on all the coefficients, so that scale differences do not appear to be a factor in the US sample. For the Canadian results, shown in table 6 - part A, deflating by a scale factor appears to provide the most plausible estimates of the three models. This has been determined by comparing the pooled GLS results, as these have been shown to be more efficient than the OLS estimates. For the 'Raw' model the coefficient estimate on the environmental liability is marginally significant (p=.1659) but positive, opposite to the theoretical expectation. This estimate is implausible because it implies the market is valuing a liability as though it were an asset, and may therefore indicate misspecification. In contrast, all the estimates from the deflated model correspond more closely to the

[36] Prior research has found AE coefficients ranging from 3 to 6, approximately (for example, Dechow, Hutton and Sloan 1997; Tse and Yaansah 1997)

theoretical expectations; this may indicate a better specification. Thus, scale-related heteroskedasticity may be a problem in the Canadian data, so the study has used the deflated variables to mitigate this.

A possible reason that the Canadian sample would have scale-related heteroskedasticity and US sample would not is that the EL variable is less material in the Canadian companies. For example, the median of EL is about 5.3% of the median of BVX for the US sample, but only 2.9% in the Canadian sample. Since all the study's analyses are done on the Canadian and US samples separately and no direct comparisons of the two samples are made, the Canadian data have been deflated to mitigate heteroskedasticity and the US data have been left raw.

Further, a visual inspection of residual plots for the OLS and pooled GLS estimations revealed that the OLS residuals displayed a notable serial correlation pattern, while the pooled GLS residuals displayed a more random pattern for both the Canadian and the US samples. This is also consistent with pooled GLS being a more efficient estimation method than OLS.

Table 6
OLS versus Pooled GLS Estimations and Comparison of Scaling Approaches[a]
Canadian and US Panel Samples

Part A: Canadian sample (n=216)

	OLS estimate	p-value	Pooled GLS estimate	p-value
'Raw'				
BVX	1.8343	.0000	1.4410	.0000
EL	-1.1310	.6653	2.1186	.1659
AE	3.8712	.0072	1.2227	.0001
CONSTANT	197570	.0001	127310	.0000
R^2	0.7514		0.8096	
'Raw plus total assets as an independent variable'				
BVX	3.3672	.0005	1.5847	.0000
EL	-2.2214	.4895	2.2284	.2105
AE	3.4144	.0430	1.0607	.0006
TA	-0.7870	.0597	-0.0977	.2703
CONSTANT	207940	.0001	106710	.0000
R^2	0.7819		0.7695	
'Raw deflated by total assets'				
BVX	3.0529	.0000	**2.4492**	**.0000**
EL	-5.8492	.0159	**-3.0419**	**.0041**
AE	1.2286	.0037	**0.8369**	**.0001**
CONSTANT	-0.2603	.2941	**-0.0584**	**.6341**
R^2	0.2520		**0.4245**	

Model:

[1] $MV_{it} = b_0 + b_1BVX_{it} + b_2EL_{it} + b_3AE_{it} + e_{it}$

where, for company i,

MV_{it} = Market value of equity three months after year end t

BVX_{it} = Book value of equity excluding the accrued environmental liability at year end t

EL_{it} = Accrued environmental liability at year end t

AE_{it} = Abnormal earnings for the year t

= Net $Income_{it}$ -(13%*$BookValue_{i,t-1}$)

TA_{it} = Total assets at year end t

e_{it} = Residuals, assumed to be independently,identically distributed

Note a

p values for OLS estimates are based on White t-statistics.

R^2 for pooled GLS estimates are goodness-of-fit measures computed by the Buse method (White 1993).

Influential and negative book value observations omitted.

The results of the model selected for the subsequent analyses are shown above in boldface.

Table 6 (cont.)
OLS versus Pooled GLS Estimations and Comparison of Scaling Approaches[a]
Canadian and US Panel Samples

Part B: US sample (n=228)

	OLS estimate	p-value	Pooled GLS estimate	p-value
'Raw'				
BVX	2.2883	.0000	**2.3599**	**.0000**
EL	-1.0329	.6663	**-1.5668**	**.0558**
AE	6.7228	.0035	**2.4140**	**.0000**
CONSTANT	289020	.1554	**89526**	**.0652**
R^2	0.8905		**0.8814**	
'Raw plus total assets as an independent variable'				
BVX	0.4049	.3235	0.5206	.0114
EL	-0.3195	.8835	-0.6960	.4607
AE	5.2632	.0007	2.5021	.0000
TA	0.7767	.0000	0.7202	.0000
CONSTANT	-220150	.1733	-174750	.0014
R^2	0.9176		0.8546	
'Raw deflated by total assets'				
BVX	1.2001	.0000	0.8164	.0000
EL	0.1561	.8727	0.9319	.0497
AE	1.2336	.0309	0.5429	.0020
CONSTANT	0.3320	.0000	0.4227	.0000
R^2	0.2020		0.2597	

Model:

[1] $MV_{it} = b_0 + b_1BVX_{it} + b_2EL_{it} + b_3AE_{it} + e_{it}$

where, for company i,

MV_{it} = Market value of equity three months after year end t

BVX_{it} = Book value of equity excluding the accrued environmental liability at year end t

EL_{it} = Accrued environmental liability at year end t

AE_{it} = Abnormal earnings for the year t

= Net $Income_{it}$ -(13%*$BookValue_{i,t-1}$)

TA_{it} = Total assets at year end t

e_{it} = Residuals, assumed to be independently,identically distributed

Note a

p values for OLS estimates are based on White t-statistics.

R^2 for pooled GLS estimates are goodness-of-fit measures computed by the Buse method (White 1993).

Influential and negative book value observations omitted.

The results of the model selected for the subsequent analyses are shown above in boldface.

5.3.4 Conclusion of model selection

The foregoing exercise leads to the conclusion that pooled GLS on the panel samples, with the Canadian data deflated by a scale factor, is the best estimation technique to use for this study. As discussed in section 5.2.2, the panel sample is reasonably representative of the full sample of companies that report accrued environmental liabilities, and so the results of analyzing this subsample may be generalizable to the full sample.

In view of the above discussion and analysis, the econometric analysis that follows uses pooled GLS on the panel sample, after omitting influential and negative-book-value observations. The Canadian data are deflated by a scale factor, total assets.

5.4 Chapter summary

This chapter has presented the sample selection process and data sources. The analysis leading to the choice to use the panel sample was described. The selection of the econometric model and estimation by the pooled generalized least squares (GLS) method was discussed. Based on these investigations, the remainder of the analysis uses pooled GLS on the panel sample data.

CHAPTER 6

EMPIRICAL ANALYSIS AND DISCUSSION

6.1 Introduction

Chapter 6 presents the study's empirical analyses and discusses the results. Section 6.2.1 presents an analysis of the change in the environmental liability coefficient at the time when the financial reporting regulation changes are expected to have become effective. This analysis indicates that there is a significant positive change in the environmental liability coefficient at the identified time for the US companies (1993), while the change at the identified time for the Canadian companies (1995) is not significant. Further analyses of the general trends in the environmental liability coefficient over time are then described in sections 6.2.2 and 6.2.3. The results of these trend analyses are also consistent with there being a positive change in the environmental liability coefficient over the study period. All the analyses provide environmental liability coefficient estimates that are negative in every period. These results provide evidence that the environmental liability coefficient becomes less negative over the study period, contrary to the research hypothesis.

A further robustness check of the Canadian results indicates that a significant positive change in the coefficient does occur at 1993, the identified time of the US change. Additional robustness checks indicate that these results are not sensitive to outlier data or alternate variable measures. The robustness checks are described in section 6.2.4. Section

6.3 discusses the results and offers a possible interpretation. Section 6.4 summarizes the chapter.

6.2 Impact of change in financial reporting standards – overview of analyses

This study has identified changes in financial reporting standards for environmental liabilities that would be expected to lead to changes in the market's valuation of these amounts. It is hypothesized that the valuation coefficient will change in a negative direction, from zero towards negative one, after the new standards come into effect. To study the impact of the new standards, the panel data were examined for a change in the environmental liability valuation coefficient between the period before the new financial reporting standards ('pre-period') and the period after ('post-period'). As described in chapter 2, the new regulations were in place from 1995 on in Canada, and from 1993 on in the US. Two additional analyses of the trend in the EL coefficient were performed. One trend analysis estimates year-by-year EL coefficients, and the other estimates the trending and non-trending components of the EL coefficient. To address the fact that the Canadian panel sample includes some companies that are also cross-listed on US stock markets, a further analysis of the Canadian data was undertaken using the same change point as the US, 1993. The approaches used in most of the analyses are an adaptation of the analysis of covariance approach used in Collins and Salatka (1993) in which changes in coefficient estimates, or 'contrasts', are examined. In these analyses the intercept and the coefficients of BVX and AE are assumed to be stable over the period.

6.2.1 Pre-period to post-period contrast analysis

The main analysis of the thesis examines the pre-post contrast in the environmental liability coefficient, using the times at which the new financial reporting standards came into force to divide the data into pre-period and post-period observations. For this analysis, the following periods are defined:

Canada- pre-period is 1991 - 1994

- post-period is 1995 - 1996

US - pre-period is 1991 - 1992

- post-period is 1993 - 1996

The following approach was used to estimate the coefficient change:

Let D_{it} = 1 if observation is in the post-period

0 if observation is in the pre-period

To estimate the pre-period coefficient and the pre-post contrast, the main model [1] was adjusted to allow the EL coefficient, b_2, to vary over the two periods, giving model [2] as follows:

$$[2] \quad MV_{it} = b_0 + b_1 BVX_{it} + b_{2PRE} EL_{it} + (b_{2POST} - b_{2PRE})(EL_{it} * D_{it}) + b_3 AE_{it} + e_{it}$$

Table 7 shows the model [2] estimates including the pre-period EL coefficient and its pre-period to post-period change. Part A(B) reports the Canadian(US) results. The US data indicate a significant change to a less negative coefficient. The pre-period coefficient is

–4.48 (p=.0003) and the change from the pre-period to the post-period is 2.22 (p=.0073). For the Canadian sample, the pre-period EL coefficient is –3.33 (p=.0023). The pre-post contrast estimate from the Canadian data at the assumed break point is 1.43, but this is not statistically significant (p=.2850). These results do not support the study's hypothesis that the contrast will be negative. Thus, the null hypothesis that the contrast is non-negative (zero or positive) cannot be rejected.

Table 7
Pooled GLS Estimation
EL Coefficient Estimates for Pre-period versus Post-period and Pre-post Contrast [a]
Canadian and US Panel Samples

Part A: Canadian sample (n=216)

Variable	Pre = 1991-4 Post = 1995-6 Coefficient estimate	Standard deviation	t-ratio 211 df	p-value
BVX	2.3669	0.2165	10.9330	.0000
EL - pre-period	-3.3340	1.0820	-3.0813	.0023
EL - pre-post contrast	*1.4314*	*1.3354*	*1.0719*	*.2850*
AE	0.8037	0.2129	3.7750	.0002
Constant	-0.0248	0.1247	-0.1991	.8424
R^2	.4175			

Model:

[2] $MV_{it} = b_0 + b_1BVX_{it} + b_{2PRE}EL_{it} + (b_{2POST} - b_{2PRE})(EL_{it} * D_{it}) + b_3AE_{it} + e_{it}$

where, for company i,

MV_{it} = Market value of equity three months after year end t
BVX_{it} = Book value of equity excluding the accrued environmental liability at year end t
EL_{it} = Accrued environmental liability at year end t
AE_{it} = Abnormal earnings for the year t
= Net $Income_{it}$ -(13%*$BookValue_{i,t-1}$)
D_{it} = 1 if observation is in the post-period
0 if observation is in the pre-period
e_{it} = Residuals, assumed to be independently,identically distributed

Note a
R^2 for pooled GLS estimates are goodness-of-fit measures computed by the Buse method (White 1993).
Influential and negative book value observations omitted.
Canadian data are deflated by a scale factor, total assets.

Table 7 (cont.)
Pooled GLS Estimation
EL Coefficient Estimates for Pre-period versus Post-period and Pre-post Contrast [a]
Canadian and US Panel Samples

Part B: US sample (n=228)

Variable	Pre = 1991-2 Post = 1993-6 Coefficient estimate:	Standard deviation	t-value 223 df	p-value
BVX	2.4821	0.1066	23.2860	.0000
EL - pre-period	-4.4838	1.2060	-3.7179	.0003
EL - pre-post contrast	*2.2262*	*0.8222*	*2.7076*	*.0073*
AE	2.1220	0.3607	5.8833	.0000
Constant	82588.	45948	1.7974	.0736
R^2	.8609			

Model:

[2] $MV_{it} = b_0 + b_1 BVX_{it} + b_{2PRE} EL_{it} + (b_{2POST} - b_{2PRE})(EL_{it} * D_{it}) + b_3 AE_{it} + e_{it}$

where, for company i,

MV_{it} = Market value of equity three months after year end t
BVX_{it} = Book value of equity excluding the accrued environmental liability at year end t
EL_{it} = Accrued environmental liability at year end t
AE_{it} = Abnormal earnings for the year t
= Net $Income_{it}$ -(13%*$BookValue_{i,t-1}$)
D_{it} = 1 if observation is in the post-period
0 if observation is in the pre-period
e_{it} = Residuals, assumed to be independently,identically distributed

Note a
R^2 for pooled GLS estimates are goodness-of-fit measures computed by the Buse method (White 1993).
Influential and negative book value observations omitted.
US data are undeflated.

To examine the significance of the post-period coefficient, the Kmenta approach, as described in Collins and Salatka (1993: 135) was used. The following restriction on model [2] was tested:

$b_{2POST} = b_{2PRE} + (b_{2POST} - b_{2PRE}) = 0$.

The restriction was tested by computing the following F statistic:

$$F_{(r,\, n-k)} = \frac{(SSE_R - SSE_U) / r}{SSE_U / (n - k)},$$

where SSE_R is the sum of squared errors from the restricted regression, SSE_U is the sum of squared errors from the unrestricted regression, r is the number of restrictions, n is the number of observations and k is the number of parameters in the unrestricted model. For both countries there is one restriction and there are five unrestricted parameters. For Canada (US) there are 216(228) observations. The F-value for the Canadian sample is 218.33, leading to a rejection of the null restriction (p-value < .01). For the US sample the F value is 225.96, also leading to a rejection of the restriction (p-value < .01).

As an alternative test to the F-test above, the post-period coefficient itself and its significance were estimated by using model [3] below:

[3] $$MV_{it} = b_0 + b_1 BVX_{it} + b_{2POST} EL_{it} + (b_{2PRE} - b_{2POST})(EL_{it} * D'_{it}) + b_3 AE_{it} + e_{it}$$

where,

D'_{it} = 1 if observation is in the pre-period

0 if observation is in the post-period

and all the other variables are as defined above.

Estimating model [3] provides a post-period coefficient of -1.9026 (p=.2139, not significant) for the Canadian sample and -2.2576 (p=.0161) for the US sample. These inferences are consistent with the F-tests for the US sample, implying the US post-period coefficient is significantly different from zero. For the Canadian sample, the model [3] regression indicates that b_{2POST} is not significantly different from zero, while the F statistic on model [2] indicates b_{2POST}, defined to equal $[b_{2PRE} + (b_{2POST} - b_{2PRE})]$, is not zero.[37] These opposite inferences may arise in the Canadian sample because the model [3] estimate of the post-period EL coefficient is only marginally insignificant. To sum up, it can be inferred from these tests that the post-period EL coefficient is significantly different from zero for the US sample, but for the Canadian sample the results are less conclusive.

6.2.2 Year-by-year trend analysis

As a further analysis of the behaviour of the EL coefficient over time, the coefficients in each year of the six-year period were examined. Table 8 reports the BVX and AE coefficients for the full period and the year-by-year EL coefficients. The regressions to

[37] It is worthwhile noting that in later robustness checks in section 6.2.4, where the transition year for the Canadian data is re-defined to occur at 1993, the post-period EL coefficient on the Canadian sample is significantly different from zero under either the t-test or the F-test.

produce these coefficient estimates are an expansion of the Collins and Salatka (1993) approach, as follows:

$$[4]\quad MV_{it} = c_0 + c_1BVX_{it} + c_2EL_{it} + c_3AE_{it} + c_4(EL*Y92)_{it} + c_5(EL*Y93)_{it} + c_6(EL*Y94)_{it} + c_7(EL*Y95)_{it} + c_8(EL*Y96)_{it} + e_{it}$$

where, in addition to the variables defined above:

Y9T = 1 if year is 199T, T= 2,3,4,5,6 and

0 otherwise

Model [4] allows the EL coefficient to vary from year to year. The relevant contrasts between the 1991 EL slope coefficient, c_2 , and the other years' EL coefficients are the c_j values (j = 4,5,6,7,8), giving the following year-by-year slope coefficients:

Year-by year EL slope coefficients					
1991	1992	1993	1994	1995	1996
c_2	$c_2 + c_4$	$c_2 + c_5$	$c_2 + c_6$	$c_2 + c_7$	$c_2 + c_8$

The significance of the 1991 slope coefficient and the BVX and AE coefficients are given by t-tests on the coefficients from estimating model [4]. To estimate and test the significance of the slope coefficients for 1992 to 1996, five versions of model [5] below were used. The version of model [5] shown below provides an estimate of the 1992 EL coefficient, (c_2+c_4), and allows a t-test of its significance, as follows:

$$[5]\ MV_{it} = a_0 + a_1 BVX_{it} + a_2 EL_{it} + a_3 AE_{it} + a_4(EL*Y92 - EL)_{it} + a_5(EL*Y93)_{it}$$
$$+ a_6(EL*Y94)_{it} + a_7(EL*Y95)_{it} + a_8(EL*Y96)_{it} + e_{it}$$

where $a_2 = (c_2 + c_4)$. Model [5] was obtained by adding and subtracting c_4*EL in model [4] and rearranging. This is technique was repeated to obtain significance levels for the other four yearly coefficients.

Table 8 indicates that the EL coefficient from the Canadian (US) sample generally becomes less negative over the six-year period, going from -8.17 (-5.80) in 1991 to -2.92 (-1.61) in 1996. For the Canadian sample the estimates for 1993 and 1996 are not significant, and for the US sample the 1993, 1995 and 1996 yearly coefficients are not significant.

Table 8
Pooled GLS Estimation
Full Period BVX and AE Coefficients, and Year-by-Year EL Coefficients
Canadian and US Panel Samples [a]

Part A: Canadian sample (n=216)

Variable	Coefficient estimate	Standard deviation	t-value 207 df	p-value
BVX	2.3307	0.2212	10.5370	.0000
AE	0.8655	0.2097	4.1280	.0001
EL - 1991	-8.1679	2.8609	-2.8550	.0047
EL - 1992	-8.5311	2.3624	-3.6112	.0004
EL - 1993	-0.7245	1.6937	-0.4278	.6639
EL - 1994	-6.1250	1.8032	-3.3967	.0008
EL - 1995	-4.4989	2.2272	-2.0200	.0447
EL - 1996	-2.9192	2.3908	-1.2210	.2235
CONSTANT	0.0475	0.1292	0.3674	.7173
R^2	.4047			

Models:

[4] $MV_{it} = c_0 + c_1BVX_{it} + c_2EL_{it} + c_3AE_{it} + c_4(EL*Y92)_{it} + c_5(EL*Y93)_{it} + c_6(EL*Y94)_{it} + c_7(EL*Y95) + c_8(EL*Y96)_{it} + e_{it}$

[5] (1992 version, variations of model [5] are used for 1993 to 1996)
$MV_{it} = a_0 + a_1BVX_{it} + a_2EL_{it} + a_3AE_{it} + a_4(EL*Y92 - EL)_{it} + a_5(EL*Y93)_{it} + a_6(EL*Y94)_{it} + a_7(EL*Y95)_{it} + a_8(EL*Y96)_{it} + e_{it}$

where, for company i,
MV_{it} = Market value of equity three months after year end t
BVX_{it} = Book value of equity excluding the accrued environmental liability at year end t
EL_{it} = Accrued environmental liability at year end t
AE_{it} = Abnormal earnings for the year t
= Net $Income_{it}$ -(13%*$BookValue_{i,t-1}$)
Y9T = 1 if year is 199T, T= 2,3,4,5,6 and
0 otherwise
e_{it} = Residuals, assumed to be independently, identically distributed

Note a
R^2 for pooled GLS estimates are goodness-of-fit measures computed by the Buse method (White 1993).
Influential and negative book value observations omitted.
Canadian data are deflated by a scale factor, total assets.

Table 8 (cont.)
Pooled GLS Estimation
Full Period BVX and AE Coefficients and Year-by-Year EL Coefficients
Canadian and US Panel Samples[a]

Part B: US sample (n=228)

Variable	Coefficient estimate	Standard deviation	t-value 219 df	p-value
BVX	2.4484	0.1057	23.1680	.0000
AE	2.0800	0.3911	5.3189	.0000
EL - 1991	-5.8032	1.2620	-4.5984	.0000
EL - 1992	-3.9323	1.1103	-3.5415	.0005
EL - 1993	-0.3330	0.9529	-0.3494	.7271
EL - 1994	-3.4816	0.9484	-3.6710	.0003
EL - 1995	-0.5848	1.0056	-0.5815	.5615
EL - 1996	-1.6071	1.2230	-1.3141	.1902
CONSTANT	61962	46092	1.3443	.1802
R^2	.8925			

Models:

[4] $MV_{it} = c_0 + c_1BVX_{it} + c_2EL_{it} + c_3AE_{it} + c_4 (EL*Y92)_{it} + c_5(EL*Y93)_{it} + c_6(EL*Y94)_{it} + c_7(EL*Y95) + c_8(EL*Y96)_{it} + e_{it}$

[5] (1992 version, variations of model [5] are used for 1993 to 1996))
$MV_{it} = a_0 + a_1BVX_{it} + a_2EL_{it} + a_3AE_{it} + a_4 (EL*Y92 - EL)_{it} + a_5(EL*Y93)_{it} + a_6(EL*Y94)_{it} + a_7(EL*Y95)_{it} + a_8(EL*Y96)_{it} + e_{it}$

where, for company i,
MV_{it} = Market value of equity three months after year end t
BVX_{it} = Book value of equity excluding the accrued environmental liability at year end t
EL_{it} = Accrued environmental liability at year end t
AE_{it} = Abnormal earnings for the year t
= Net $Income_{it}$ -(13%*$BookValue_{i,t-1}$)
Y9T = 1 if year is 199T, T= 2,3,4,5,6 and
0 otherwise
e_{it} = Residuals, assumed to be independently, identically distributed

Note a
R^2 for pooled GLS estimates are goodness-of-fit measures computed by the Buse method (White 1993).
Influential and negative book value observations omitted.
US data are undeflated.

6.2.3 Trend component analysis

A further trend analysis is provided by estimating a model in which the EL coefficient is split into a trend component and a non-trending component.[38] The results of this trend component analysis are presented in Table 9.

Model [6] is used to estimate the trend and non-trending components of the EL coefficient and their significance levels, as follows:

[6] $MV_{it} = b_0 + b_1 BVX_{it} + b_{2.1} EL_{it} + b_{2.2}(EL_{it} * T) + b_3 AE_{it} + e_{it}$

where,

T = 1 if year is 1991

2 if year is 1992

3 if year is 1993

4 if year is 1994

5 if year is 1995

6 if year is 1996

$b_2 = b_{2.1} + (b_{2.2} * T)$

$b_{2.1}$ is the non-trending component of the EL coefficient for the six year period

$b_{2.2}$ is the trend component of the EL coefficient for the six year period

The results in Table 9 indicate that the non-trending component has a negative value of

–4.57 (p=.0317) for the Canadian sample and –5.84 (p=.0000) for the US sample. For the Canadian sample the trend component estimate is 0.41, but this estimate is not significant (p=.4089). For the US sample, the trend component estimate for the US coefficient is 0.95 (p=.0004). These results are consistent with the pre-post analysis in Table 8, indicating the EL coefficient is negative and has generally become less negative over the period studied. As in the pre-post analysis, the results for the Canadian sample are inconclusive.

[38] I am grateful to Professor Tony Wirjanto for suggesting this approach.

Table 9
Pooled GLS Estimation
Trend and Non-trending Components of the EL Coefficient
Canadian and US Panel Samples [a]

Part A: Canadian sample (n=216)

Variable	Coefficient estimate	p-value
BVX	2.3908	.0000
EL, non-trending	-4.5676	.0317
EL, trend	0.4128	.4089
AE	0.7807	.0004
Constant	-0.0303	.8083
R^2	.4165	

Model:

[6] $MV_{it} = b_0 + b_1 BVX_{it} - b_{2.1} EL_{it} - b_{2.2}(EL_{it} * T) + b_3 AE_{it} + e_{it}$

where, for company i,

MV_{it} = Market value of equity three months after year end t
BVX_{it} = Book value of equity excluding the accrued environmental liability at year end t
EL_{it} = Accrued environmental liability at year end t
AE_{it} = Abnormal earnings for the year t
= Net $Income_{it}$-(13%*$BookValue_{i,t-1}$)
T = 1 if year is 1991
2 if year is 1992
3 if year is 1993
4 if year is 1994
5 if year is 1995
6 if year is 1996

$b_2 = b_{2.1} + (b_{2.2} * T)$
$b_{2.1}$ is the nontrending EL coefficient for the six year period
$b_{2.2}$ is the trend component of the EL coefficient for the six year period
e_{it} = Residuals, assumed to be independently,identically distributed

Note a
R^2 for pooled GLS estimates are goodness-of-fit measures computed by the Buse method (White 1993).
Influential and negative book value observations omitted.
Canadian data are deflated by a scale factor, total assets.

Table 9 (cont.)
Pooled GLS Estimation
Trend and Non-trending Components of the EL Coefficient
Canadian and US Panel Samples [a]

Part B: US sample (n=228)

Variable	Coefficient estimate	p-value
BVX	2.3941	.0000
EL, non-trending	-5.8418	.0000
EL, trend	0.9523	.0004
AE	1.7785	.0000
Constant	69741	.1009
R^2	.8558	

Model:

[6] $MV_{it} = b_0 + b_1 BVX_{it} - b_{2.1} EL_{it} - b_{2.2}(EL_{it} * T) + b_3 AE_{it} + e_{it}$

where, for company i,

MV_{it} = Market value of equity three months after year end t

BVX_{it} = Book value of equity excluding the accrued environmental liability at year end t

EL_{it} = Accrued environmental liability at year end t

AE_{it} = Abnormal earnings for the year t
= Net $Income_{it}$ -(13%*$BookValue_{i,t-1}$)

T = 1 if year is 1991
2 if year is 1992
3 if year is 1993
4 if year is 1994
5 if year is 1995
6 if year is 1996

$b_2 = b_{2.1} + (b_{2.2} * T)$

$b_{2.1}$ is the nontrending EL coefficient for the six year period

$b_{2.2}$ is the trend component of the EL coefficient for the six year period

e_{it} = Residuals, assumed to be independently,identically distributed

Note a

R^2 for pooled GLS estimates are goodness-of-fit measures computed by the Buse method (White 1993).
Influential and negative book value observations omitted.
US data are undeflated.

6.2.4 Robustness checks

In addition to the analyses used above for model selection purposes in chapter 5, further ex post robustness checks have been performed on the data. This section summarizes these checks. First, the impact of the presence of cross-listed companies in the Canadian panel sample is investigated. Second, the impact of not omitting influential and/or negative book-value observations is discussed. Third, the impact of using different AE variable definitions is discussed.

The analysis of the Canadian sample above does not provide evidence of a significant change in the EL coefficient at 1995, the identified time of the change in Canadian financial reporting standards. One reason for this result could be that the Canadian sample contains a mixture of cross-listed companies (that is, companies whose shares are also listed on US stock markets) and non-cross-listed companies. It is possible that the cross-listed companies are influenced more by US financial reporting standards than the non-cross-listed companies are. Another possibility is that the change in the US standards influenced all the Canadian companies, not just the cross-listers, perhaps because important financial reporting standards that are issued in the US often become part of Canadian standards within one or two years. To study these two questions, the following additional testing has been performed.

The Canadian sample was divided into subsamples of cross-listers and non-cross-listers and re-analyzed to consider the impact of using 1993 as the break point (that is, the

identified time of the US regulatory change) instead of 1995. To investigate the first question, whether the standards may be affecting Canadian cross-listers at the time of the US intervention, the cross-lister subsample was analyzed with 1993 versus 1995 break points. To investigate the second question, whether all the Canadian companies may have been affected by the US intervention, the non-cross-lister subsample and the full panel sample were analyzed to compare the results with 1993 versus 1995 as the transition year. Table 10 presents these results. The first and second columns of table 10 show the results for the full Canadian panel sample of 36 firms (216 observations), the third and fourth columns show the 11 cross-listed companies (66 observations), and the fifth and sixth columns show the 25 non-cross-listed companies (150 observations).

For the cross-lister subsample, when the 1995 break point is used the pre-post contrast in the EL coefficient is not significant, the same result as for the full Canadian panel sample with a 1995 break point. In contrast, when a 1993 break point is used on the cross-listers, the pre-post contrast is positive and significant, as was the case for the US sample. This result is consistent with the cross-listed companies being influenced by the US intervention in 1993, rather than the Canadian intervention in 1995.

For the non-cross-listers, when a 1995 break point is used the pre-post contrast is not significant, the same as for the full Canadian sample with a 1995 break point. When the 1993 break point is used on the non-cross-listed subsample (i.e. time of US regulatory change), the pre-post contrast is positive and significant. This result is consistent with the non-cross-listed companies also being influenced by the US intervention in 1993, rather

than the Canadian intervention in 1995. Finally, the full Canadian panel sample was re-analyzed using the 1993 break point. In this case the pre-post contrast is again positive and significant, as it was for the cross-listers and non-cross-listers.

In addition to the information reported in table 10, the post-period EL coefficient estimates (p-values) with 1993 as the break point, as determined by model [3], are as follows:

- -2.6415 (.0578) for full Canadian panel sample
- -5.0446 (.0864) for cross-lister subsample
- -0.4364 (.8715) for non-cross-lister subsample

In comparison, the model [3] estimate of the post-period EL coefficient for the full Canadian panel sample, using a 1995 break point, was not significant.

One possible explanation for these findings is that the 1993 regulatory change in the US also had an impact on the Canadian sample companies in 1993. Anticipating that similar changes would soon occur in Canada, these companies may have changed their behaviour in 1993. If this were the case, the change in US standards in 1993 would preempt the later change in Canadian standards. That is, most of the change in the environmental liability coefficient for the Canadian companies would occur in 1993, and no further significant change would be observed in 1995. However, it is also possible that other events in 1993, besides the new financial reporting standards, changed investors' perceptions of environmental liability valuations and/or companies' reporting practices for environmental liabilities. One possibility for the Canadian setting would be the publicity

surrounding the Bata Industries (1993) legal decision, which would have raised the public's awareness of environmental liabilities; this may have led Canadian companies to report better environmental liability estimates. Another possibility is that other events in 1993 had an impact in both Canada and the US. The replicated time-series research design was intended to rule out this threat, but since the change is observed in both groups at the same time, this possibility has not been ruled out by the evidence provided here. A further limitation of this cross-lister analysis is that the subsamples are small.

Table 10
Pooled GLS Estimation
EL Coefficient Estimates for Pre-period and Pre-post Contrast [a]
Comparison of Canadian Samples: Full Panel Sample, Cross-Lister Subsample and Non-Cross-Lister Subsample

Variable	Canadian Full Sample (36 companies)		Canadian Cross-Listers (11 companies)		Canadian Non-Cross-Listers (25 companies)	
	1995 break point (n=216)	1993 break point (n=216)	1995 break point (n=66)	1993 break point (n=66)	1995 break point (n=150)	1993 break point (n=150)
BVX	2.3669 [b]	2.3249 [b]	3.6253 [b]	3.6608 [b]	1.6970 [b]	1.7835 [b]
EL, pre-period	-3.3340 [b]	-6.9339 [b]	-5.8471 [b]	-9.4500 [b]	-0.8293	-8.4244 [b]
EL, pre-post contrast	*1.4314*	*4.2924* [b]	*-0.2494*	*4.4054* [c]	*-1.4839*	*7.9880* [b]
AE	0.8037 [b]	0.7098 [b]	0.3504	0.1395	1.0068 [b]	0.8277 [b]
Constant	-0.0248	0.0182	-0.3055	-0.2472	0.2498	0.2097
R^2	.4175	.3810	.5906	.5895	.2616	.3263

Model:

[2] $MV_{it} = b_0 + b_1 BVX_{it} + b_{2PRE} EL_{it} + (b_{2POST} - b_{2PRE})(EL_{it} * D_{it}) + b_3 AE_{it} + e_{it}$

where, for company i,

MV_{it} = Market value of equity three months after year end t

BVX_{it} = Book value of equity excluding the accrued environmental liability at year end t

EL_{it} = Accrued environmental liability at year end t

AE_{it} = Abnormal earnings for the year t
= Net $Income_{it}$ -(13%*$BookValue_{i,t-1}$)

D_{it} = 1 if observation is in the post-period
0 if observation is in the pre-period

e_{it} = Residuals, assumed to be independently,identically distributed

Notes

a -
R^2 for pooled GLS estimates are goodness-of-fit measures computed by the Buse method (White 1993).
Negative book value observations omitted.
Data are deflated by a scale factor, total assets.

b - significance level, $p < .01$
c - significance level, $p < .05$

The second robustness check considers the impact of outlier data in the analyses. It compares the results with and without sample companies that have highly influential observations or negative book values during the study period. For the Canadian sample, this check was done assuming a 1993 break point, because the cross-lister test above indicated that this break point is more consistent with the data than the 1995 break point. There was only one company with negative book values in the Canadian sample. Whether or not the observations for this company are included makes very little difference to the results as reported above in tables 7, 8 and 9.

For the US sample, there are two companies with negative book values and one company with highly influential observations during the study period. Whether or not these outlier observations are omitted makes very little difference to any of the results presented above in tables 7 and 9. The results of the year-by-year analysis reported in table 8 also do not appear to be sensitive to whether or not the company with influential observations is included. However, some estimates and significance levels of the year-by-year coefficients in table 8 do change when the companies with negative book-value observations are included.[39] This sensitivity may be due to the fact that the year-by-year model lacks statistical power because nine parameters are being estimated from a relatively small sample (less than 250 observations). Despite this sensitivity to negative book-value observations in the year-by-year analysis, the overall conclusion that the EL coefficient is becoming more positive over the study period is still supported by the data.

[39] For example, instead of 1991, 1992 and 1994 being significant, 1991, 1995 and 1996 are significant.

The third robustness check investigates the impact of different AE variable definitions. Instead of a discount rate of 13%, discount rates ranging from 7% to 16% were used to calculate AE. Also, net income was used instead of the computed AE value. Using any of these alternate AE variable definitions makes very little difference to the results shown in tables 7, 8 and 9.

To summarize the robustness checks, the cross-lister robustness check indicates a significant positive contrast at 1993, rather than 1995, in the Canadian sample data. This could indicate that the standards promulgated by the SEC in the US in 1993 also influenced Canadian public companies, thus preempting the Canadian standards that were issued later in 1995. The outliers robustness check indicates that the pre-post analysis (table 7) and the trend analysis (table 9) are not sensitive to omission of influential and negative book-value observations. The year-by-year analysis (table 8) is not sensitive to influential observations, but it does appear to be sensitive to data with negative book values. This sensitivity limits the conclusiveness of the year-by-year results. All the analyses were found to be insensitive to how the AE variable is defined. Overall, all the robustness checks support the conclusion that the EL coefficient becomes less negative over the study period. As a caveat, the results are sensitive to scale effects and methods of deflation, as discussed in section 5.3.3.

6.2.5 Summary of change in financial reporting standards analysis

This section has presented analyses of the pre-period to post-period change in the EL coefficient, the year-by-year EL coefficients and the trend in the EL coefficient over the study period. The pre-post analysis indicates that a significant **positive** change in the EL coefficient occurs at the hypothesized time in the US sample. This does not support the research hypothesis, which states that this contrast will be negative. The Canadian contrast estimates are also positive, but not significant when a 1995 break point is used. When the 1993 break point is used, however, the Canadian results are similar to those of the US. There is also evidence that the coefficient itself is negative throughout the study period. The replicated research design was intended to increase our ability to infer that the change in the EL coefficient is associated with the change in standards rather than the manifestation of other, general trends in the market valuation of environmental liabilities. Since the empirical results for the Canadian data also indicate that a change occurred in 1993, the study's ability to rule out this possibility is limited.

6.3 Discussion of results

This section provides a discussion and offers a possible interpretation of the study's empirical results. The study has found evidence consistent with a positive change in the EL coefficient at the time of the US regulatory intervention, 1993. The results outlined above do not support the study's directional hypothesis. In particular, while a negative

contrast in the EL coefficient was hypothesized from theory, the study provides evidence that this contrast was positive and significant.

A failure to find evidence consistent with the alternative hypothesis does not automatically imply acceptance of the null hypothesis. As pointed out in Cook and Campbell (1979), there are two possible interpretations of not rejecting the null. One, the theory implied by the alternate hypothesis may be true, but the empirical tests lacked the power to detect the hypothesized effect. Two, the hypothesized effect was not obtained under the conditions in which the testing occurred (or, more simply put, the theory implied by the alternate hypothesis may be false.) This interpretation can be made with more confidence when, as in this study, '... an explicit directional hypothesis guides the research and the results are statistically significant and in the opposite direction to that specified in the hypothesis.' (Cook and Campbell 1979: 45).

Thus, it is reasonable to consider the possibility that the theory underlying the research hypothesis is inadequate. For example, it may be that a strong suppressor variable is offsetting a weaker, true effect in the hypothesized direction. For this study, one such suppressor factor is suggested by new theoretical research by Fischer and Verrecchia (1998), first presented after the present study's empirical results were obtained. This new theory suggests that one possible way to interpret the results would be to consider the potential for the reported environmental liability estimates to be biased. This potential bias interpretation is discussed below.

An important assumption in the Holthausen and Verrecchia (1988) model underlying the study's hypothesis is that the mean of the true distribution of the profit is known, and equals the mean of the reported profit estimate. In other words, the model assumes there is no bias in the report or in the investors' priors. Consistent with Holthausen and Verrecchia (1988) and other theoretical work available when the present study was conducted, the research hypothesis is based on the assumption of no bias. However, recent work by Fisher and Verrecchia (1998) in an asymmetric information setting shows that it may be an equilibrium strategy for managers to provide biased information.

Fisher and Verrecchia (1998) present an equilibrium model of reporting bias in which investors do not know whether the manager's financial reporting objective is to inflate or deflate share price, so that they cannot perfectly adjust for the bias in the manager's report. These authors find that the value relevance of the manager's report decreases with the extent to which it is biased. Comparative static results suggest that the value relevance of the manager's report falls as the cost of biasing the report falls or the uncertainty about the manager's objective increases. This presents the possibility that, in contrast to the Holthausen and Verrecchia (1988) model, the mean of the estimate can differ systematically from the true mean, that is, it can be biased.

For the levels specification used in this study, the potential for the estimate to be biased is important to consider. In particular, if the investors' priors are that the estimate is biased, their attempt to compensate for bias may lead them to place a value on the liability that is closer to their beliefs, and that differs from the number the company reports in its

financial statements. For example, if a company reported that its environmental liability was one dollar, but investors believed this was understated, they would be valuing the company as though its environmental liability were more than one dollar, say 10 dollars. In a regression model, this bias correction would translate into a coefficient on EL that is more negative than negative one, say -10. Thus, a possible interpretation of these empirical results is that they reflect the influence of bias, a factor that was omitted from the study's ex ante theoretical prediction. The results may indicate that bias is a powerful suppressor variable that acts in the opposite direction to precision. As noted, the Holthausen and Verrecchia (1988) theory considers the impact of changes in the precision of a report while assuming that bias has no effect. In view of this, one possible interpretation of the results might be obtained by considering the opposite case to Holthausen and Verrecchia (1988), that is, the case in which only bias matters and precision has no effect.

While the **magnitude** of any possible bias effect would be difficult to explain in this study, the **direction** of the effect observed here might be explained as follows. Note that the intent of the new financial reporting standards is to increase the cost to the company of not providing a reasonable environmental liability estimate. These regulatory costs could take the form of additional monitoring or sanctions such as an adverse audit report. Thus lack of standards can be construed as a 'low cost of not estimating' regime. If there is a low expected regulatory cost, a company would have little incentive to incur the cost of an extensive investigation of its sites. If a company leaves some polluted sites uninvestigated, or only tests for a few of the many possible pollutants, an understated

liability estimate may result. When standards are increased, more effort may result in more sites and more pollutants being identified and thus less understatement of the environmental liability estimate.

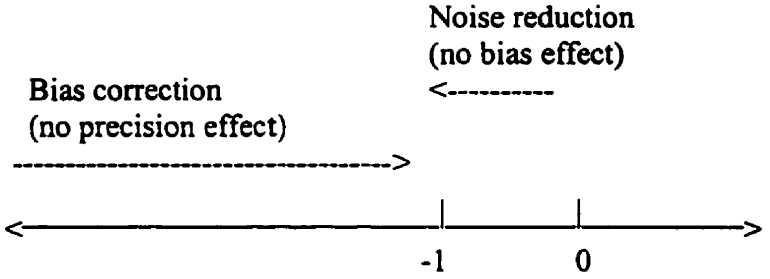
Further, GAAP for contingent liabilities require that, if no estimate in a range of estimates is more likely than any other, the minimum value in the range should be accrued (for example, FASB Interpretation No.14 to FAS No.5). This particular GAAP provides a link between the estimation effort and the investors' priors regarding bias, as follows. If little effort is expended, it is more probable that no estimate in the range will be better than any other, therefore a GAAP-induced downward bias will result. If more estimation effort is applied, it is more probable that companies can key in on a most-likely amount in the range, and so more companies would be reporting an amount other than the minimum. Thus, investors' priors may be that the information reported is, on average, less understated after standards are raised and more effort is applied to the estimation process.

Investors with priors that the estimated environmental liability is understated might correct for this by placing a value on the liability that is more negative than negative one, say –5 times or –10 times, depending on how severe they believed the understatement bias to be. If a less understated estimate were reported, the investors' valuation would be closer to the theoretical value of the negative one. Therefore, it might be expected that the correction for bias would become smaller under the higher financial reporting standards, and thus the valuation coefficient would become less negative. The above discussion

indicates that bias correction could be a factor that acts in the opposite direction to the study's research hypothesis and, if so, it would work against observing the hypothesized result.

To summarize, the original research hypothesis assumed that bias has no effect and only the precision of the report matters. This led to the expectation that the contrast from low to high standards will be a negative movement from a coefficient of zero to a coefficient of negative one. In contrast, if investors expect the report to be an understated amount and they believe this bias is reduced when standards are raised, and if one assumes changes in precision would have no effect, this could explain the observed result. That is, we observe a positive movement from a coefficient less than negative one in the low standards period, up towards negative one in the high standards period.

The figure below illustrates these situations.



Along the lines argued in chapter 3 (section 3.4), note that in an association study such as this, an environmental liability valuation coefficient closer to negative one could be interpreted as an indication that the reported information is less biased. That is, we can say the number on the balance sheet has come to resemble more closely the information the investors are using, and this will be the case regardless of changes in investors'

beliefs. However, we cannot say anything about the source of these beliefs based on an association study.

Viewed in light of the study's empirical results, the new theory regarding biased reporting and the discussion above point to a different theoretical approach to the research problem, one that is closer to what might be considered an 'ideal' research design for a quasi-experimental setting. In such an ideal design, competing theoretical predictions are put forward as two alternate hypotheses. The alternative hypotheses are structured such that finding evidence consistent with one of the hypotheses simultaneously refutes the other. Here the alternatives are a bias-correction theory and a noise-effect theory, the first implying the pre-post change in EL will be positive, the second implying it will be negative. For this study such an ideal design can only be put forward in hindsight, but it does provide an interesting way to view the empirical results.

6.4 Chapter summary

This chapter has presented empirical analyses indicating that the market places a negative valuation on environmental liabilities. Results for the US sample are consistent with this coefficient becoming less negative after the regulatory change in 1993. The Canadian sample also indicates a change to a less negative coefficient; this change is not significant when 1995 is used as the effective date of the regulatory change, but it is significant when 1993 (the time of the US change) is used. This may indicate the US standards also

influenced the companies in the Canadian sample, thus preempting the Canadian standards that were issued later. Notably, these results are significant but opposite to the directional research hypothesis. The US data also indicate a general trend to a less negative value over the study period. The Canadian results are less conclusive because the coefficient estimates not highly significant. The potential for reporting bias to be an omitted factor that works in the opposite direction to the hypothesized precision effect was explored as one possible theoretical interpretation of the results.

Overall, the evidence is consistent with the environmental liability valuation coefficient having a negative value that becomes less negative during the study period. However, conclusive results were not obtained in both settings of the replicated, interrupted time-series design. Since the replication was intended to control against the threat of omitted factors, the study does not provide strong evidence that could rule out the possibility that the observed contrast is due to a change in 1993 in some other factor besides the new financial reporting standards.

CHAPTER 7

CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Overall, evidence has been obtained that the market places a negative valuation on environmental liabilities. Results for the US sample indicate a significant, positive change in this coefficient at the time of the regulatory change, 1993. This evidence is not consistent with the hypothesis that the environmental liability valuation coefficient will move in a negative direction, from zero closer to its theoretical value of negative one, when higher financial reporting standards are in place. In contrast, the coefficient was found to be less than negative one in the pre-period, and the change in the coefficient between the pre-period and the post-period was found to be positive. One interpretation offered for this result is that investors may be correcting a perceived understatement bias in the reported environmental liability estimates, and they believe that this bias is less severe in the post-period than in the pre-period. This interpretation would indicate that the new standards were effective, but not in the way hypothesized. The results for the Canadian sample do not indicate that a significant change occurred in the EL coefficient at 1995, the identified time of change in the Canadian financial reporting standards. Robustness checks on these results indicate that a significant, positive change does occur in this coefficient at the same time as the US regulatory change, 1993. This result would be consistent with the US standards also being effective for Canadian companies, thus preempting the Canadian standards that were introduced later. As in the US case, this evidence is not consistent with the research hypothesis concerning the direction of the pre-post change. However, other interpretations of these results are possible. For

example, the observed change at 1993 may be due to some unidentified change in the market's information set, which occurred around 1993 and changed how investors value, or companies report, environmental liabilities in both Canada and the US.

The trend analyses also suggest a general trend to a less negative valuation coefficient over the study period. This result also opposes the research hypothesis but it is, again, consistent with the new standards being effective. The Canadian results are generally less conclusive since the Canadian trend coefficient estimate is insignificant. Thus, the possibility that the observed pre-post change reflects a continual change due to other factors than the new financial reporting standards has not been specifically ruled out.

Some further limitations of the analyses are as follows. In general, the levels model used in the study is vulnerable to omitted variables that may be correlated with EL. An omitted factor, reporting bias, that acts in the opposite direction to the hypothesized precision effect, has been suggested as a possible explanation for the study results. Existing research on the impact of bias in financial reporting is limited. Future research could be directed towards developing formal means of measuring reporting bias. Recent work by Chen (1998), first presented after the present study was completed, has studied the bias in reported environmental liabilities. The Chen (1998) study used the method of modeling conservative accounting set out in Feltham and Ohlson (1995) as a basis for measuring bias in environmental liability reports.[40]

There may also be other relevant variables that have not been identified and addressed in the present study. Other value relevant information could come from knowing what type of environmental liability is being reported. For example, some environmental liabilities are the 'site-restoration' type, which are not fully recognized. Instead, these are added to the balance sheet liability balance over time as resources are extracted from the site. This may indicate the booked liability is an understatement of the ultimate cash outflow. A simple way to capture this would be to divide the sample into resource and non-resource companies. This approach is suggested by the 'other information' variable in the Feltham and Ohlson (1995) model, and was used by Amir (1993) to study post-retirement benefit liability valuation. Ideally, a larger sample would be used for this purpose. More robust econometric techniques might be developed for analyzing incomplete panels of cross-sectional time-series data that would allow larger samples to be analyzed. The accounting used for site-restoration liabilities might also be modeled more explicitly, for example by using the expanded valuation model presented in Feltham and Ohlson (1997); this model formally incorporates the structure of amortization accounting, and might be adapted to address site-restoration accounting.

In summary, this thesis has presented evidence that changes in financial reporting standards are associated with changes in the market valuation of environmental liabilities. The empirical results are generally opposite to the study's ex ante predictions. One interpretation of the results is that investors believe the standards have the effect of reducing an understatement bias in environmental liability estimates. The thesis

[40] The Chen (1998) study differs from this thesis in that it considers the relation between other information disclosed in annual reports and the market's valuation of environmental liabilities during the period 1992 to

contributes to our stock of knowledge concerning the role of financial reporting standards in the reporting and valuation of environmental liability estimates, and suggests several avenues for future research.

1995. It does not examine changes in the valuation over time, as this study does.

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APPENDIX 1

Event Line and Descriptions of Canadian and US Financial Reporting Standards Relating to Environmental Liabilities

CANADA

EFFECTIVE DATE	DESCRIPTION
August 1978	**CICA Handbook section 3290 'Contingencies'.** This standard requires: (.12) accrual of a contingent loss if a loss is likely and amount is reasonably determinable (.15) disclosure of a contingent loss if a loss is likely but amount cannot be reasonably determined, or if loss is likely and amount accrued but there is exposure to loss in excess of the amount accrued, or if the probability of loss is not determinable (.22) the disclosure should include the nature of the contingency and an estimate of the contingent loss or a statement that such an estimate cannot be made.
Nov 10, 1989; amended March 9,1990	**The Ontario Securities Commission (OSC) Policy Statement 5.10 'Annual Information Form and Management's Discussion and Analysis of Financial Condition and Results of Operations - Policies'** Effective for fiscal years ending on or after September 30, 1990 for companies with revenues or shareholders' equity greater than $25,000,000 or December 31, 1989 for other companies. Part III, Item 1(e) requires companies to: 'Disclose information on risks and uncertainties facing the Issuer... Discuss and analyze risks, events and uncertainties that would cause reported financial information not necessarily to be indicative of future operating results or of future financial condition.' Part I(7) states: 'There is no regulatory requirement for auditor involvement with respect to the preparation of the AIF and MD&A. However, Issuers may choose to involve their auditors. The auditing profession's standards may require limited auditor involvement in certain circumstances such as where MD&A accompanies an Issuer's audited financial statements.

APPENDIX 1 (cont.)

Event Line and Descriptions of Canadian and US Financial Reporting Standards Relating to Environmental Liabilities

CANADA

December 1, 1990	**CICA Handbook section 3060 'Capital Assets'** Effective for years commencing on or after this date. It states: (.39) '*When reasonably determinable, provision should be made for future removal and site restoration costs, net of expected recoveries, in a rational and systematic manner by charges to income.*' (.63) 'Additional desirable disclosures include: (a) accumulated provision for future removal and site restoration costs and the major assumptions used and the basis for determining the provision; and (b) the amount of the future removal and site restoration costs charged to income for the period.'
January 29, 1993	**OSC Bulletin (16 OSCB 375), 'A Guide to OSC Policy Statement 5.10'** This bulletin was issued because OSC compliance reviews of MD&A in 1990 and 1991 indicated that the quality of information being provided to market participants was inconsistent. As a result of this situation, in 1992 the OCS undertook a broad review of the 1991 MD&A of 240 of the TSE 300 companies. The Guide is intended to assist issuers and their advisors in the preparation of more effective narrative financial disclosure. Among other things, the Guide clarifies that 'risks and uncertainties' may include environmental risks, effects of government policy and legislative developments, and effects of contingencies (p.11).
February 1993	**CICA Exposure Draft - 'Contingent Liabilities'** Provides revised accounting recommendations regarding contingent liabilities (section 3290). The Exposure Draft was withdrawn in 1996.

APPENDIX 1 (cont.)

Event Line and Descriptions of Canadian and US Financial Reporting Standards Relating to Environmental Liabilities

CANADA

Jan 1994 Revised Dec 1994 to reflect release of s.5136 (see below)	**CICA Handbook Audit Guideline 19 (AuG19) 'Audit of Financial Statements Affected by Environmental Matters'** This standard provides guidance on application of GAAS to financial statements when they may be affected by environmental matters, under the headings: 'Planning considerations', 'Circumstances which may make the auditor suspect the financial statements are materially misstated', 'Using the work of a specialist' and 'Examples of audit procedures.'
January 1, 1995	**CICA Handbook section 5136 'Misstatements - Illegal Acts'** Effective for years commencing on or after this date, this standard states: 'The auditor should apply his or her knowledge of the entity's business and make enquiries of management to identify laws and regulations which, if violated, could reasonably be expected to result in a material misstatement in the financial statements.' (5136.11) 'The auditor should enquire of and obtain a written representation from management to confirm that either: a) management is not aware of any illegal or possible illegal acts: b) management has disclosed to the auditor all facts related to illegal or possibly illegal acts.' (5126.31) 'When the auditor has obtained evidence which indicates an illegal or possibly illegal act, other than one considered inconsequential, may have occurred, the auditor should ensure the audit committee and other appropriate levels of management are informed.' (5136.28)

APPENDIX 1 (cont.)

Event Line and Descriptions of Canadian and US Financial Reporting Standards Relating to Environmental Liabilities

CANADA

July 1995	**CICA Handbook section 1508 'Measurement Uncertainty'.** It requires: (.06) disclosure of the nature of a material measurement uncertainty (.07) disclosure of the extent of a material measurement uncertainty when it is reasonably possible that the recognized amount could change by a material amount in the near term (i.e. within one year) (.08) the recognized amount of the measurement uncertainty disclosed under .06 or .07 should be disclosed except when disclosure of the amount would have a significant adverse effect on the enterprise. The reasons for non-disclosure should be indicated.

APPENDIX 1 (cont.)

Event Line and Descriptions of Canadian and US Financial Reporting Standards Relating to Environmental Liabilities

US

March 1975	**FASB Statement of Financial Accounting Standards No. 5 'Accounting for Contingencies' (FAS No. 5)** This standard requires companies to recognize an estimated loss from a loss contingency by a charge to income when both of the following conditions are met: (1) It is 'probable' (i.e. a future event is likely to occur) that an asset has been impaired or liability has been incurred at the financial statement date, and (2) The amount of the loss can be reasonably estimated Disclosure is required of the nature and amount of a contingent loss accrual, of reasonably possible losses in excess of the amount accrued, and in situations when the company cannot estimate the range of reasonably possible outcomes.
1976	**FASB Interpretation No. 14 (FIN 14)** This standard applies if a company determines it has a probable loss but can only estimate a range of losses, not a point estimate. FIN 14 requires that if an estimated loss falls within a range of possible amounts the company should accrue the best estimate in the range, or if no amount is better than any other the minimum should be accrued.

APPENDIX 1 (cont.)

Event Line and Descriptions of Canadian and US Financial Reporting Standards Relating to Environmental Liabilities

US

1988	**AICPA Statement on Auditing Standards no. 54 'Illegal Acts by Clients' (SAS 54)** Requires auditors to make inquiries of management concerning a company's compliance with environmental laws and regulations, even though these may have only an 'indirect' or contingent effect on financial statement amounts rather than a direct and material effect. Written representation should be obtained concerning the absence of violations or possible violations of laws and regulations. Ultimate determination of illegality must be obtained through legal advice or by a court of law, however.
1989 and various later additions	**SEC Regulation S-K - Reporting requirements for SEC registrants.** Item 101 requires a description of the business, including specific disclosure of material effects that compliance with environmental laws may have on the registrant's capital expenditures, earnings and competitive position. Item 103 requires disclosure of any material pending legal proceedings under environmental laws. Item 303 sets out MD&A requirements; MD&A must include forward-looking disclosures triggered by any known trends, demands, commitments, events or uncertainties that are reasonably likely to have a material effect on the registrant's operating results or financial condition.

APPENDIX 1 (cont.)

Event Line and Descriptions of Canadian and US Financial Reporting Standards Relating to Environmental Liabilities

US

1991	**AICPA Audit Risk Alert** This annual AICPA guideline for auditors indicated that auditors should consider whether a client has been designated as a 'potentially responsible party (PRP)' under environmental law or if it has a high risk of environmental liabilities and consider any financial statement implications of such matters. It provides a list of 'red flags' that may be indicators of increased environmental liability risks.
January 1992	**AICPA Statement on Auditing Standards no. 69 (SAS 69) 'The Meaning of 'Present Fairly in Conformity with Generally Accepted Accounting Principles' in the Independent Auditor's Report'** This standard identifies the sources of established generally accepted accounting principles (GAAP) and their hierarchy of authority. The highest category, category (a) includes FASB statements and AICPA research bulletins. Category (b) includes AICPA's AcSEC (Accounting Standards Executive Committee) SOPs and audit and accounting guides. Category (c) includes FASB Emerging Issues Task Force (EITF) consensuses and AcSEC practice bulletins.
1993	**FASB Emerging Issues Task Force Issue no. 93-5 (EITF 93-5) 'Accounting for Environmental Liabilities'** EITF 93-5 allows environmental liabilities to be reduced by probable recoveries. (EITF 93-5 is superceded for SEC registrants by SAB 92 - see below- which does not allow offsetting.) Discounting is allowed, but not required, only if the aggregate amount of the obligation and the timing and amounts of cash payments are fixed or reasonably determinable. If the liability is discounted, any recovery must also be discounted. If the discounting effect is material, the effect and the discount rate should be disclosed. The EITF did not address balance sheet presentation of environmental liabilities or the appropriate discount rate to be used.

APPENDIX 1 (cont.)

Event Line and Descriptions of Canadian and US Financial Reporting Standards Relating to Environmental Liabilities

US

January 1993	**AICPA Environmental Issues Roundtable** Representatives of the AICPA, FASB, SEC, CICA and industry CPAs convened to discuss accounting and auditing problems relating to environmental issues. The AICPA project that ultimately resulted in SOP 96-1 in 1996 (described below) was initiated. The applicability of SAS no. 54 to auditors' responsibility to detect non-compliance with environmental laws was noted, but also the need for more specific guidance on environment-related financial statement assertions.
June 1993	**SEC Staff Accounting Bulletin No. 92 (SAB 92)** Sets out the SEC Staff's interpretation of GAAP with regard to contingent liabilities, in particular environmental liabilities. Its purpose is to promote timely recognition of contingent losses and to address the diversity in practice with respect to accounting for and disclosure of environmental liabilities which the SEC found unacceptable. SABs are administrative interpretations and principles rather than official rules of the SEC, however they do provide insight into the kinds of deficiencies likely to result in SEC enforcement actions - a costly and undesirable outcome for registrants. Three key requirements of SAB 92 are: (1) Contingent liabilities must be displayed on balance sheet separately from any recoveries recognized (no offsetting) (2) 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. (3) 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 the SAB the Staff note that zero is unlikely to be the 'best estimate in the range' if a known liability exists, and state that it will not accept lack of certainty as an argument for a failure to provide investors with all material factors relating to contingent liabilities.

APPENDIX 1 (cont.)

Event Line and Descriptions of Canadian and US Financial Reporting Standards Relating to Environmental Liabilities

US

October 1996	**AICPA Statement of Position 96-1 (SOP 96-1) 'Environmental Remediation Liabilities (Including Auditing Guidance)'** This statement reinforces FASB 5 requirements, provides details of the costs to be included in the environmental liability accrual, states how to address sharing of responsibility with other parties, states that current laws and technology should be used in environmental liability measurements, allows discounting under specific conditions, gives guidance on disclosure and provides guidance for auditors on planning, executing and reporting for engagements in which environmental liabilities exist. Effective December 1996.

Sources:

American Institute of Certified Public Accountants (AICPA) 1996.
Canadian Institute of Chartered Accountants (CICA) 1997.
Financial Accounting Standards Board (FASB) 1996.
Fleming 1993.
Gagnon-Valotaire and Chlala 1993.
Price, Waterhouse 1994.
Roberts and Hohl 1994.
Roussey 1992.
Specht 1992.
Walker 1995.

APPENDIX 2

List of Sample Companies

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END (yymmdd)
	CANADIAN COMPANIES	
	COMPLETE PANELS 1996-1 OR LONGER	
1	AGNICO-EAGLE MINES	961231
2	AGNICO-EAGLE MINES	951231
3	AGNICO-EAGLE MINES	941231
4	AGNICO-EAGLE MINES	931231
5	AGNICO-EAGLE MINES	921231
6	AGNICO-EAGLE MINES	911231
7	AGNICO-EAGLE MINES	911231
8	ARC INTERNATIONAL CORPORATION	961231
9	ARC INTERNATIONAL CORPORATION	951231
10	ARC INTERNATIONAL CORPORATION	941231
11	ARC INTERNATIONAL CORPORATION	931231
12	ARC INTERNATIONAL CORPORATION	921231
13	ARC INTERNATIONAL CORPORATION	911231
14	CAMECO CORPORATION	961231
15	CAMECO CORPORATION	951231
16	CAMECO CORPORATION	941231
17	CAMECO CORPORATION	931231
18	CAMECO CORPORATION	921231
19	CAMECO CORPORATION	911231
20	CANADIAN NATURAL RESOURCES LIMITED	961231
21	CANADIAN NATURAL RESOURCES LIMITED	951231
22	CANADIAN NATURAL RESOURCES LIMITED	941231
23	CANADIAN NATURAL RESOURCES LIMITED	931231
24	CANADIAN NATURAL RESOURCES LIMITED	921231
25	CANADIAN NATURAL RESOURCES LIMITED	911231
26	CANFOR CORPORATION	961231
27	CANFOR CORPORATION	951231
28	CANFOR CORPORATION	941231
29	CANFOR CORPORATION	931231
30	CANFOR CORPORATION	921231
31	CANFOR CORPORATION	911231
32	CANFOR CORPORATION	901231
33	CATHEDRAL GOLD CORPORATION	961231
34	CATHEDRAL GOLD CORPORATION	951231
35	CATHEDRAL GOLD CORPORATION	941231
36	CATHEDRAL GOLD CORPORATION	931231
37	CATHEDRAL GOLD CORPORATION	921231
38	CATHEDRAL GOLD CORPORATION	911231
39	CHAUVCO RESOURCES LTD	961231
40	CHAUVCO RESOURCES LTD	951231
41	CHAUVCO RESOURCES LTD	941231
42	CHAUVCO RESOURCES LTD	931231
43	CHAUVCO RESOURCES LTD	921231
44	CHAUVCO RESOURCES LTD	911231
45	COMINCO LIMITED	961231
46	COMINCO LIMITED	951231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
47	COMINCO LIMITED	941231
48	COMINCO LIMITED	931231
49	COMINCO LIMITED	921231
50	COMINCO LIMITED	911231
51	COMINCO LIMITED	901231
52	COMSTATE RESOURCES LTD	961231
53	COMSTATE RESOURCES LTD	951231
54	COMSTATE RESOURCES LTD	941231
55	COMSTATE RESOURCES LTD	931231
56	COMSTATE RESOURCES LTD	921231
57	COMSTATE RESOURCES LTD	911231
58	CRESTBROOK FOREST INDUSTRIES LTD	961231
59	CRESTBROOK FOREST INDUSTRIES LTD	951231
60	CRESTBROOK FOREST INDUSTRIES LTD	941231
61	CRESTBROOK FOREST INDUSTRIES LTD	931231
62	CRESTBROOK FOREST INDUSTRIES LTD	921231
63	CRESTBROOK FOREST INDUSTRIES LTD	911231
64	CRESTBROOK FOREST INDUSTRIES LTD	901231
65	CRESTBROOK FOREST INDUSTRIES LTD	891231
66	CRESTBROOK FOREST INDUSTRIES LTD	881231
67	CRESTBROOK FOREST INDUSTRIES LTD	871231
68	CS RESOURCES LIMITED	961231
69	CS RESOURCES LIMITED	951231
70	CS RESOURCES LIMITED	941231
71	CS RESOURCES LIMITED	931231
72	CS RESOURCES LIMITED	921231
73	CS RESOURCES LIMITED	911231
74	DOMTAR INC	961231
75	DOMTAR INC	951231
76	DOMTAR INC	941231
77	DOMTAR INC	931231
78	DOMTAR INC	921231
79	DOMTAR INC	911231
80	DOMTAR INC	901231
81	FLETCHER CHALLENGE CANADA LIMITED	960630
82	FLETCHER CHALLENGE CANADA LIMITED	950630
83	FLETCHER CHALLENGE CANADA LIMITED	940630
84	FLETCHER CHALLENGE CANADA LIMITED	930630
85	FLETCHER CHALLENGE CANADA LIMITED	920630
86	FLETCHER CHALLENGE CANADA LIMITED	911231
87	FLETCHER CHALLENGE CANADA LIMITED	901231
88	FLETCHER CHALLENGE CANADA LIMITED	891231
89	GLAMIS GOLD LTD	961231
90	GLAMIS GOLD LTD	951231
91	GLAMIS GOLD LTD	941231
92	GLAMIS GOLD LTD	931231
93	GLAMIS GOLD LTD	921231
94	GLAMIS GOLD LTD	911231
95	GLAMIS GOLD LTD	901231
96	GLAMIS GOLD LTD	891231
97	GLAMIS GOLD LTD	881231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
98	GLAMIS GOLD LTD	871231
99	GLAMIS GOLD LTD	861231
100	GLAMIS GOLD LTD	851231
101	GLAMIS GOLD LTD	841231
102	GLAMIS GOLD LTD	831231
103	IMPERIAL OIL LIMITED	961231
104	IMPERIAL OIL LIMITED	951231
105	IMPERIAL OIL LIMITED	941231
106	IMPERIAL OIL LIMITED	931231
107	IMPERIAL OIL LIMITED	921231
108	IMPERIAL OIL LIMITED	911231
109	IMPERIAL OIL LIMITED	901231
110	IMPERIAL OIL LIMITED	891231
111	MAXX PETROLEUM LTD	961231
112	MAXX PETROLEUM LTD	951231
113	MAXX PETROLEUM LTD	941231
114	MAXX PETROLEUM LTD	931231
115	MAXX PETROLEUM LTD	921231
116	MAXX PETROLEUM LTD	911231
117	NORTHSTAR ENERGY CORPORATION	961231
118	NORTHSTAR ENERGY CORPORATION	951231
119	NORTHSTAR ENERGY CORPORATION	941231
120	NORTHSTAR ENERGY CORPORATION	931231
121	NORTHSTAR ENERGY CORPORATION	921231
122	NORTHSTAR ENERGY CORPORATION	911231
123	NOVA CORPORATION OF ALBERTA	961231
124	NOVA CORPORATION OF ALBERTA	951231
125	NOVA CORPORATION OF ALBERTA	941231
126	NOVA CORPORATION OF ALBERTA	931231
127	NOVA CORPORATION OF ALBERTA	921231
128	NOVA CORPORATION OF ALBERTA	911231
129	ORBIT OIL & GAS LTD	961231
130	ORBIT OIL & GAS LTD	951231
131	ORBIT OIL & GAS LTD	941231
132	ORBIT OIL & GAS LTD	931231
133	ORBIT OIL & GAS LTD	921231
134	ORBIT OIL & GAS LTD	911231
135	ORBIT OIL & GAS LTD	901231
136	PARAMOUNT RESOURCES LTD	961231
137	PARAMOUNT RESOURCES LTD	951231
138	PARAMOUNT RESOURCES LTD	941231
139	PARAMOUNT RESOURCES LTD	931231
140	PARAMOUNT RESOURCES LTD	921231
141	PARAMOUNT RESOURCES LTD	911231
142	PENN WEST PETROLEUM LTD	961231
143	PENN WEST PETROLEUM LTD	951231
144	PENN WEST PETROLEUM LTD	941231
145	PENN WEST PETROLEUM LTD	931231
146	PENN WEST PETROLEUM LTD	921231
147	PENN WEST PETROLEUM LTD	911231
148	PETRO-CANADA	961231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
149	PETRO-CANADA	951231
150	PETRO-CANADA	941231
151	PETRO-CANADA	931231
152	PETRO-CANADA	921231
153	PETRO-CANADA	911231
154	PETROMET RESOURCES LIMITED	961231
155	PETROMET RESOURCES LIMITED	951231
156	PETROMET RESOURCES LIMITED	941231
157	PETROMET RESOURCES LIMITED	931231
158	PETROMET RESOURCES LIMITED	921231
159	PETROMET RESOURCES LIMITED	920131
160	PLACE RESOURCES CORPORATION	961231
161	PLACE RESOURCES CORPORATION	951231
162	PLACE RESOURCES CORPORATION	941231
163	PLACE RESOURCES CORPORATION	931231
164	PLACE RESOURCES CORPORATION	921231
165	PLACE RESOURCES CORPORATION	911231
166	POCO PETROLEUM LTD	961231
167	POCO PETROLEUM LTD	951231
168	POCO PETROLEUM LTD	941231
169	POCO PETROLEUM LTD	931231
170	POCO PETROLEUM LTD	921231
171	POCO PETROLEUM LTD	911231
172	BARRICK GOLD CORP	961231
173	BARRICK GOLD CORP	951231
174	BARRICK GOLD CORP	941231
175	BARRICK GOLD CORP	931231
176	BARRICK GOLD CORP	921231
177	BARRICK GOLD CORP	911231
178	BREAKWATER RESOURCES	961231
179	BREAKWATER RESOURCES	951231
180	BREAKWATER RESOURCES	941231
181	BREAKWATER RESOURCES	931231
182	BREAKWATER RESOURCES	921231
183	BREAKWATER RESOURCES	911231
184	BREAKWATER RESOURCES	901231
185	BREAKWATER RESOURCES	891231
186	CANADIAN OCCIDENTAL PETROLEUM LTD.	961231
187	CANADIAN OCCIDENTAL PETROLEUM LTD.	951231
188	CANADIAN OCCIDENTAL PETROLEUM LTD.	941231
189	CANADIAN OCCIDENTAL PETROLEUM LTD.	931231
190	CANADIAN OCCIDENTAL PETROLEUM LTD.	921231
191	CANADIAN OCCIDENTAL PETROLEUM LTD.	911231
192	CANADIAN OCCIDENTAL PETROLEUM LTD.	901231
193	CANADIAN OCCIDENTAL PETROLEUM LTD.	891231
194	NEWALTA CORPORATION	961231
195	NEWALTA CORPORATION	951231
196	NEWALTA CORPORATION	941231
197	NEWALTA CORPORATION	931231
198	NEWALTA CORPORATION	921231
199	NEWALTA CORPORATION	911231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
200	PRINCETON MINING	961231
201	PRINCETON MINING	951231
202	PRINCETON MINING	941231
203	PRINCETON MINING	931231
204	PRINCETON MINING	921231
205	PRINCETON MINING	911231
206	PRINCETON MINING	901231
207	PRINCETON MINING	891231
208	RANGER OIL	961231
209	RANGER OIL	951231
210	RANGER OIL	941231
211	RANGER OIL	931231
212	RANGER OIL	921231
213	RANGER OIL	911231
214	RANGER OIL	901231
215	RANGER OIL	891231
216	RANGER OIL	881231
217	RANGER OIL	871231
218	RANGER OIL	861231
219	RANGER OIL	851231
220	RANGER OIL	841231
221	REA GOLD	961231
222	REA GOLD	951231
223	REA GOLD	941231
224	REA GOLD	931231
225	REA GOLD	921231
226	REA GOLD	911231
227	REA GOLD	901231
228	SHELL CANADA LIMITED	961231
229	SHELL CANADA LIMITED	951231
230	SHELL CANADA LIMITED	941231
231	SHELL CANADA LIMITED	931231
232	SHELL CANADA LIMITED	921231
233	SHELL CANADA LIMITED	911231
234	SLOCAN FOREST	961231
235	SLOCAN FOREST	951231
236	SLOCAN FOREST	941231
237	SLOCAN FOREST	931231
238	SLOCAN FOREST	921231
239	SLOCAN FOREST	911231
240	SLOCAN FOREST	911231
241	SLOCAN FOREST	891231
242	SLOCAN FOREST	881231
243	SUMMIT RESOURCES	961231
244	SUMMIT RESOURCES	951231
245	SUMMIT RESOURCES	941231
246	SUMMIT RESOURCES	931231
247	SUMMIT RESOURCES	921231
248	SUMMIT RESOURCES	911231
249	UNITED TRI-STAR RESOURCES	961231
250	UNITED TRI-STAR RESOURCES	951231

#	COMPANY NAME	YEAR END
251	UNITED TRI-STAR RESOURCES	941231
252	UNITED TRI-STAR RESOURCES	931231
253	UNITED TRI-STAR RESOURCES	921231
254	UNITED TRI-STAR RESOURCES	911231
255	TARRAGON OIL AND GAS LIMITED	961231
256	TARRAGON OIL AND GAS LIMITED	951231
257	TARRAGON OIL AND GAS LIMITED	941231
258	TARRAGON OIL AND GAS LIMITED	931231
259	TARRAGON OIL AND GAS LIMITED	921231
260	TARRAGON OIL AND GAS LIMITED	911231
	CANADIAN COMPANIES, CONT	
	ADDITIONAL COMPANIES - INCOMPLETE OR LESS THAN 1996-1 PANELS	
261	AGRIUM INC (was COMINCO FERT.)	961231
262	ALCAN	961231
263	ANDERSON EXPLORATION LTD	960930
264	ANDERSON EXPLORATION LTD	950930
265	ANDERSON EXPLORATION LTD	940930
266	ANDERSON EXPLORATION LTD	930930
267	ANDERSON EXPLORATION LTD	920930
268	AT PLASTICS INC	961231
269	AT PLASTICS INC	951231
270	AT PLASTICS INC	941231
271	ATLANTIS RESOURCES LTD	941130
272	ATLANTIS RESOURCES LTD	931231
273	ATLANTIS RESOURCES LTD	921231
274	ATLANTIS RESOURCES LTD	911231
275	AUR RESOURCES INC	961231
276	AUR RESOURCES INC	951231
277	AUR RESOURCES INC	930930
278	AUR RESOURCES INC	920930
279	AVENOR INC	961231
280	AVENOR INC	931231
281	BACA RESOURCES LTD	931130
282	BACA RESOURCES LTD	921130
283	BACA RESOURCES LTD	911130
284	BACKER PETROLEUM CORP	961231
285	BACKER PETROLEUM CORP	951231
286	BACKER PETROLEUM CORP	941231
287	BARRINGTON PETROLEUM LTD	961231
288	BARRINGTON PETROLEUM LTD	951231
289	BARRINGTON PETROLEUM LTD	941231
290	BARRINGTON PETROLEUM LTD	931231
291	BARRINGTON PETROLEUM LTD	921231
292	BATTLE CREEK DEVELOPMENTS LTD	940228
293	BATTLE CREEK DEVELOPMENTS LTD	930228
294	BC SUGAR REFINERY LIMITED	960930
295	BC SUGAR REFINERY LIMITED	950930
296	BC SUGAR REFINERY LIMITED	940930
297	BC SUGAR REFINERY LIMITED	930930

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#	COMPANY NAME	YEAR END
298	BEAU CANADA EXPLORATION LTD	961231
299	BEAU CANADA EXPLORATION LTD	951231
300	BEAU CANADA EXPLORATION LTD	941231
301	BEAU CANADA EXPLORATION LTD	931231
302	BEAU CANADA EXPLORATION LTD	911231
303	BEMA GOLD CORP	951231
304	BEMA GOLD CORP	941231
305	BEMA GOLD CORP	931231
306	BEMA GOLD CORP	921231
307	BEMA GOLD CORP	911231
308	BEMA GOLD CORP	901231
309	BEMA GOLD CORP	891231
310	BLUE RANGE RESOURCE CORPORATION	950331
311	BLUE RANGE RESOURCE CORPORATION	930331
312	BLUE RANGE RESOURCE CORPORATION	920331
313	BLUE RANGE RESOURCE CORPORATION	960331
314	BLUE RANGE RESOURCE CORPORATION	941231
315	BLUE RANGE RESOURCE CORPORATION	921231
316	BOW VALLEY ENERGY INC	931231
317	BOW VALLEY INDUSTRIES LTD	921231
318	BOW VALLEY INDUSTRIES LTD	911231
319	BOW VALLEY INDUSTRIES LTD	901231
320	BOW VALLEY INDUSTRIES LTD	891231
321	BOWTEX ENERGY (CANADA) CORP	930331
322	BOWTEX ENERGY (CANADA) CORP	920331
323	BRASCADE RESOURCES INC	941231
324	BRASCADE RESOURCES INC	931231
325	BRASCADE RESOURCES INC	921231
326	BRASCAN LIMITED	941231
327	BRASCAN LIMITED	931231
328	BRASCAN LIMITED	921231
329	BRENDA MINES LTD	951231
330	BRENDA MINES LTD	941231
331	BRENDA MINES LTD	931231
332	BRENDA MINES LTD	921231
333	BRENDA MINES LTD	911231
334	BRENDA MINES LTD	901231
335	BRENDA MINES LTD	891231
336	BRENDA MINES LTD	881231
337	BRENDA MINES LTD	871231
338	BRENDA MINES LTD	861231
339	CABER EXPLORATION LTD	950731
340	CABER EXPLORATION LTD	940731
341	CABER EXPLORATION LTD	930731
342	CABER EXPLORATION LTD	920731
343	CABER EXPLORATION LTD	961231
344	CAMBIOR INC	961231
345	CAMBIOR INC	951231
346	CAMBIOR INC	941231
347	CAMBIOR INC	931231
348	CAMBIOR INC	931231

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#	COMPANY NAME	YEAR END
349	CAMPBELL RESOURCES INC	931231
350	CAMPBELL RESOURCES INC	921231
351	CAMPBELL RESOURCES INC	911231
352	CAMPBELL RESOURCES INC	901231
353	CAMPBELL RESOURCES INC	891231
354	CAMPBELL RESOURCES INC	881231
355	CAMPBELL RESOURCES INC	871231
356	CANADA SOUTHERN PETROLEUM LTD	951231
357	CANADA SOUTHERN PETROLEUM LTD	941231
358	CANADA SOUTHERN PETROLEUM LTD	931231
359	CANADA SOUTHERN PETROLEUM LTD	921231
360	CANADA SOUTHERN PETROLEUMLTD	961231
361	CANADA TUNGSTEN INC	951231
362	CANADA TUNGSTEN INC	941231
363	CANADA TUNGSTEN INC	931231
364	CANADA TUNGSTEN INC	930101
365	CANADA TUNGSTEN INC	911231
366	CANADA TUNGSTEN INC	901231
367	CANADA TUNGSTEN INC	891231
368	CANADA TUNGSTEN INC	881231
369	CANADA TUNGSTEN INC	871231
370	CANADA TUNGSTEN INC	861231
371	CANADA TUNGSTEN INC	851231
372	CANADIAN 88 ENERGY CORP	961231
373	CANADIAN 88 ENERGY CORP	951231
374	CANADIAN 88 ENERGY CORP	941231
375	CANADIAN 88 ENERGY CORP	931231
376	CANADIAN JOREX LIMITED	951231
377	CANADIAN JOREX LIMITED	941231
378	CANADIAN JOREX LIMITED	931231
379	CANADIAN JOREX LIMITED	921231
380	CANADIAN PACIFIC	951231
381	CANFOR CORP	921231
382	CHANNEL RESOURCES LTD	940930
383	CHANNEL RESOURCES LTD	930930
384	CIMARRON PETROLEUM LTD	961231
385	CIMARRON PETROLEUM LTD	951231
386	CIMARRON PETROLEUM LTD	941231
387	CIMARRON PETROLEUM LTD	940430
388	CIMARRON PETROLEUM LTD	930430
389	CIMARRON PETROLEUM LTD	920430
390	CITADEL GOLD MINES INC	960930
391	CITADEL GOLD MINES INC	950930
392	CITADEL GOLD MINES INC	940930
393	CLAUDE RESOURCES INC	961231
394	CLAUDE RESOURCES INC	951231
395	CLAUDE RESOURCES INC	951231
396	CLAUDE RESOURCES INC	941231
397	CLAUDE RESOURCES INC	931231
398	CLAUDE RESOURCES INC	921231
399	CO-ENERCO RESOURCES LTD	931231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
400	CO-ENERCO RESOURCES LTD	921231
401	CO-ENERCO RESOURCES LTD	911231
402	CO-MAXX ENERGY GROUP INC	941231
403	CO-MAXX ENERGY GROUP INC	941231
404	CO-MAXX ENERGY GROUP INC	931231
405	COGAS ENERGY LIMITED	931231
406	COGAS ENERGY LIMITED	921231
407	COMINCO FERTILIZERS LTD	941231
408	COMINCO FERTILIZERS LTD	931231
409	CONSOLIDATED NEVADA GOLDFIELDS	960630
410	CONSOLIDATED NEVADA GOLDFIELDS	950630
411	CONSOLIDATED NEVADA GOLDFIELDS	940630
412	CONWEST EXPLORATION COMPANY LIMITED	941231
413	CONWEST EXPLORATION COMPANY LIMITED	931231
414	CONWEST EXPLORATION COMPANY LIMITED	921231
415	CONWEST EXPLORATION COMPANY LIMITED	911231
416	CORNUCOPIA RESOURCES LTD	961231
417	CORNUCOPIA RESOURCES LTD	951231
418	CORNUCOPIA RESOURCES LTD	941231
419	CORNUCOPIA RESOURCES LTD	931231
420	CORNUCOPIA RESOURCES LTD	921231
421	CZAR RESOURCES LTD	941231
422	CZAR RESOURCES LTD	931231
423	CZAR RESOURCES LTD	921231
424	CZAR RESOURCES LTD	911231
425	CZAR RESOURCES LTD	901231
426	DENBRIDGE CAPITAL CORPORATION	941231
427	DENBRIDGE CAPITAL CORPORATION	931231
428	DEVRAN PETROLEUM LTD	941231
429	DEVRAN PETROLEUM LTD	931231
430	DEVRAN PETROLEUM LTD	921231
431	DISCOVERY WEST CORP	951231
432	DISCOVERY WEST CORP	931231
433	DISCOVERY WEST CORP	921231
434	DISCOVERY WEST CORP	911231
435	ELAN ENERGY INC	961231
436	ELAN ENERGY INC	951231
437	ELAN ENERGY INC	951231
438	ELAN ENERGY INC	941231
439	ELAN ENERGY INC	931231
440	ELAN ENERGY INC	921231
441	ELECTROHOME LIMITED	960831
442	ELECTROHOME LIMITED	950831
443	ELECTROHOME LIMITED	960831
444	ELECTROHOME LIMITED	950831
445	ELECTROHOME LIMITED	940831
446	ELECTROHOME LIMITED	930831
447	ENCAL ENERGY LTD	961231
448	ENCAL ENERGY LTD	951231
449	ENCAL ENERGY LTD	941231
450	ENCAL ENERGY LTD	931231

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#	COMPANY NAME	YEAR END
451	ENCAL ENERGY LTD	921231
452	ENCSOR INC	950731
453	ENCSOR INC	940731
454	ENCSOR INC	930731
455	ENERPLUS RESOURCES CORPORATION	921231
456	ENERPLUS RESOURCES CORPORATION	911231
457	ENERPLUS RESOURCES CORPORATION	931231
458	ENERPLUS RESOURCES CORPORATION	901231
459	EQUITY SILVER MINES LIMITED	941231
460	EQUITY SILVER MINES LIMITED	931231
461	EQUITY SILVER MINES LIMITED	921231
462	EQUITY SILVER MINES LIMITED	911231
463	EQUITY SILVER MINES LIMITED	901231
464	EQUITY SILVER MINES LIMITED	891231
465	EQUITY SILVER MINES LIMITED	881231
466	EQUITY SILVER MINES LIMITED	871231
467	ESPALAU INC	950831
468	FORTUNE ENERGY INC	961231
469	FORTUNE ENERGY INC	951231
470	FORTUNE ENERGY INC	941231
471	FORTUNE ENERGY INC	931231
472	GIBRALTAR MINES LIMITED	951231
473	GIBRALTAR MINES LIMITED	941231
474	GIBRALTAR MINES LIMITED	931231
475	GIBRALTAR MINES LIMITED	921231
476	GIBRALTAR MINES LIMITED	911231
477	GIBRALTAR MINES LIMITED	901231
478	GIBRALTAR MINES LIMITED	891231
479	GOLDCORP INC	961231
480	GOLDCORP INC	951231
481	GOLDCORP INC	941231
482	GOLDCORP INC	931231
483	GOLDCORP INC	921231
484	GRANGER ENERGY CORP	951130
485	GRANGER ENERGY CORP	931130
486	GRANGES INC	951231
487	GRANGES INC	941231
488	GRANGES INC	931231
489	GRANGES INC	921231
490	GULF CANADA RESOURCES LIMITED	951231
491	GULF CANADA RESOURCES LIMITED	941231
492	GULF CANADA RESOURCES LIMITED	931231
493	GULF CANADA RESOURCES LIMITED	921231
494	GULF CANADA RESOURCES LIMITED	961231
495	HARBOUR PETROLEUM COMPANY LIMITED	961231
496	HARBOUR PETROLEUM COMPANY LIMITED	951231
497	HARBOUR PETROLEUM COMPANY LIMITED	941231
498	HARBOUR PETROLEUM COMPANY LIMITED	931231
499	HARBOUR PETROLEUM COMPANY LIMITED	921231
500	HCO ENERGY LTD	961231
501	HCO ENERGY LTD	951231

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#	COMPANY NAME	YEAR END
502	HCO ENERGY LTD	941231
503	HCO ENERGY LTD	931231
504	HEMLO GOLD MINES INC	951231
505	HEMLO GOLD MINES INC	941231
506	HEMLO GOLD MINES INC	931231
507	HEMLO GOLD MINES INC	921231
508	HEMLO GOLD MINES INC	911231
509	HIGHRIDGE EXPLORATION LTD	961231
510	HIGHRIDGE EXPLORATION LTD	951231
511	HIGHRIDGE EXPLORATION LTD	941231
512	HIGHRIDGE EXPLORATION LTD	931231
513	HIGHRIDGE EXPLORATION LTD	921231
514	HILLCREST RESOURCES LTD	941130
515	HILLCREST RESOURCES LTD	931130
516	HILLCREST RESOURCES LTD	921130
517	HILLCREST RESOURCES LTD	911130
518	HYCROFT RESOURCES & DEVELOPMENT CORP	941231
519	HYCROFT RESOURCES & DEVELOPMENT CORP	931231
520	IMPERIAL METALS CORPORATION	951231
521	IMPERIAL METALS CORPORATION	941231
522	IMPERIAL METALS CORPORATION	940331
523	IMPERIAL METALS CORPORATION	930331
524	IMPERIAL METALS CORPORATION	920331
525	IMPERIAL METALS CORPORATION	961231
526	INCO LIMITED	961231
527	INCO LIMITED	951231
528	INTENSITY RESOURCES LTD	951231
529	INTENSITY RESOURCES LTD	941231
530	INTENSITY RESOURCES LTD	931231
531	INTENSITY RESOURCES LTD	921231
532	INTENSITY RESOURCES LTD	961231
533	INTER-CITY PRODUCTS CORPORATION	961231
534	INTER-CITY PRODUCTS CORPORATION	951231
535	INTER-CITY PRODUCTS CORPORATION	941231
536	INTER-CITY PRODUCTS CORPORATION	931231
537	INTER-CITY PRODUCTS CORPORATION	921231
538	INTERNATIONAL COLIN ENERGY CORPORATION	951231
539	INTERNATIONAL COLIN ENERGY CORPORATION	941231
540	INTERNATIONAL COLIN ENERGY CORPORATION	931231
541	INTERNATIONAL PETROLEUM CORPORATION	960930
542	INTERNATIONAL PETROLEUM CORPORATION	950930
543	INTERNATIONAL PETROLEUM CORPORATION	940930
544	INTERNATIONAL PETROLEUM CORPORATION	930930
545	JORDAN PETROLEUM LTD	951130
546	JORDAN PETROLEUM LTD	941130
547	JORDAN PETROLEUM LTD	931130
548	JORDAN PETROLEUM LTD	961130
549	KINROSS GOLD CORPORATION	951231
550	KINROSS GOLD CORPORATION	941231
551	KINROSS GOLD CORPORATION	931231
552	KINROSS GOLD CORPORATION	961231

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#	COMPANY NAME	YEAR END
553	LAC MINERALS LTD.	931231
554	LAIDLAW INC	960831
555	LAIDLAW INC	950831
556	MANNVILLE OIL & GAS LTD	941231
557	MANNVILLE OIL & GAS LTD	931231
558	MANNVILLE OIL & GAS LTD	921231
559	MARK RESOURCES INC	951231
560	MARK RESOURCES INC	941231
561	MARK RESOURCES INC	931231
562	MARK RESOURCES INC	921231
563	MARK RESOURCES INC	901231
564	METALL MINING CORPORATION	941231
565	METALL MINING CORPORATION	931231
566	METALL MINING CORPORATION	921231
567	MIRAMAR MINING CORPORATION	951231
568	MIRAMAR MINING CORPORATION	941231
569	MIRAMAR MINING CORPORATION	931231
570	MIRAMAR MINING CORPORATION	961231
571	MORGAN HYDROCARBONS INC	951231
572	MORGAN HYDROCARBONS INC	941231
573	MORGAN HYDROCARBONS INC	931231
574	MORGAN HYDROCARBONS INC	921231
575	MORGAN HYDROCARBONS INC	911231
576	MORRISON PETROEUMS LTD	951231
577	MORRISON PETROEUMS LTD	941231
578	MORRISON PETROEUMS LTD	931231
579	MORRISON PETROEUMS LTD	921231
580	MORRISON PETROEUMS LTD	911231
581	NEWALTA CORPORATION	951231
582	NEWALTA CORPORATION	941231
583	NEWALTA CORPORATION	931231
584	NEWALTA CORPORATION	921231
585	NEWALTA CORPORATION	911231
586	NORTH AMERICAN PALLADIUM LTD	961231
587	NORTH AMERICAN PALLADIUM LTD	951231
588	NORTH AMERICAN PALLADIUM LTD	941231
589	NORTH AMERICAN PALLADIUM LTD	931231
590	NORTH CANADIAN OILS LIMITED	931231
591	NORTH CANADIAN OILS LIMITED	921231
592	NORTH CANADIAN OILS LIMITED	911231
593	NOVA CORPORATION	961231
594	NOVA CORPORATION	951231
595	NOVA CORPORATION	941231
596	NUGAS LIMITED	961231
597	NUGAS LIMITED	951231
598	NUGAS LIMITED	941231
599	NUGAS LIMITED	931231
600	NUMAC ENERGY INC	931231
601	OCELOT ENERGY INC	951231
602	OCELOT ENERGY INC	941231
603	OCELOT ENERGY INC	931231

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#	COMPANY NAME	YEAR END
604	OCELOT ENERGY INC	921231
605	OCELOT ENERGY INC	961231
606	OGY PETROLEUMS LTD	951231
607	OGY PETROLEUMS LTD	941231
608	OGY PETROLEUMS LTD	931231
609	OGY PETROLEUMS LTD	921231
610	OGY PETROLEUMS LTD	911231
611	OGY PETROLEUMS LTD	961231
612	OMEGA HYDROCARBONS LTD	941231
613	OMEGA HYDROCARBONS LTD	931231
614	OMEGA HYDROCARBONS LTD	921231
615	OMEGA HYDROCARBONS LTD	911231
616	ORENDA FOREST PRODUCTS LTD	960331
617	ORENDA FOREST PRODUCTS LTD	950331
618	ORENDA FOREST PRODUCTS LTD	940331
619	ORENDA FOREST PRODUCTS LTD	930331
620	ORENDA FOREST PRODUCTS LTD	920331
621	PALOMA PETROLEUM LTD	951231
622	PALOMA PETROLEUM LTD	941231
623	PALOMA PETROLEUM LTD	931231
624	PALOMA PETROLEUM LTD	911231
625	PALOMA PETROLEUM LTD	921231
626	PANCANADIAN PETROLEUM LIMITED	951231
627	PANCANADIAN PETROLEUM LIMITED	941231
628	PANCANADIAN PETROLEUM LIMITED	931231
629	PANCANADIAN PETROLEUM LIMITED	921231
630	PANCANADIAN PETROLEUM LIMITED	911231
631	PANCANADIAN PETROLEUM LIMITED	961231
632	PETROREP RESOURCES LTD	951231
633	PETROREP RESOURCES LTD	941231
634	PETROREP RESOURCES LTD	931231
635	PETROREP RESOURCES LTD	921231
636	PETROREP RESOURCES LTD	961231
637	PETROSTAR PETROLEUMS INC	951231
638	PETROSTAR PETROLEUMS INC	941231
639	PETROSTAR PETROLEUMS INC	931231
640	PETROSTAR PETROLEUMS INC	921231
641	PHILIP ENVIRONMENTAL INC	961231
642	PHILIP ENVIRONMENTAL INC	951231
643	PHILIP ENVIRONMENTAL INC	941231
644	PHILIP ENVIRONMENTAL INC	931231
645	PINNACLE RESOURCES LTD	961231
646	PINNACLE RESOURCES LTD.	951231
647	PINNACLE RESOURCES LTD.	941231
648	PINNACLE RESOURCES LTD.	931231
649	PINNACLE RESOURCES LTD.	921231
650	PLACER DOME INC	961231
651	POTASH CORP OF SASKATCHEWAN INC	961231
652	POTASH CORP OF SASKATCHEWAN INC	951231
653	PRAIRIE OIL ROYALTIES COMPANY, LTD	931231
654	PRINCETON MINING CORPORATION	951231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
655	QUEBECOR PRINTING INC	961231
656	QUEBECOR PRINTING INC	951231
657	QUEBECOR PRINTING INC	941231
658	RAM PETROLEUMS LIMITED	961231
659	RAM PETROLEUMS LIMITED	951231
660	RAM PETROLEUMS LIMITED	941231
661	RAM PETROLEUMS LIMITED	931231
662	RANCHMEN'S RESOURCES LTD	941231
663	RANCHMEN'S RESOURCES LTD	931231
664	RANCHMEN'S RESOURCES LTD	921231
665	RANCHMEN'S RESOURCES LTD	911231
666	RAYROCK YELLOWKNIFE RESOURCES INC	961231
667	RAYROCK YELLOWKNIFE RESOURCES INC	951231
668	RAYROCK YELLOWKNIFE RESOURCES INC	931231
669	RAYROCK YELLOWKNIFE RESOURCES INC	921231
670	RAYROCK YELLOWKNIFE RESOURCES INC	911231
671	RENAISSANCE ENERGY LTD	961231
672	RENAISSANCE ENERGY LTD	951231
673	RENAISSANCE ENERGY LTD	941231
674	RENAISSANCE ENERGY LTD	931231
675	RENAISSANCE ENERGY LTD	921231
676	RICHMONT MINES INC	961231
677	RICHMONT MINES INC	951231
678	RICHMONT MINES INC	941231
679	RICHMONT MINES INC	931231
680	RIGEL ENERGY CORPORATION	961231
681	RIGEL ENERGY CORPORATION	951231
682	RIGEL ENERGY CORPORATION	941231
683	RIGEL ENERGY CORPORATION	931231
684	RIO ALGOM LIMITED	951231
685	RIO ALGOM LIMITED	941231
686	RIO ALGOM LIMITED	921231
687	RIO ALGOM LIMITED	911231
688	RIO ALGOM LIMITED	931231
689	ROYAL OAK MINES INC	961231
690	ROYAL OAK MINES INC	951231
691	ROYAL OAK MINES INC	941231
692	SAXON PETROLEUM INC	951231
693	SAXON PETROLEUM INC	941231
694	SAXON PETROLEUM INC	931231
695	SAXON PETROLEUM INC	921231
696	SAXON PETROLEUM INC	911231
697	SCEPTRE RESOURCES LIMITED	951231
698	SCEPTRE RESOURCES LIMITED	941231
699	SCEPTRE RESOURCES LIMITED	931231
700	SCEPTRE RESOURCES LIMITED	921231
701	SCEPTRE RESOURCES LIMITED	911231
702	SERENPET INC	951231
703	SERENPET INC	941231
704	SERENPET INC	931231
705	SERENPET INC	921231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
706	SHELTER OIL & GAS LTD	931231
707	SHERRITT INC	941231
708	SHERRITT INC	931231
709	SILCORP LIMITED	961229
710	SILCORP LIMITED	951231
711	SILCORP LIMITED	941231
712	SONORA GOLD CORP	951231
713	SONORA GOLD CORP	941231
714	SONORA GOLD CORP	931231
715	ST ANDREW GOLDFIELDS LTD	961231
716	ST ANDREW GOLDFIELDS LTD	951231
717	ST ANDREW GOLDFIELDS LTD	941231
718	ST ANDREW GOLDFIELDS LTD	931231
719	SUNCOR INC	961231
720	SUNCOR INC	951231
721	SUNCOR INC	941231
722	SUNCOR INC	931231
723	SUNCOR INC	921231
724	TAI ENERGY CORPORATION	931231
725	TALISMAN ENERGY INC	961231
726	TALISMAN ENERGY INC	951231
727	TALISMAN ENERGY INC	941231
728	TALISMAN ENERGY INC	931231
729	TEMINCO RESOURCES LTD	960731
730	TEMINCO RESOURCES LTD	950731
731	TEMINCO RESOURCES LTD	940731
732	TEMINCO RESOURCES LTD	930731
733	THE RIMOIL CORPORATION	941231
734	THE RIMOIL CORPORATION	931231
735	THE RIMOIL CORPORATION	921231
736	TIVERTON PETROLEUMS LTD	960331
737	TIVERTON PETROLEUMS LTD	950331
738	TIVERTON PETROLEUMS LTD	940331
739	TIVERTON PETROLEUMS LTD	930331
740	TIVERTON PETROLEUMS LTD	920331
741	TRANSWEST ENERGY INC	951231
742	TRANSWEST ENERGY INC	941231
743	TRANSWEST ENERGY INC	931231
744	TRI LINK RESOURCES LTD	960331
745	TRI LINK RESOURCES LTD	941231
746	TRI LINK RESOURCES LTD	931231
747	ULSTER PETROLEUMS LTD	961231
748	ULSTER PETROLEUMS LTD	951231
749	ULSTER PETROLEUMS LTD	941231
750	ULSTER PETROLEUMS LTD	931231
751	ULSTER PETROLEUMS LTD	921231
752	UNITED RAYORE GAS LTD	951231
753	UNITED RAYORE GAS LTD	941231
754	UNITED RAYORE GAS LTD	931231
755	UNITED RAYORE GAS LTD	930331
756	UNITED RAYORE GAS LTD	920331

#	COMPANY NAME	YEAR END
757	UNITED RAYORE GAS LTD	961231
758	VICEROY RESOURCE CORP	960331
759	WASCANA ENERGY INC	951231
760	WASCANA ENERGY INC	941231
761	WASCANA ENERGY INC	931231
762	WASCANA ENERGY INC	961231
763	WEST FRASER TIMBER CO LTD	961231
764	WESTMIN RESOURCES LIMITED	951231
765	WESTMIN RESOURCES LIMITED	941231
766	WESTMIN RESOURCES LIMITED	931231
767	WESTMIN RESOURCES LIMITED	921231
	US COMPANIES	
	COMPLETE PANELS 1996-1 OR LONGER	
768	ALLIANT TECHSYSTEMS INC	960331
769	ALLIANT TECHSYSTEMS INC	950331
770	ALLIANT TECHSYSTEMS INC	940331
771	ALLIANT TECHSYSTEMS INC	930331
772	ALLIANT TECHSYSTEMS INC	920331
773	ALLIANT TECHSYSTEMS INC	910331
774	ALLIANT TECHSYSTEMS INC	901231
775	ALLIEDSIGNAL INC	961231
776	ALLIEDSIGNAL INC	951231
777	ALLIEDSIGNAL INC	941231
778	ALLIEDSIGNAL INC	931231
779	ALLIEDSIGNAL INC	921231
780	ALLIEDSIGNAL INC	911231
781	ALUMINUM CO OF AMERICA	961231
782	ALUMINUM CO OF AMERICA	951231
783	ALUMINUM CO OF AMERICA	941231
784	ALUMINUM CO OF AMERICA	931231
785	ALUMINUM CO OF AMERICA	921231
786	ALUMINUM CO OF AMERICA	911231
787	ALUMINUM CO OF AMERICA	901231
788	ATLANTIC RICHFIELD CO	961231
789	ATLANTIC RICHFIELD CO	951231
790	ATLANTIC RICHFIELD CO	941231
791	ATLANTIC RICHFIELD CO	931231
792	ATLANTIC RICHFIELD CO	921231
793	ATLANTIC RICHFIELD CO	911231
794	ATLANTIC RICHFIELD CO	901231
795	ATLANTIC RICHFIELD CO	891231
796	B F GOODRICH CO	961231
797	B F GOODRICH CO	951231
798	B F GOODRICH CO	941231
799	B F GOODRICH CO	931231
800	B F GOODRICH CO	921231
801	B F GOODRICH CO	911231
802	B F GOODRICH CO	901231
803	B F GOODRICH CO	891231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
804	B F GOODRICH CO	881231
805	CHEVRON CORP	961231
806	CHEVRON CORP	951231
807	CHEVRON CORP	941231
808	CHEVRON CORP	931231
809	CHEVRON CORP	921231
810	CHEVRON CORP	911231
811	CHEVRON CORP	901231
812	CHEVRON CORP	881231
813	CHEVRON CORP	871231
814	E I DU PONT DE NEMOURS & CO	961231
815	E I DU PONT DE NEMOURS & CO	951231
816	E I DU PONT DE NEMOURS & CO	941231
817	E I DU PONT DE NEMOURS & CO	931231
818	E I DU PONT DE NEMOURS & CO	921231
819	E I DU PONT DE NEMOURS & CO	911231
820	E I DU PONT DE NEMOURS & CO	901231
821	EXXON CORP	961231
822	EXXON CORP	951231
823	EXXON CORP	941231
824	EXXON CORP	931231
825	EXXON CORP	921231
826	EXXON CORP	911231
827	EXXON CORP	901231
828	EXXON CORP	891231
829	EXXON CORP	881231
830	GENERAL SIGNAL CORP	961231
831	GENERAL SIGNAL CORP	951231
832	GENERAL SIGNAL CORP	941231
833	GENERAL SIGNAL CORP	931231
834	GENERAL SIGNAL CORP	921231
835	GENERAL SIGNAL CORP	911231
836	GENERAL SIGNAL CORP	901231
837	GENERAL SIGNAL CORP	891231
838	HOMESTAKE MINING CO	961231
839	HOMESTAKE MINING CO	951231
840	HOMESTAKE MINING CO	941231
841	HOMESTAKE MINING CO	931231
842	HOMESTAKE MINING CO	921231
843	HOMESTAKE MINING CO	911231
844	HOMESTAKE MINING CO	901231
845	HOMESTAKE MINING CO	891231
846	HOMESTAKE MINING CO	881231
847	KAISER ALUMINUM CORPORATION	961231
848	KAISER ALUMINUM CORPORATION	951231
849	KAISER ALUMINUM CORPORATION	941231
850	KAISER ALUMINUM CORPORATION	931231
851	KAISER ALUMINUM CORPORATION	921231
852	KAISER ALUMINUM CORPORATION	911231
853	MOBIL CORP	961231
854	MOBIL CORP	951231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
855	MOBIL CORP	941231
856	MOBIL CORP	931231
857	MOBIL CORP	921231
858	MOBIL CORP	911231
859	MOBIL CORP	901231
860	MOBIL CORP	891231
861	MOBIL CORP	881231
862	MOBIL CORP	871231
863	PEGASUS GOLD INC	961231
864	PEGASUS GOLD INC	951231
865	PEGASUS GOLD INC	941231
866	PEGASUS GOLD INC	931231
867	PEGASUS GOLD INC	921231
868	PEGASUS GOLD INC	911231
869	PEGASUS GOLD INC	901231
870	PEGASUS GOLD INC	891231
871	PEGASUS GOLD INC	881231
872	PHILLIPS PETROLEUM CO	961231
873	PHILLIPS PETROLEUM CO	951231
874	PHILLIPS PETROLEUM CO	941231
875	PHILLIPS PETROLEUM CO	931231
876	PHILLIPS PETROLEUM CO	921231
877	PHILLIPS PETROLEUM CO	911231
878	PHILLIPS PETROLEUM CO	901231
879	PHILLIPS PETROLEUM CO	891231
880	PHILLIPS PETROLEUM CO	881231
881	PHILLIPS PETROLEUM CO	871231
882	REYNOLDS METALS CO	961231
883	REYNOLDS METALS CO	951231
884	REYNOLDS METALS CO	941231
885	REYNOLDS METALS CO	931231
886	REYNOLDS METALS CO	921231
887	REYNOLDS METALS CO	911231
888	SL INDUSTRIES INC	960731
889	SL INDUSTRIES INC	950731
890	SL INDUSTRIES INC	940731
891	SL INDUSTRIES INC	930731
892	SL INDUSTRIES INC	920731
893	SL INDUSTRIES INC	910731
894	SL INDUSTRIES INC	900731
895	UNOCAL CORP	961231
896	WITCO CORP	961231
897	UNOCAL CORP	951231
898	UNOCAL CORP	941231
899	UNOCAL CORP	931231
900	UNOCAL CORP	921231
901	UNOCAL CORP	911231
902	UNOCAL CORP	901231
903	WITCO CORP	951231
904	WITCO CORP	941231
905	WITCO CORP	931231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
906	WITCO CORP	921231
907	WITCO CORP	911231
908	WITCO CORP	901231
909	WITCO CORP	891231
910	ASARCO INC	961231
911	ASARCO INC	951231
912	ASARCO INC	941231
913	ASARCO INC	931231
914	ASARCO INC	921231
915	ASARCO INC	911231
916	ASARCO INC	901231
917	ASARCO INC	891231
918	CABOT CORP	960930
919	CABOT CORP	950930
920	CABOT CORP	940930
921	CABOT CORP	930930
922	CABOT CORP	920930
923	CABOT CORP	910930
924	CABOT CORP	900930
925	CABOT CORP	890930
926	CHEMED CORP	961231
927	CHEMED CORP	951231
928	CHEMED CORP	941231
929	CHEMED CORP	931231
930	CHEMED CORP	921231
931	CHEMED CORP	911231
932	CRANE CO	961231
933	CRANE CO	951231
934	CRANE CO	941231
935	CRANE CO	931231
936	CRANE CO	921231
937	CRANE CO	911231
938	CRANE CO	901231
939	CRANE CO	891231
940	CRANE CO	881231
941	CURTISS WRIGHT CORP	961231
942	CURTISS WRIGHT CORP	951231
943	CURTISS WRIGHT CORP	941231
944	CURTISS WRIGHT CORP	931231
945	CURTISS WRIGHT CORP	921231
946	CURTISS WRIGHT CORP	911231
947	CURTISS WRIGHT CORP	901231
948	CYPRUS AMAX MINERALS CO	961231
949	CYPRUS AMAX MINERALS CO	951231
950	CYPRUS AMAX MINERALS CO	941231
951	CYPRUS AMAX MINERALS CO	931231
952	CYPRUS AMAX MINERALS CO	921231
953	CYPRUS AMAX MINERALS CO	911231
954	DEXTER CORP	961231
955	DEXTER CORP	951231
956	DEXTER CORP	941231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
957	DEXTER CORP	931231
958	DEXTER CORP	921231
959	DEXTER CORP	911231
960	FREEPORT McMORAN INC	961231
961	FREEPORT McMORAN INC	951231
962	FREEPORT McMORAN INC	941231
963	FREEPORT McMORAN INC	931231
964	FREEPORT McMORAN INC	921231
965	FREEPORT McMORAN INC	911231
966	FREEPORT McMORAN INC	901231
967	FREEPORT McMORAN INC	891231
968	FREEPORT McMORAN INC	881231
969	GENERAL HOUSEWARES CORP	961231
970	GENERAL HOUSEWARES CORP	951231
971	GENERAL HOUSEWARES CORP	941231
972	GENERAL HOUSEWARES CORP	931231
973	GENERAL HOUSEWARES CORP	921231
974	GENERAL HOUSEWARES CORP	911231
975	GENERAL HOUSEWARES CORP	901231
976	GOODYEAR TIRE & RUBBER CO	961231
977	GOODYEAR TIRE & RUBBER CO	951231
978	GOODYEAR TIRE & RUBBER CO	941231
979	GOODYEAR TIRE & RUBBER CO	931231
980	GOODYEAR TIRE & RUBBER CO	921231
981	GOODYEAR TIRE & RUBBER CO	911231
982	HECLA MINING CO	961231
983	HECLA MINING CO	951231
984	HECLA MINING CO	941231
985	HECLA MINING CO	931231
986	HECLA MINING CO	921231
987	HECLA MINING CO	911231
988	HECLA MINING CO	901231
989	INTERNATIONAL SPECIALTY PRODUCTS INC	961231
990	INTERNATIONAL SPECIALTY PRODUCTS INC	951231
991	INTERNATIONAL SPECIALTY PRODUCTS INC	941231
992	INTERNATIONAL SPECIALTY PRODUCTS INC	931231
993	INTERNATIONAL SPECIALTY PRODUCTS INC	921231
994	INTERNATIONAL SPECIALTY PRODUCTS INC	911231
995	LYONDELL PETROCHEMICAL CO	961231
996	LYONDELL PETROCHEMICAL CO	951231
997	LYONDELL PETROCHEMICAL CO	941231
998	LYONDELL PETROCHEMICAL CO	931231
999	LYONDELL PETROCHEMICAL CO	921231
1000	LYONDELL PETROCHEMICAL CO	911231
1001	M A HANNA CO	961231
1002	M A HANNA CO	951231
1003	M A HANNA CO	941231
1004	M A HANNA CO	931231
1005	M A HANNA CO	921231
1006	M A HANNA CO	911231
1007	M A HANNA CO	901231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
1008	M A HANNA CO	891231
1009	MUELLER INDUSTRIES INC	961228
1010	MUELLER INDUSTRIES INC	951230
1011	MUELLER INDUSTRIES INC	941231
1012	MUELLER INDUSTRIES INC	931231
1013	MUELLER INDUSTRIES INC	921226
1014	MUELLER INDUSTRIES INC	911228
1015	MUELLER INDUSTRIES INC	901231
1016	PENNZOIL CO	961231
1017	PENNZOIL CO	951230
1018	PENNZOIL CO	941231
1019	PENNZOIL CO	931231
1020	PENNZOIL CO	921226
1021	PENNZOIL CO	911228
1022	PPG INDUSTRIES INC	961231
1023	PPG INDUSTRIES INC	951231
1024	PPG INDUSTRIES INC	941231
1025	PPG INDUSTRIES INC	931231
1026	PPG INDUSTRIES INC	921231
1027	PPG INDUSTRIES INC	911231
1028	ROHM & HAAS CO	961231
1029	ROHM & HAAS CO	951231
1030	ROHM & HAAS CO	941231
1031	ROHM & HAAS CO	931231
1032	ROHM & HAAS CO	921231
1033	ROHM & HAAS CO	911231
1034	SOUTHDOWN INC	961231
1035	SOUTHDOWN INC	951231
1036	SOUTHDOWN INC	941231
1037	SOUTHDOWN INC	931231
1038	SOUTHDOWN INC	921231
1039	SOUTHDOWN INC	911231
1040	TREDEGAR INDUSTRIES INC	961231
1041	TREDEGAR INDUSTRIES INC	951231
1042	TREDEGAR INDUSTRIES INC	941231
1043	TREDEGAR INDUSTRIES INC	931231
1044	TREDEGAR INDUSTRIES INC	921231
1045	TREDEGAR INDUSTRIES INC	911231
1046	TREDEGAR INDUSTRIES INC	901231
1047	TRW INC	961231
1048	TRW INC	951231
1049	TRW INC	941231
1050	TRW INC	931231
1051	TRW INC	921231
1052	TRW INC	911231
1053	VULCAN MATERIALS CO	961231
1054	VULCAN MATERIALS CO	951231
1055	VULCAN MATERIALS CO	941231
1056	VULCAN MATERIALS CO	931231
1057	VULCAN MATERIALS CO	921231
1058	VULCAN MATERIALS CO	911231

#	COMPANY NAME	YEAR END
1059	VULCAN MATERIALS CO	901231
1060	VULCAN MATERIALS CO	891231
1061	WATKINS JOHNSON CO	961231
1062	WATKINS JOHNSON CO	951231
1063	WATKINS JOHNSON CO	941231
1064	WATKINS JOHNSON CO	931231
1065	WATKINS JOHNSON CO	921231
1066	WATKINS JOHNSON CO	911231

US COMPANIES, CONT.

ADDITIONAL COMPANIES - INCOMPLETE OR LESS THAN 1996-1 PANELS

1067	ALBEMARLE CORP	961231
1068	ALLEGHENY TELEDYNE INC	961231
1069	ALLIED PRODUCTS CORP	961231
1070	ALUMAX INC	961231
1071	AMAX GOLD INC	961231
1072	AMERICAN HOME PRODUCTS	951231
1073	AMERICAN HOME PRODUCTS	941231
1074	AMERICAN HOME PRODUCTS CORP	961231
1075	AMERON INTERNATIONAL CORP	961130
1076	AMERON INTERNATIONAL CORP	951130
1077	AMERON INTERNATIONAL CORP	941130
1078	AMERON INTERNATIONAL CORP	931130
1079	AMERON INTERNATIONAL CORP	921130
1080	AMOCO CORP	961231
1081	AMOCO CORP	951231
1082	AMOCO CORP	941231
1083	AMOCO CORP	931231
1084	AMOCO CORP	921231
1085	AOI COAL CO	921231
1086	AOI COAL CO	911231
1087	AOI COAL CO	901231
1088	AOI COAL CO	891231
1089	AOI COAL CO	881231
1090	AOI COAL CO	871231
1091	APACHE CORP	961231
1092	APPLIED POWER INC	940831
1093	ARCO CHEMICAL CO	961231
1094	ARMSTRONG WORLD INDUSTRIES INC	961231
1095	ARMSTRONG WORLD INDUSTRIES INC	951231
1096	ARMSTRONG WORLD INDUSTRIES INC	941231
1097	ARMSTRONG WORLD INDUSTRIES INC	931231
1098	ARVIN INDUSTRIES INC	961229
1099	BATTLE MOUNTAIN GOLD CO	961231
1100	BATTLE MOUNTAIN GOLD CO	951231
1101	BATTLE MOUNTAIN GOLD CO	931231
1102	BEMIS CO INC	961231
1103	BESTFOODS	961231
1104	BORG WARNER AUTOMOTIVE INC	961231

#	COMPANY NAME	YEAR END
1105	BORG WARNER AUTOMOTIVE INC	951231
1106	BORG WARNER AUTOMOTIVE INC	941231
1107	BORG WARNER AUTOMOTIVE INC	931231
1108	BRUSH WELLMAN INC	961231
1109	BRUSH WELLMAN INC	951231
1110	BRUSH WELLMAN INC	941231
1111	BRUSH WELLMAN INC	931231
1112	CALMAT CO	961231
1113	CALMAT CO	951231
1114	CALMAT CO	931231
1115	CARPENTER TECHNOLOGY CORP	950630
1116	CARPENTER TECHNOLOGY CORP	940630
1117	CARPENTER TECHNOLOGY CORP	930630
1118	CARPENTER TECHNOLOGY CORP	920630
1119	CASE CORP	961231
1120	CHAMPION ENTERPRISES INC	961228
1121	CHAMPION ENTERPRISES INC	951231
1122	CHAMPION INTERNATIONAL CORP	961231
1123	CHART INDUSTRIES INC	961231
1124	CHEMFIRST INC	961231
1125	CLEVELAND CLIFFS INC	961231
1126	COASTAL CORP	961231
1127	COASTAL CORP	951231
1128	COASTAL CORP	941231
1129	COASTAL CORP	931231
1130	COLTEC INDUSTRIES INC	961231
1131	COLTEC INDUSTRIES INC	951231
1132	COLTEC INDUSTRIES INC	941231
1133	CONGOLEUM CORP	961231
1134	COOPER INDUSTRIES INC	961231
1135	COOPER INDUSTRIES INC	951231
1136	COOPER INDUSTRIES INC	941231
1137	COOPER INDUSTRIES INC	931231
1138	COUER D ALENE MINES CORP	961231
1139	CROMPTON & KNOWLES CORP	961228
1140	CROWN CORK & SEAL CO INC	961231
1141	CROWN CORK & SEAL CO INC	951231
1142	CROWN CORK & SEAL CO INC	941231
1143	CROWN CORK & SEAL CO INC	931231
1144	CTS CORP	961231
1145	CTS CORP	951231
1146	CTS CORP	941231
1147	CYTEC INDUSTRIES INC	961231
1148	DAKOTA MINING CORPORATION	951231
1149	DAKOTA MINING CORPORATION	941231
1150	DAKOTA MINING CORPORATION	931231
1151	DANA CORP	961231
1152	DANA CORP	951231
1153	DANA CORP	941231
1154	DANA CORP	931231
1155	DANAHER CORP	961231

#	COMPANY NAME	YEAR END
1156	DDL ELECTRONICS INC	960630
1157	DDL ELECTRONICS INC	950630
1158	DDL ELECTRONICS INC	940630
1159	DDL ELECTRONICS INC	930630
1160	DDL ELECTRONICS INC	920630
1161	DOW CHEMICAL CO	961231
1162	DOW CHEMICAL CO	951231
1163	DOW CHEMICAL CO	941231
1164	DOW CHEMICAL CO	931231
1165	DOW CHEMICAL CO	921231
1166	DUCOMMUN INC	961231
1167	DUCOMMUN INC	951231
1168	DUCOMMUN INC	941231
1169	DUCOMMUN INC	931231
1170	DUCOMMUN INC	921231
1171	DUCOMMUN INC	911231
1172	DUCOMMUN INC	901231
1173	DUCOMMUN INC	891231
1174	EASTMAN KODAK CO	961231
1175	EASTMAN KODAK CO	951231
1176	EASTMAN KODAK CO	941231
1177	EATON CORP	961231
1178	EATON CORP	951231
1179	EATON CORP	931231
1180	ECKO GROUP INC	951231
1181	ECKO GROUP INC	950101
1182	ECKO GROUP INC	940102
1183	EDO CORP	961231
1184	EG&G INC	961229
1185	EKCO GROUP INC	961231
1186	ELI LILLY & CO	961231
1187	ELI LILLY & CO	951231
1188	ETHAN ALLEN INTERIORS INC	960630
1189	ETHAN ALLEN INTERIORS INC	950630
1190	ETHYL CORP	961231
1191	ETHYL CORP	951231
1192	ETHYL CORP	941231
1193	ETHYL CORP	931231
1194	ETHYL CORP	921231
1195	EXIDE CORP	960331
1196	EXIDE CORP	950331
1197	EXIDE CORP	940331
1198	FAIRCHILD CORPORATION	960630
1199	FAIRCHILD CORPORATION	950630
1200	FANSTEEL CORP	961231
1201	FANSTEEL INC	951231
1202	FANSTEEL INC	931231
1203	FANSTEEL INC	921231
1204	FINA INC	961231
1205	FMC CORP	961231
1206	FMC CORP	951231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
1207	FMC CORP	941231
1208	FMC CORP	931231
1209	FMC CORP	921231
1210	FORT JAMES CORP	961229
1211	GENCORP INC	961130
1212	GENCORP INC	951130
1213	GENCORP INC	941130
1214	GENCORP INC	931130
1215	GENCORP INC	921130
1216	GENERAL CHEMICAL GROUP INC	961231
1217	GENERAL SEMICONDUCTOR INC	961231
1218	GEON CO	961231
1219	GEON CO	951231
1220	GEON CO	941231
1221	GEON CO	931231
1222	GIANT INDUSTRIES INC	961231
1223	GIANT INDUSTRIES INC	951231
1224	GIANT INDUSTRIES INC	941231
1225	GOODRICH PETROLEUM CORP	961231
1226	GRACE ENERGY CORPORATION	911231
1227	GRACE ENERGY CORPORATION	901231
1228	GRACE ENERGY CORPORATION	891231
1229	GUARDSMAN PRODUCTS INC	951231
1230	GUARDSMAN PRODUCTS INC	941231
1231	GUARDSMAN PRODUCTS INC	931231
1232	GUARDSMAN PRODUCTS INC	921231
1233	GUARDSMAN PRODUCTS INC	911231
1234	GULF RESOURCES & CHEMICALS CORP	911231
1235	GULF RESOURCES & CHEMICALS CORP	901231
1236	GULF RESOURCES & CHEMICALS CORP	891231
1237	GULF RESOURCES & CHEMICALS CORP	881231
1238	GULF RESOURCES & CHEMICALS CORP	871231
1239	GULF USA CORPORATION	921231
1240	HARLEY DAVIDSON	961231
1241	HARLEY DAVIDSON INC	951231
1242	HARLEY DAVIDSON INC	941231
1243	HARLEY DAVIDSON INC	931231
1244	HARSCO CORP	961231
1245	HARSCO CORP	951231
1246	HARSCO CORP	941231
1247	HARSCO CORP	911231
1248	HARSCO CORP	911231
1249	HEXCEL CORP	961231
1250	IMC FERTILIZER GROUP INC	940630
1251	IMC FERTILIZER GROUP INC	930630
1252	IMC FERTILIZER GROUP INC	920630
1253	IMC FERTILIZER GROUP INC	910630
1254	IMC FERTILIZER GROUP INC	900630
1255	IMC FERTILIZER GROUP INC	890630
1256	IMC FERTILIZER GROUP INC	880630
1257	INLAND STEEL INDUSTRIES INC	961231

#	COMPANY NAME	YEAR END
1258	INLAND STEEL INDUSTRIES INC	951231
1259	INLAND STEEL INDUSTRIES INC	941231
1260	INTERLAKE CORP	961225
1261	INTERLAKE CORP	951225
1262	INTERLAKE CORP	941225
1263	INTERNATIONAL BUSINESS MACHINES CORP	961231
1264	INTERNATIONAL BUSINESS MACHINES CORP	951231
1265	INTERNATIONAL BUSINESS MACHINES CORP	941231
1266	INTERNATIONAL BUSINESS MACHINES CORP	931231
1267	JOHNS MANVILLE CORP DE	961231
1268	JOSTENS INC	961228
1269	JOSTENS INC	950630
1270	K2 INC	961231
1271	KANEB SERVICES INC	961231
1272	KATY INDUSTRIES INC	961231
1273	KATY INDUSTRIES INC	951231
1274	KERR MCGEE CORP	961231
1275	KEYSTONE CONSOLIDATED INDUSTRIES INC	961231
1276	KFX INC	961231
1277	LA Z BOY INC	960427
1278	LA Z BOY INC	950429
1279	LOCKHEED MARTIN CORP	961231
1280	LONE STAR INDUSTRIES INC	961231
1281	LONE STAR INDUSTRIES INC	891231
1282	LONE STAR TECHNOLOGIES INC	961231
1283	LOUIS DREYFUS NATURAL GAS CORP	961231
1284	LOUIS DREYFUS NATURAL GAS CORP	951231
1285	LOUIS DREYFUS NATURAL GAS CORP	941231
1286	LOUIS DREYFUS NATURAL GAS CORP	931231
1287	LOUISIANA PACIFIC CORP	961231
1288	LTV CORP	961231
1289	LTV CORP	951231
1290	LTV CORP	941231
1291	LTV CORP	931231
1292	LTV CORP	921231
1293	LUKENS INC	961230
1294	LYDALL INC	911231
1295	LYDALL INC	901231
1296	LYDALL INC	891231
1297	MANVILLE CORP	941231
1298	MANVILLE CORP	931231
1299	MANVILLE CORP	921231
1300	MANVILLE CORP	911231
1301	MANVILLE CORP	901231
1302	MANVILLE CORP	891231
1303	MAPCO INC	961231
1304	MAPCO INC	951231
1305	MAPCO INC	941231
1306	MAPCO INC	931231
1307	MATERIAL SCIENCES CORP	960229
1308	MATERIAL SCIENCES CORP	950228

#	COMPANY NAME	YEAR END
1309	MATERIAL SCIENCES CORP	940228
1310	MAXUS ENERGY CORPORATION	931231
1311	MAXUS ENERGY CORPORATION	921231
1312	MAXUS ENERGY CORPORATION	911231
1313	MERIDIAN GOLD INC	961231
1314	MONARCH MACHINE TOOL CO	961231
1315	MONARCH MACHINE TOOL CO	951231
1316	MONARCH MACHINE TOOL CO	941231
1317	MONARCH MACHINE TOOL CO	931231
1318	MONSANTO CO	961231
1319	MONSANTO CO	951231
1320	MONSANTO CO	941231
1321	MONSANTO CO	931231
1322	MONSANTO CO	911231
1323	MORRISON KNUDSEN CORP NEW	961130
1324	MOTOROLA INC	961231
1325	MOTOROLA INC	951231
1326	MOTOROLA INC	941231
1327	MOTOROLA INC	931231
1328	N L INDUSTRIES INC	961231
1329	NALCO CHEMICAL CO	961231
1330	NALCO CHEMICAL CO	951231
1331	NALCO CHEMICAL CO	941231
1332	NALCO CHEMICAL CO	931231
1333	NASHUA CORP	961231
1334	NASHUA CORP	951231
1335	NASHUA CORP	941231
1336	NATIONAL PRESTO INDUSTRIES	951231
1337	NATIONAL PRESTO INDUSTRIES	941231
1338	NATIONAL PRESTO INDUSTRIES	931231
1339	NATIONAL PRESTO INDUSTRIES INC	961231
1340	NERCO INC	911231
1341	NERCO INC	901231
1342	NERCO INC	891231
1343	NERCO INC	881231
1344	NERCO INC	871231
1345	NEWELL CO	961231
1346	NEWELL CO	951231
1347	NEWELL CO	941231
1348	NEWELL CO	931231
1349	NEWMONT GOLD CO	961231
1350	NOBLE AFFILIATES INC	961231
1351	NOBLE AFFILIATES INC	951231
1352	NOBLE AFFILIATES INC	941231
1353	NOBLE AFFILIATES INC	931231
1354	NORTHROP GRUMMAN CORP	961231
1355	NORTHROP GRUMMAN CORP	951231
1356	NORTHROP GRUMMAN CORP	941231
1357	NORTHROP GRUMMAN CORP	931231
1358	OCCIDENTAL PETROLEUM CORP	961231
1359	OCCIDENTAL PETROLEUM CORP	951231

#	COMPANY NAME	YEAR END
1360	OCCIDENTAL PETROLEUM CORP	941231
1361	OCCIDENTAL PETROLEUM CORP	931231
1362	OCCIDENTAL PETROLEUM CORP	921231
1363	OCCIDENTAL PETROLEUM CORP	911231
1364	OCCIDENTAL PETROLEUM CORP	901231
1365	OLIN CORP	961231
1366	OLIN CORP	951231
1367	OLIN CORP	941231
1368	OLIN CORP	931231
1369	OLIN CORP	921231
1370	ORYX ENERGY CO	961231
1371	ORYX ENERGY CO	951231
1372	ORYX ENERGY CO	941231
1373	ORYX ENERGY CO	931231
1374	OWENS CORNING	961231
1375	PACIFIC SCIENTIFIC CO	961231
1376	PACIFIC SCIENTIFIC CO	951229
1377	PHELPS DODGE CORP	961231
1378	PHELPS DODGE CORP	951231
1379	PHELPS DODGE CORP	941231
1380	PHELPS DODGE CORP	931231
1381	POLAROID CORP	961231
1382	PREMARK INTERNATIONAL	951230
1383	PREMARK INTERNATIONAL	941231
1384	PREMARK INTERNATIONAL INC	961228
1385	PROCTER & GAMBLE CO	960630
1386	PROCTER & GAMBLE CO	950630
1387	PROCTER & GAMBLE CO	940630
1388	PROCTER & GAMBLE CO	930630
1389	QUANEX CORP	961031
1390	RAYONIER INC	961231
1391	RAYONIER INC	951231
1392	RAYONIER INC	941231
1393	RMI TITANIUM CO	961231
1394	ROBERTSON CECO CORP	961231
1395	ROWAN COS INC	961231
1396	SANTA FE ENERGY RESOURCES INC	961231
1397	SEQUA CORP	961231
1398	SEQUA CORP	961231
1399	SEQUA CORP	951231
1400	SEQUA CORP	931231
1401	SMITH INTERNATIONAL INC	961231
1402	SOLA INTERNATIONAL INC	960331
1403	SOLA INTERNATIONAL INC	950331
1404	SPARTON CORP	960630
1405	SPARTON CORP	950630
1406	SPARTON CORP	940630
1407	SPARTON CORP	930630
1408	SPS TECHNOLOGIES INC	961231
1409	SPS TECHNOLOGIES INC	941231
1410	SPX CORP	961231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
1411	STANLEY WORKS	961230
1412	STANLEY WORKS	951230
1413	STANLEY WORKS	941231
1414	STANLEY WORKS	940101
1415	STANLEY WORKS	930102
1416	STEPAN CO	961231
1417	STEPAN CO	951231
1418	STEPAN CO	941231
1419	STEPAN CO	931231
1420	STEPAN CO	921231
1421	SUN CO INC	961231
1422	SUNBEAM CORP NEW	961229
1423	SUNSHINE MINING & REFINING CO	961231
1424	TENNECO INC	951231
1425	TENNECO INC	941231
1426	TENNECO INC	931231
1427	TENNECO INC	921231
1428	TENNECO INC	911231
1429	TESORO PETROLEUM CORP	961231
1430	TESORO PETROLUEM CORP	951231
1431	TESORO PETROLUEM CORP	941231
1432	TEXACO INC	961231
1433	TEXACO INC	951231
1434	TEXACO INC	941231
1435	TEXACO INC	931231
1436	TEXACO INC	921231
1437	THIOKOL CORP	960630
1438	THIOKOL CORP	950630
1439	THIOKOL CORP	940630
1440	TOKHEIM CORP	961130
1441	TOKHEIM CORP	951130
1442	TOSCO CORP	961231
1443	TOSCO CORP	951231
1444	TOSCO CORP	941231
1445	TOSCO CORP	931231
1446	TOSCO CORP	921231
1447	ULTRAMAR DIAMOND SHAMROCK CORP	961231
1448	UNION CARBIDE CORP	951231
1449	UNION CARBIDE CORP	941231
1450	UNION CARBIDE CORP	931231
1451	UNION CARBIDE CORP	921231
1452	UNION CARBIDE CORP NEW	961231
1453	UNION PACIFIC RESOURCES GROUP INC	961231
1454	US CAN CORP	961231
1455	W R GRACE & CO	951231
1456	W R GRACE & CO	941231
1457	W R GRACE & CO	931231
1458	W R GRACE & CO DE	961231
1459	WHITMAN CORP	961231
1460	WOLVERINE TUBE INC	961231
1461	WOLVERINE TUBE INC	951231

APPENDIX 2 - List of Sample Companies

#	COMPANY NAME	YEAR END
1462	WOLVERINE TUBE INC	941231
1463	WOLVERINE TUBE INC	931231
1464	WYNN S INTERNATIONAL INC	961231
1465	WYNN S INTERNATIONAL INC	951231
1466	WYNN S INTERNATIONAL INC	941231
1467	WYNN S INTERNATIONAL INC	931231