THE BP OIL SPILL: SHAREHOLDER WEALTH EFFECTS AND ENVIRONMENTAL DISCLOSURES

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Abstract

We investigate whether the British Petroleum, PLC oil spill affected the shareholder wealth of oil and gas firms (other than BP). While we find no evidence of a share price reaction for the whole industry, we find share price declines for firms with offshore drilling operations in United States waters. Further, we find evidence that firms with more expansive environmental disclosures suffered a smaller negative shareholder wealth effect, suggesting that shareholders believe firms with more extensive environmental disclosures are better prepared to address possible future regulatory costs and possible future similar environmental incidents. We also document an increase in environmental disclosure, specifically in the disclosure of disaster readiness plans, in the year following the BP spill. Last, we find that firms with higher institutional ownership and lower ownership concentration were more likely to increase disclosures about disaster readiness plans.

Keywords: Environmental Disclosure; Stock returns

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1. Introduction

On April 20, 2010, an explosion caused by a well blowout occurred on the drilling platform of an oil rig called the Deepwater Horizon. The rig, located roughly 40 miles off the coast of Louisiana in the Gulf of Mexico, was owned and operated by Transocean Ltd. and leased to British Petroleum, PLC (BP, hereafter). The explosion caused 11 deaths and 17 injuries. BP did not own or operate the well, but owned the drilling rights and was, therefore, largely the sole firm held responsible for cleanup efforts. In this paper, we investigate (1) whether the BP spill precipitated stockholder wealth changes for other oil and gas firms, (2) whether oil and gas firms' pre-spill environmental disclosures affected the magnitude of any BP spill-induced wealth changes, (3) whether oil and gas firms changed their environmental disclosures in response to the BP spill, and (4) whether various factors suggested by prior research affect cross-sectional variation in environmental disclosure changes.[1]

As a result of a corporate disaster, such as the BP spill, same-industry firms' stock prices can be affected by changes in investors' assessments of the probability of (1) increased regulatory costs, and (2) similar disasters by/for other firms. Corporate disasters can result in increased government regulation. Investors are aware that stricter rules can increase a firm's operating costs, and these increased regulatory costs can have a negative impact on firm value. Firms incur political costs to fight proposed legislation and to participate in the policy-making process (Watts and Zimmerman 1986). Environmental disasters can also increase investor awareness regarding the potential for another accident within the industry. Based on disclosures from oil and gas firms, statements in trade publications, and prior research on corporate disasters (e.g. Blacconiere and Patten 1994), we argue that the BP spill created the potential for increased regulatory and expected future disaster costs for the oil and gas industry.[2] This hypothesis is not without 'tension', however. An increase in expectations by investors of future disaster costs is far from certain. Such expectations depend on whether investors believe the BP spill is a one-time, highly-

[1] Henceforth, when we refer to oil and gas firms, we mean oil and gas firms other than BP.

[2] As we explain in Section 2, the spill eventually garnered the attention of multiple governmental regulatory agencies, including the Environmental Protection Agency (EPA), the U.S. Department of the Interior, and the Minerals Management Service (MMS) (Rascoe 2010; U.S. Department of the Interior 2010b).

unlikely event or is indicative of widespread safety lapses in the industry. Additionally, prior research notes that shareholder wealth changes due to increased expectations of regulatory costs can be mitigated if investors expect legislators to offset increased regulatory costs with *other* favors, such as tax relief (Bowen, Castanias, and Daley 1983). Indeed, various sources suggest oil and gas firms have often received favorable political treatment and suggest the potential for regulation targeting BP that could benefit other oil and gas firms (see Section 2). Thus, the shareholder wealth impact of the BP spill for the oil and gas industry is an empirical question. Our results suggest no shareholder wealth changes for the oil and gas industry as a whole, but shareholders in firms with offshore operations in United States waters experienced a significant decline in wealth. Thus, our results suggest investors expected increased regulatory and/or potential disaster costs, but only for firms with deep water offshore operations in the United States.

We next address voluntary disclosures. Prior research asks whether voluntary environmental disclosure can mitigate the expected regulatory cost consequences of environmental disasters (e.g. Blaccioniere and Patten 1994) and whether environmental disclosures provide valuation relevant information (Clarkson, Li, and Richardson 2004; Clarkson, Fang, Li, and Richardson 2010). There are two broad perspectives regarding voluntary disclosure strategies in corporate narratives—incremental information and impression management (Merkl-Davies and Brennan 2007; Clarkson, Li, Richardson, and Vasvari 2008). The incremental information view assumes management's voluntary disclosures provide relevant information aimed at improving investor decision making. Within the context of environmental disclosure, this means better environmental performers make more extensive environmental disclosures to distinguish themselves from poorer environmental performers. Thus, the incremental information perspective suggests firms with better environmental disclosures will suffer smaller shareholder wealth declines in response to the BP spill because investors expect smaller incremental costs for these firms to adopt and adapt to new oil and gas regulations and/or a lesser chance of a future environmental disaster.

Impression management research assumes management's voluntary disclosures represent an attempt to manipulate and manage the impression conveyed to users of accounting information. Within the context of environmental research, this implies poor environmental performers provide *more* environmental disclosures than better performers to create the impression of environmental concern. This perspective suggests that firms with more extensive environmental disclosures are no better or even less well prepared to adopt new regulations and prevent future disasters and so will experience zero or even more negative share price reactions.[3] Given the inconclusive nature of the results in prior research, we use the BP spill as an opportunity to revisit whether more extensive environmental disclosures mitigate the stock price response to negative environmental news. Following prior research (Blacconiere and Patten 1994), we construct an environmental disclosure rating score from various 10-K environmental disclosures.[4] Our evidence suggests that oil and gas firms (operating in the offshore U.S.) with more environmental disclosures suffered smaller shareholder wealth losses. We interpret this evidence as consistent with the notion that investors anticipate firms with more expansive environmental disclosures are better prepared to handle potential regulatory or disaster costs following the spill.

Finally, we examine whether the threat of potential regulation and disaster costs prompts changes in environmental disclosures in our sample firms' annual filings in the year following the BP spill. Recent research suggests firms increase their voluntary disclosures (management forecasts) in response to negative changes in investor sentiment (Bergman and Roychowdhury 2008). We extend this theory to environmental disasters. We hypothesize that the BP spill negatively impacted investor sentiment regarding environmental issues and that oil and gas firms respond by increasing environmental

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[3] If investors cannot see through poor performers' disclosure ploy, it is possible that these high disclosers will suffer smaller share price declines than their better performing, but lower disclosing competitors. The environmental accounting literature finds evidence in support of both the incremental information and impression management perspectives. However, for a number of reasons we explain in Section 3, we follow most prior research on price reactions to environmental news in interpreting the results of our tests. Specifically, we interpret muted negative stock price reactions to the spill for firms with more extensive environmental disclosures as suggesting investors view such firms as better prepared to deal with future regulatory and disaster costs, consistent with the incremental information perspective. See Section 3 for more detail regarding prior research on the incremental information and impression management perspectives.

[4] We describe this environmental disclosure rating variable in detail in a later section. We alter the construction of this variable somewhat relative to Blacconiere and Patten (1994) to fit our setting.

disclosures. We find that both firms with and without U.S. offshore operations increased their disclosures about disaster plans and disaster readiness. However, we find no changes in disclosures about environmental capital expenditures, environmental liabilities, environmental litigation, or environmental regulations. Our results are both similar to and different from Patten (1992), who studies disclosure changes in response to the Exxon Valdez oil spill and finds an increase in a composite environmental disclosure score that does not include disaster plan disclosure. Thus, while both our study and his find an increase in post-spill disclosures, our specific results differ considerably.

We extend our change in disclosure analysis by examining several potential cross-sectional determinants of firms' changes in environmental disclosures in response to the spill. Prior research in contexts other than corporate disasters and other than voluntary environmental disclosure suggests several factors potentially influence voluntary disclosure. These potential determinants include litigation risk, information asymmetry, political lobbying expenditures, institutional ownership, and ownership concentration.[5] Our evidence suggests higher institutional ownership and lower ownership concentration contributed to firms' decisions to increase disclosures about disaster readiness plans.

Our paper is related and contributes to existing research in the following ways. First, our analyses of the intra-industry stock price response to the BP spill is related to a small number of papers that investigate intra-industry price responses to corporate disasters, including the Three Mile Island incident (Bowen et al. 1983; Hill and Schneeweis 1983), the Johnson & Johnson Co. Tylenol product tampering incident (Dowdell, Govindaraj, and Jain 1992), the Union Carbide, Inc. Bhopal, India chemical leak (Blacconiere and Patten 1994) and the Exxon, Inc. oil tanker spill (Patten and Nance 1998). Our results are consistent with most of these studies in that most document negative share price reactions for same industry firms. Our results differ from the only other study of an oil industry disaster, however, as Patten and Nance (1998) find share price increases for oil and gas firms following the Exxon incident.

[5] There are numerous papers addressing these factors. See Section 4 for a review and discussion.

A paper closely related to only the first part of our study is Blacconiere and Patten (1994). They investigate the market reaction to the Bhopal chemical leak caused by Union Carbide, which resulted in legislative proposals to tighten regulation of the chemical industry. They find that the event negatively affected the market values of other firms in the chemical industry. They also conclude that firms with superior environmental disclosures suffered less negative stock market reactions, suggesting that investors view environmental disclosures as a positive signal that the firm is managing its exposure to future environmental regulatory costs. However, Blacconiere and Patten's (1994) evidence regarding environmental disclosure is weak and their study (like ours) represents only one incident. The BP spill offers a relatively unique opportunity to assess whether the inferences in Blaccconiere and Patten (1994) are specific to that particular incident (the Union Carbide leak) or can be generalized to other settings. Given the centrality of disclosure to accounting research (Healy and Palepu 2001; Verrecchia 2001), we believe this issue is worth revisiting in a different setting. Our study differs from Blacconiere and Patten (1994) in that our stock price response evidence is limited to a subset of the entire industry, but our evidence seems more robust.[6]

Our study differs most from prior research on corporate disasters, including environmental disasters and Blacconiere and Patten (1994) in particular, in that we examine changes in firms' disclosures as a result of the disaster. Our evidence suggests that the mere threat of increased regulatory costs, or the potential for future disaster costs, prompts a change in voluntary disclosure, a matter not generally investigated in the accounting literature.[7] We also use prior research in other contexts (e.g. research on management earnings forecasts and investor sentiment and institutional ownership) to develop hypotheses regarding firms' environmental disclosure responses to corporate environmental

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[6] Patten and Nance (1998) also investigate stock price responses to a corporate environmental disaster (the ExxonValdez oil spill) and whether environmental disclosures influence the magnitude of the stock price responses. They find, however, that competitors' prices increased, not decreased, in response to the spill, which clouds the interpretation of their analyses of the relation between event-period stock price changes and environmental disclosures.

[7] As we note above, an exception is Patten (1992), who finds an increase in oil company environmental disclosures following the Exxon oil spill in Alaska. As we also note above, however, our inferences differ considerably from Patten's (1992) regarding the type of disclosures that changed.

disasters. To our knowledge, ours is the first study to link theories regarding disclosure determinants to firms' environmental disclosure decisions following corporate environmental disasters.[8]

The remainder of this paper is organized as follows. In Section 2, we provide the motivation and results for the test of the overall stock market reaction to the BP spill for oil and gas firms. Section 3 presents the motivation and findings for our test of the influence of environmental disclosure on the stock price reaction. Section 4 provides the motivation and results for our tests of the change in disclosure and the determinants of the change. Section 5 concludes.

2. Stock Market Reaction

Motivation

How the spill affected the values of oil and gas companies is likely influenced by changes in investors' expectations regarding (1) regulatory costs, (2) the potential for similar disasters, (3) counteractions by regulators to offset increased regulatory costs, and (4) supply and demand. We discuss each in turn.

Potential Regulatory Cost Consequences of the BP Spill

Some prior research argues that firm-specific disasters lead to increases in expected regulatory costs. Bowen et al. (1983) and Hill and Schneeweis (1983) find negative returns for electric utility firms following the 1979 Three Mile Island nuclear power plant accident. Blacconiere and Patten (1994) find negative abnormal returns for chemical firms following Union Carbide's Bhopal, India chemical leak. These papers argue the negative returns are likely attributable to increased expected regulatory costs for same-industry firms.

News of increased regulation for the oil and gas industry began surfacing soon after the BP spill and continued for the ensuing year. Interior Secretary Ken Salazar detailed plans to overhaul the Minerals Management Service (MMS), which manages the natural gas, oil, and other mineral resources

[8] A caveat to our study is that our sample sizes are small. However, we conduct a number of specification and robustness checks. Our inferences are not driven by outliers, cross-sectional correlation, heteroscedasticity, or unspecified time-series variation in test statistics.

on the U.S. outer continental shelf (www.mms.gov). Salazar announced the creation of an Outer Continental Shelf Safety Board, charged with tightening oversight of industry equipment testing (U.S. Department of the Interior 2010a). In a press conference on May 27, 2010, President Barack Obama announced new operating requirements for offshore energy companies as a result of a 30-day safety and environmental review. The President issued several other directives, such as continuance of a six-month moratorium on new deepwater drilling permits and suspension of permits for 33 deepwater exploratory wells underway in the Gulf of Mexico (Obama 2010a). Additionally, the White House announced its support for replacing the $75 million oil-spill liability cap with unlimited liability (Obama 2010b). In May 2011, President Obama announced measures to speed oil production, but the article also notes, "New safety requirements put in place since the BP spill also have delayed drilling in Alaska…" (Superville and Cappiello 2011).

Following the BP spill, some stakeholders called for increased disclosure from oil companies regarding risks and safety measures. In Exxon Mobil's annual shareholders' meeting on May 26, 2010, shareholders demanded increased disclosure about the risks involved in its oil sands projects. Investors called for more information on the social, environmental, and legal challenges associated with the projects (Tait 2010). This suggests that following the BP spill, investors became more concerned regarding the environmental risks of potentially hazardous production projects. Moreover, Senator Robert Byrd (D, W. Va) proposed an amendment to a financial regulatory reform bill that would require companies with "risky workplaces", such as coal mining and oil rig companies, to disclose to the SEC significant health and safety conditions that might affect the company's operating results (Byrd 2010).

To gain some sense of whether firms in the oil and gas industry consider the BP spill a threat to regulatory costs, or whether these firms even considered the BP spill when making their annual disclosure decisions, we examined whether our sample firms mention the BP spill in their 10-K filed in the year following the BP spill. Firms made statements such as:

> "*…increases in insurance costs or decreases in insurance availability, and delays in our offshore exploration and drilling activities that may result from the*

April 22, 2010 sinking of the Deepwater Horizon and subsequent oil spill in the Gulf of Mexico." (PetroQuest Energy, Inc. 2011)

"Further impacts of the accident and oil spill include added delays in deepwater Gulf of Mexico drilling activities, and additional future regulations covering offshore drilling operations, plus expected higher costs for future drilling operations and offshore insurance." (Murphy Oil Corporation 2011)[9]

Table 1 shows that 19 out of the 130 sample firms (15%) with no operations in U.S. waters mentioned the BP spill in their 10-Ks, and 23 out of 27 sample firms (85%) with offshore operations in the U.S. mentioned the spill. A test of the difference in proportions indicates a significantly higher proportion of U.S. offshore firms mention the BP spill in their post-spill 10-Ks. These excerpts suggest management of oil and gas firms, particularly those with U.S. offshore operations, were thinking about the potential for new regulations as a result of the BP spill. Additionally, that there is such a pronounced difference in discussion of the spill between U.S. offshore and non-U.S. offshore firms suggests the potential importance of analyzing the two groups separately (see below).

Potential Disaster Cost Consequences of the BP Spill

Whether events and news concerning one company affect the market values of same-industry companies (a phenomenon coined "contagion" or "information transfer") is an issue of long-standing academic and regulator interest. Prior research addresses the issue in a variety of settings including accounting restatements (Gleason, Jenkins, and Johnson 2008), earnings announcements (Firth 1976; Foster 1981; Freeman and Tse 1992; Ramnath 2002), bankruptcy announcements (Lang and Stulz 1992), dividend changes (Firth 1996), and management earnings forecasts (Pyo and Lustgarten 1990), among several other events. The general notion is that news about one firm conveys information useful to investors in determining the prices of similar firms. In our setting, information transfer would be that news of the BP spill caused oil and gas firm investors to increase their expectations of similar spills by other firms. News reports suggest some sentiment among investors that BP may have just been unlucky

[9] Full excerpts of BP spill disclosures of four firms are provided in the Appendix.

since an accident of this type "could have happened at any of the other 57 wells in the area using the same design and procedures" (Warner 2010). Indeed, BP's post-spill CEO noted, "I think it would be a mistake to dismiss our experience of the last year simply as a 'black swan', a one-in-a-million occurrence that carries no wider application for our industry as a whole..." (Krauss 2011). Thus, it is plausible that an increase in investors' expectations of similar spills at other oil and gas firms could negatively affect those firms' share prices.

Potential for Regulatory Offset

Prior research on corporate disasters notes the possibility that politicians and regulators can both increase regulatory costs in one aspect of an industry's operations (such as environmental and safety) and offset those costs with tax breaks and looser regulations in other aspects. For example, Bowen et al. (1983) state that "no reaction (to the Three Mile Island incident) is consistent with investors' belief that the regulatory authorities can and will perfectly compensate the utilities for any losses and, thus, maintain their equity value." Such an outcome is plausible regarding the BP spill because the oil and gas industry is likely one of the more politically favored industries in the U.S. There are several examples. The Energy Policy Act of 2005 gave $14.5 billion in tax breaks and loosened regulations (Mayer 2008). The Deep Water Royalty Relief Act in 1995 granted a royalty "holiday" to petroleum companies drilling in deep waters from 1996-2000 (Colby 2008). In response to the results of a study by the Government Accountability Office (GAO), Representative Nick Rahall, chair of the House Natural Resources Committee stated, "…the U.S. has one of the most lenient royalty collection systems in the world" (Chernoff 2008). In 2005 the Congressional Budget Office (CBO) reported that the effective marginal tax rate on capital investments such as oil field leases and drilling equipment was 9.2%, which is significantly lower than the average rate (26.3%) for all asset types and is lower than virtually any other industry (CBO 2005). The U.S. tax code also reveals tax breaks available at almost every stage of exploration and extraction, making oil production one of the most extensively subsidized activities (Kocieniewski 2010). Additionally, U.S. regulators considered restricting BP's oil exploration and drilling leases as a result of the spill (Efstathiou and Plungin 2010). It is at least plausible other oil companies' shareholders benefitted because investors developed expectations of increased restrictions on BP's ability to gain and hold oil exploration and drilling leases. Thus, it is possible that investors expect new environmental and safety regulations following the spill, but also expect the costs of those regulations to be offset by new tax breaks and easing of other regulations.

Potential Supply/Demand Effects

The consequence of the BP spill for the supply of oil to the U.S. is likely minimal. The well would have contributed only 40,000 of the U.S.' 18.69 million (as of 2009) barrel per day consumption (MacDonald, Amos, Crone, and Werely 2010; CIA Factbook 2009). The spill's only impact on oil delivered via Gulf shipping was to necessitate stops to clean oil off the ships (Elliot 2010). The consequence for demand for competitor's products is also likely minimal. Following the spill, some consumers avoided BP gas stations (Weber 2010). Although these consumers possibly shifted their gasoline purchases to non-BP logoed stations, this likely provided little benefit to BP's competitors. BP owns very few retail gas stations, and gasoline at any particular filling station often comes from a variety of oil extraction companies (of which BP is one). Thus, it seems unlikely the spill caused either supply or demand shifts that benefitted other oil companies.

In summary, a number of statements by legislators, regulators, and stakeholders suggest potential for increased environmental and safety regulatory costs for oil and gas companies and increased investor expectations of spills by other oil and gas companies. If so, the spill should have produced negative equity price reactions for oil and gas companies. However, the historically favorable political treatment of oil and gas companies could plausibly cause investors to expect politicians and regulators to implement regulatory and tax changes that could reduce or even completely offset the costs of future environmental and safety regulations. Thus, the actual intra-industry equity price effects of the BP spill is an empirical question. Overall, despite the potential for regulatory offset discussed above and the (likely minimal) supply and demand effects, considering the potential for increased expectations of future regulatory and disaster costs, we state our first hypothesis in alternative form as follows:

> ***H1a:*** *Oil and gas firms (other than BP) experienced a negative equity share price reaction to the BP spill.*

Although it is plausible that increased regulatory costs would be imposed on all oil and gas companies, there are reasons to suspect that firms with offshore U.S. operations would be most affected. Almost half the oil and gas reserves added globally since 2006 have been in deep water, and total deep water production is projected to double by 2030 (Krauss 2010). Additionally, much of the proposed regulation following the BP spill addresses offshore drilling in U.S. waters and some addressed Gulf of Mexico (GOM) drilling specifically (e.g. the above mentioned suspension of deep water permits for GOM wells underway).[10] Finally, investors' assessment of the potential for future disaster costs is likely most salient for firms operating offshore, since the BP spill was a marine accident. Therefore, we investigate whether the intensity of any price reaction to the BP spill is stronger for firms with deep water offshore U.S. operations and label this hypothesis as version 'b' (and the original as version 'a'):

> ***H1b:*** *Oil and gas firms with offshore oil rigs in United States waters experienced a negative equity share price reaction to the BP spill.*

Research Design

Sample Firms and Data

We begin with a sample of all publicly traded firms in SIC codes 1311 (Crude Petroleum and Natural Gas) and 2911 (Petroleum Refining), according to the 2009 Compustat file. Next, we limit the sample to those firms that filed a 10-K with the SEC in the fiscal year ending immediately prior to the spill. We remove from our sample firms that were the targets of acquisitions with merger announcements

[10] The U.S. government called for stricter equipment inspections for offshore drilling rigs and certification from the company chief executive that offshore drilling personnel are properly trained (Chazan and Daker 2010).

during the period from April 20, 2010 (the date of the initial rig explosion) through July 30, 2010 because of the influence of mergers and acquisitions on the stock prices of target firms (Denis and McConnell 1986, Healy, Palepu, and Ruback 1992). The final sample consists of 162 firms. Approximately 88% of the sample firms are in SIC code 1311.

We obtain merger announcement dates from SDC Platinum M&A. We obtain stock return information from CRSP and financial statement information from Compustat.[11] Because we exclude earnings announcement and management forecast days (as described below), we collect earnings announcement dates from Compustat and management earnings forecast dates from First Call Company Issued Guidance. We collect environmental disclosures (described below) from each firm's most recent 10-K filed prior to and following the BP spill.

Measuring Price Changes

We measure daily abnormal returns using the standard daily market model augmented with the return on the price of oil. The model is as follows:

$$R_{it} = \alpha_i + \beta_{1i} R_{mt} + \beta_{2i} R_{ot} + e_{it} \quad (1)$$

where

R_{it} = return for firm *i* on day *t*

α_i = intercept for firm *i*

R_{mt} = return on the CRSP equal-weighted market portfolio on day *t*

R_{ot} = return on the futures price of light-sweet crude oil[12]

e_{it} = error term with mean zero

We estimate the parameters α_i, β_1, and β_2 over the first quarter of 2010, which is the quarter immediately prior to the event date. We remove from the estimation period the three-day windows surrounding

[11] Twenty-three of the sample firms traded on the Pink Sheets or over-the-counter (OTC), and CRSP does not house data for firms traded on those exchanges. For these firms, we obtained daily stock price and return information from Yahoo! Finance.

[12] We retrieve oil prices from the U.S. Energy Information Administration (EIA) website.

confounding events, including target firm merger announcements, management earnings forecast dates, and earnings announcements. We calculate daily abnormal returns (AR_{it}) as follows:

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_{1i} R_{mt} + \hat{\beta}_{2i} R_{ot}) \quad (2)$$

We calculate the cumulative abnormal return ($CAR_{i,T}$) for each firm and event window T (described below) by summing across the T days in an event window.

Event Test Periods

The initial explosion occurred on Tuesday, April 20, 2010 at approximately 10:00 p.m. Oil from the rig began spilling in the gulf. Two days later (Thursday, April 22), the Deepwater Horizon sank. On Friday, April 23, the U.S. Coast Guard announced no additional oil was leaking into the Gulf of Mexico from the wellhead at the ocean floor. However, on Saturday, April 24, the U.S. Coast Guard announced that the wellhead was leaking oil.

We investigate the market reaction to the BP spill over four different event periods. Any choice of event periods involves a trade-off of signal to noise. Shorter windows reduce the amount of noise by minimizing the potential for including returns from days with no change in investor expectations (about future regulations or disasters), but potentially miss days on which investor expectations did, in fact, change. Longer windows exercise this trade-off in the opposite direction. With this trade-off in mind, we investigate both a short and a long window. Our long window begins on April 21 (the first day after the explosion) and ends July 30, which is a total of 71 trading days. We use three versions of our short window, which we describe next, because of our uncertainty regarding the effect of April 23 on investor expectations.

As we note above, on April 23, the U.S. Coast Guard indicated their evidence suggested no oil was leaking from the wellhead. However, the next day, the Coast Guard reversed this announcement. Whether April 23 is a “good news” or a “bad news” day is uncertain. On one hand, the Coast Guard’s announcement that no oil was leaking from the wellhead might have reversed investor expectations possibly developed over the previous two days that the wellhead would leak, which could increase pressure on lawmakers and regulators to tighten regulations. On the other hand, the news regarding the fate of the rig workers continued to worsen, as hopes that they might be alive dimmed. Additionally, the rig itself had sunk just the day before, and uncertainty about the consequences of the rig sinking likely continued to spread.[13]

As a result of our uncertainty regarding April 23, we construct three different short windows. The first is an eight-trading-day window following the well explosion. This window begins on April 21 (the first trading day after the explosion) and ends on Friday, April 30 (the end of the first trading week following the explosion).[14] This window allows time for investors to learn that (1) the rig sunk, (2) the rig workers had been killed, and (3) oil was leaking from wellhead and would potentially be difficult to stop. This window includes April 23, assuming it is a bad-news day because we add April 23's returns to the returns on the other seven trading days in the window. We refer to this as the "eight-day-a" return window for brevity. To accommodate the possibility April 23 is a good-news day (i.e. reduced investors' expectations about the severity of the spill and future regulatory/disaster costs), we construct a second eight-day window. For this second eight-day window, we use a procedure similar to Schipper and Thompson (1983) in that we multiply the returns on April 23 by minus-one (i.e. we reverse the sign).[15] We refer to this as the "eight-day-b" return for brevity. This approach increases the power of the test, but only if April 23 is a good-news day.[16] Finally, we construct a seven-day window where we simply exclude April 23. Figure 1 contains a graphical representation of this timeline.

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[13] The mean abnormal return across firms on April 23 was 0.005 for the full sample and -0.001 for the U.S. offshore sample.

[14] On April 21 and April 22, BP made statements suggesting there was minimal oil spillage. Nonetheless, we include these days because (1) the explosion itself and resulting loss of life could have caused investors to increase their expectations of future regulatory/disaster costs, (2) oil actually was spilling into the Gulf, and (3) investors plausibly did not view BP's claims at that point as credible. We think it likely investors viewed the US Coastguard statements on the following days as more credible.

[15] Schipper and Thomson (1983) use indicator variables to identify event periods. Their indicator variables take the value of minus one for days where events likely reversed the regulatory change process they study (page 196).

[16] Note that reversing the sign of the returns on days where the news is of the opposite direction results in a cumulative abnormal return that overstates (in magnitude) the return from holding the stock from the beginning to the end of the window. Thus, such a return should not be used as a gauge of the change in shareholder wealth over the window. However, such a return can be useful in testing whether changes in the probability of an event affect

Results

Table 2, Panel A shows the mean $CAR_{i,T}$ and the associated t-statistic for the null hypothesis that the mean is zero. The means for the seven- and both eight-day *CARs* are negative. The seven-day mean and the eight-day-b mean are significant at only the ten percent level. The eight-day-a mean *CAR* is smaller in magnitude and is not statistically significant. The 71-day mean is positive and is significant at the five percent level. The seven- and eight-day-b window results are consistent with H1a. However, the 71-day results suggest a reversal over time, perhaps as the apparent severity of the spill consequences diminished.

To test H1b (whether firms with drilling operations in U.S. waters suffered a negative stock price reaction), we test the event period *CAR*s as described above, but for a reduced sample of firms with offshore drilling operations in United States waters. To determine whether a sample firm has offshore drilling operations in the U.S. waters, we searched the 10-Ks of each sample firm. We included in this subsample any firms with deep water, offshore operations in United States' waters. Overall, our procedures yielded a sample of 29 firms with offshore drilling operations in U.S. waters. We refer to this sample as the "U.S. offshore" sample for brevity.

Panel B of Table 2 displays the results. For all windows except the 71-day window, the *CAR*s for the U.S. offshore sample are negative and the magnitudes are much larger than for the full sample. Despite the much reduced sample size, each of these windows produce t-statistics that are much larger in magnitude than for the full sample. The 71-day *CAR* is negative but is insignificant.[17] In total, our evidence generally supports H1b.[18]

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prices and is not biased in favor of rejecting the null. Under the null of no impact on investor expectations, reversing the sign on days with opposite news will still result in a cumulative (or average) abnormal return of zero.

[17] When calculating abnormal returns over a longer period of time, such as in the 71-day window, researchers often calculate buy-and-hold abnormal returns (BHAR). We calculate BHARs for the 71-day window for both the full and U.S. offshore samples. The 71-day BHARs are not significantly different from zero in either sample.

[18] In small samples, such as ours, outliers can influence test statistics considerably. We examined plots of residuals against predicted values for both the full and U.S. offshore samples for the analyses in this section and the disclosure

Studies where the sample firms are from the same industry and event and calendar time are perfectly aligned face the possibility of cross-sectional correlation (e.g., Collins and Dent 1984, Bernard 1987). Conventional OLS standard errors may be biased downward and corresponding t-statistics upward. Additionally, other unknown factors may cause the true variation in standard OLS t-statistics to be larger than that represented by the Student's t-distribution. In order to address this issue, for the seven- and eight-day windows, we construct an empirical distribution of t-statistics using daily returns from outside our actual event windows. For our eight-day window, we use all 39 non-overlapping eight-day periods (i.e. pseudo event windows) from the period October 2008 – December 2009. We remove the three-day window surrounding confounding event dates including earnings announcements, management earnings forecasts, and merger announcements for target firms. We then calculate a pseudo $CAR_{i,8}$ for each firm (with available data) for each of the 39 eight-day pseudo event windows. We calculate a pseudo t-statistic for each eight-day pseudo event window, generating a distribution of 39 pseudo t-statistics. We then determine where our actual $CAR_{i,8}$ t-statistic falls within the distribution of 39 pseudo t-statistics. An actual t-statistic that is in the 95th percentile of the distribution of pseudo t-statistics would be significant at the five percent level of confidence. We construct a distribution of pseudo t-statistics for our seven-day windows analogously, except our non-event period allows construction of 45 pseudo t-statistics. We do not produce a distribution of pseudo t-statistics for our 71-day window because our non-event period is of insufficient length to generate a meaningful number of pseudo t-statistics.[19]

The right-most three columns of Table 2 display the results of this analysis. Panel A shows that, for the full sample, the eight-day-b and seven-day *CAR*s have t-statics that rank 11th and 10th respectively in their distributions of pseudo t-statistics. These rankings produce p-values that are both above 0.20.[20]

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analyses in later sections. Our visual inspections of these plots (available upon request) suggest no outliers in any of our analyses.

[19] With 315 non-event period days, we would only be able to produce 4 pseudo t-statistics.

[20] We compute the p-values from the empirical distribution of pseudo t-statistics by computing the actual t-statistic's percentile rank within the distribution of non-event t-statistics using the linear interpolation method for computing percentiles. The p-value is given by (n-0.5)/N, where n is the actual t-statistic's ranking within the empirical distribution and N is the number of pseudo t-statistics in the empirical distribution.

We do not produce a distribution of pseudo t-statistics for the eight-day-a window because its OLS t-statistic is well below any conventional standard of significance. Thus, based on our distribution of pseudo t-statistics, we conclude that none of the *CAR*s for the full sample are statistically significant. Panel B shows results for the U.S. offshore sample. The seven-day and both eight-day *CAR*s rank first among their respective pseudo t-statistic distributions and have p-values of 0.011 or 0.013, depending on number of pseudo-event replications possible.[21] Thus, our construction of empirical distributions of pseudo t-statistics from non-event periods suggests that equity holders of oil and gas firms with U.S. offshore operations lost wealth as a result of the BP spill.

Overall, although standard parametric tests weakly suggest equity share value declines for *all* oil and gas firms at the time of the BP spill, analyses employing an empirical distribution of t-statistics from non-event periods fails to reject the null of no equity share price reactions. However, both parametric tests and our non-event period empirical distribution analysis suggest that oil and gas firms with U.S. offshore operations experienced a negative equity share price reaction to the BP spill. Our results are consistent with investors increasing their expectations of (1) economically significant additional regulatory costs, or (2) similar disasters at competing oil and gas firms (or both). However, investors appear to have expected those costs (future regulatory and spill) to be borne mostly by firms with U.S. offshore operations.

3. Effect of Disclosure on Share Price Reactions to the Spill

Motivation

Two broad perspectives have emerged to explain managers' voluntary disclosure decisions—incremental information and impression management.[22] Under the impression management perspective,

[21] By the linear interpolation method, the percentile for the highest ranking observation in a distribution is (1-0.5)/N. Therefore, to achieve a p-value of 0.01 or better, the distribution must have at least (1-0.5)/0.01 = 50 observations. Again, we do not construct an empirical distribution for the 71-day window *CAR* t-statistic because our non-event period would allow only 315/71 = 4 replications.

[22] For a review, see Merkl-Davies and Brennan (2007). See also Clarkson, Li, Richardson, and Vasvari (2008).

managers make disclosures designed to create particular impressions with stakeholders. In the environmental disclosure literature, the impression management perspective is also referred to as the socio-political perspective or 'legitimacy theory'. Its central tenant is that managers of firms with poor environmental performance provide *more* environmental disclosures to create the impression they are legitimately concerned about and addressing environmental issues. Thus, higher disclosing firms are actually poorer environmental performers. Examples of empirical results supporting this theory include Patten (2002), who finds that firms with higher levels of toxic releases (poor environmental performers) have more expansive environmental disclosures and Cho and Patten (2007), who find a negative relation between environmental performance and non-litigation related environmental disclosure. Cho, Roberts, and Patten (2010) find that poorer environmental performers use language in environmental disclosures that is more optimistic and reflects less certainty.

Under the incremental information perspective (often referred to as 'voluntary disclosure theory'), managers will voluntarily disclose information if the benefits of disclosure, such as sending a positive signal to stakeholders, outweigh the costs, such as sharing proprietary information with competitors. Since a manager's objective is to maximize firm value and there are costs associated with the disclosure of certain information, equilibriums exist at which favorable information that increases firm value is disclosed and unfavorable information is withheld (Verrecchia 2001, Verrecchia 1983, Dye 1985, Diamond and Verrecchia 1991). As Clarkson et al. (2008) note, voluntary disclosure theory suggests that better environmental performers make more extensive disclosures about their environmental activities to distinguish themselves from poorer environmental performers. The poorer performers cannot easily mimic the better performers because of the proprietary disclosure costs for better performers and uncertainty about their true type. Recent evidence consistent with this perspective can be found in Al-Tuwaijri, Christensen, and Hughes (2004) and Clarkson et al. (2008). Employing a simultaneous equations approach, Al-Tuwaijri et al. (2004) find a negative relation between waste recycled and environmental disclosures. Clarkson et al. (2008) find a negative relation between pollution discharge and sustainability report disclosures. Clarkson et al. (2008) also argue that earlier research on voluntary disclosure and environmental performance suffers from methodological limitations which limit the reliability of their inferences. Clarkson, Fang, Li, and Richardson (2010) find evidence that the extensiveness of environmental disclosures is associated with equity value *after* controlling for environmental performance, which is consistent with environmental disclosures signaling better environmental performance beyond the signal contained in current and past actual environmental performance.

With respect to environmental disasters, the incremental information perspective suggests that managers of firms that are more prepared to mitigate environmental disasters and deal with potential consequences (including new regulations) will make more extensive environmental disclosures to inform investors (and other stakeholders) that they are prepared for environmental problems. Firms that are less prepared have less information to provide and make fewer disclosures. This perspective suggests that firms with more pre-incident environmental disclosures will suffer a smaller shareholder wealth decline at the occurrence of an environmental incident because shareholders know the high disclosing firms can deal with the potential consequences at lower cost. Predictions from the impression management perspective regarding stock price responses to an environmental incident and pre-incident disclosures are less clear. If the less-well prepared firms disclose more (pre-incident) than the better prepared firms and investors do not see through the ruse, the high disclosers will, as in the incremental information perspective, suffer smaller share price declines (but they will be the less prepared firms, not the better prepared ones). However, if investors are aware that the high disclosers are actually less well prepared, the high disclosers will suffer *greater* share price declines at the time of the incident.

Previous studies of disclosure and stock price responses to unfavorable environmental news generally interpret their results in the context of the incremental information perspective (i.e. voluntary disclosure theory). For example, Blacconiere and Patten (1994) use the extent of chemical firms' 10-K environmental disclosures prior to the Union Carbide, Inc. Bhopal, India chemical leak as an inverse proxy for expected changes in regulatory costs. Blacconiere and Northcut (1997) study chemical firm stock price responses to Superfund legislation and state "extensive environmental disclosures are posited to be a positive signal concerning the firm' exposure to environmental risk." Both studies conclude that chemical-industry firms with more extensive environmental disclosures suffered smaller share price declines, but both studies report their results are sensitive to specification issues.[23] These interpretations are at least consistent with results from a number of other studies suggesting that *actual* corporate environmental performance information is valuation relevant. For example, Clarkson, et al. (2004) find a positive relation between equity value and environmental capital expenditures, and Barth and McNichols (1994) find that Superfund cleanup cost estimates are negatively associated with equity values.[24] Higher equity values for firms with better environmental performance provides managers of better performing firms an incentive to disclose more and separate themselves from poorer performers, especially if poorer environmental performers cannot (credibly) mimic the disclosures of better performers.

Thus, prior research is somewhat inconclusive regarding whether better environmental-performing firms provide more or less extensive environmental disclosures, but given (1) results of valuation research on environmental information, (2) the interpretations of results by prior research on environmental news, (3) the fact that the evidence supporting a positive environmental-disclosure-environmental-performance link is at least as substantial as evidence to the contrary, and (4) the effects of environmental disclosure on stock price reactions to environmental news are more easily interpreted under the incremental information perspective, we will follow prior environmental news research (i.e. Blacconiere and Patten 1994, Blacconiere and Northcut 1997) in interpreting our tests. That is, we will interpret a muted stock price response to the BP spill by firms with more extensive environmental disclosures as consistent with the notion that such disclosures reflect the ability to contend with future

[23] Patten and Nance (1998) also investigate stock price responses to a corporate environmental disaster (the ExxonValdez oil spill). They find, however, that competitors' prices increased in response to the spill, which clouds the interpretation of their analyses of the relation between event-period stock price changes and environmental disclosures.

[24] Clarkson, Li, and Richardson (2004) find a positive value-environmental capital expenditure relation only among better environmental performers, which is consistent with prior research suggesting better environmental performers obtain cost advantages from over-compliance with environmental regulations but poorer environmental performers do not.

disasters and regulations at lower cost and that investors interpret those disclosures in that way. Therefore, our hypothesis (in alternative form) is:

> ***H2**: Oil and gas firms with superior environmental disclosures experienced a less negative equity share price change following the BP spill than those firms with inferior environmental disclosures.*

Research Design

Environmental disclosures within a firm's 10-K and annual report to shareholders are governed by the Securities and Exchange Commission (SEC) (through Regulation S-K) and the Financial Accounting Standards Board (FASB). There are four main areas that firms must address via disclosure in their annual filing to the SEC: (1) any material effects of compliance with governmental requirements relating to environmental protection that influence capital expenditures, earnings, and the firm's competitive position; (2) any material pending environmental legal proceedings; (3) significant implications of environmental regulation on future firm operations; and (4) material risk factors that could influence the firm's business[25]. Beyond these items, Statement of Financial Accounting Standard (SFAS) Numbers 5 and 143 require firms to disclose environmental loss contingencies that can be reasonably estimated, as well as the costs of retiring long-lived tangible assets, or asset retirement obligations (AROs).

Although regulators provide guidelines regarding environmental disclosures, managers have considerable discretion in determining what, and to what extent, to disclose. Since firms disclose the mandatory items only if they are material, it is possible they use this discretion to simply not disclose any amounts for these items. For instance, Al-Tuwaijri et al. (2004) note their finding that high environmental performers also disclose more regarding pollution specific measures and occurrences suggests poor environmental performers either do not strictly follow SFAS 5 requirements to disclose

[25] See Code of Federal Regulations §229.101 (Item 101) Description of Business; §229.103 (Item 103) Legal Proceedings; and §229.503 (Item 503) Prospectus Summary, Risk Factors, and Ratio of Earnings to Fixed Charges

environmental liabilities, or SFAS 5 provides enough leeway for these firms to rationalize non-disclosure. Therefore, although some of the disclosures we collect are governed by SEC regulations and FASB standards, we treat them as voluntary.

Firms in the oil and gas industry often provide other environmental disclosures outside those required by regulators. First, oil and gas firms generally have spill prevention and remediation plans, and some firms refer to this plan in their 10-K, potentially signaling their preparedness to prevent and mitigate environmental disasters. Similarly, firms may disclose a sustainability report, a standalone document detailing a commitment to social and environmental issues. Dhaliwal, Li, Tsang, and Yang (2011) find that following the initial year of issuing a sustainability report, firms with superior social responsibility enjoy a reduction in the cost of equity capital and also attract institutional investors and analyst coverage. Their results suggest investors and analysts alike attach positive value to a firm's decision to issue a sustainability report. Last, oil and gas firms often mention the environmental regulations to which they adhere, conceivably to signal environmental awareness and preparedness. Thus, some of the disclosures we collect (in this and later sections) are outside the purview of regulators.

We evaluate each sample firm's last SEC annual filing (Form 10-K) prior to the BP spill to assess the firm's level of environmental disclosure. We use content analysis to create, for our sample firms, an environmental disclosure score similar to the one used by Blacconiere and Patten (1994), although our score components differ somewhat from theirs (reflecting our different industry and disaster setting).[26] Based on the regulatory requirements and standard disclosures for the oil and gas industry, as well as those disclosures examined in prior research, we collect seven environmental disclosures. Thus, our environmental disclosure score (*RATING*) ranges from 0-7, depending on how many of the seven following items the firm discloses.

(1) *CAPEX* = 1 if an amount of capital expenditures for environmental protection is included, and 0 otherwise;

[26] Blacconiere and Patten (1994) examine five environmental disclosures: 1) current or proposed environmental regulations, 2) compliance efforts of the company relative to environmental standards, 3) current or past environmental expenditures, 4) future estimates of environmental expenditures, and 5) environmental litigation.

(2) *PLAN_DUM* = 1 if the environmental laws or regulations that require a disaster recovery plan are mentioned, or if the firm's personalized disaster recovery plan is mentioned, or if a detailed description of a disaster recovery plan is provided, and 0 otherwise;

(3) *SR* = 1 if a sustainability report is mentioned, or if the firm has a standalone sustainability report on their company website, and 0 otherwise;

(4) *ENVLIAB* = 1 if an amount for environmental liabilities is included, and 0 otherwise;

(5) *REGUL* = 1 if current or future environmental regulation is mentioned, and 0 otherwise;

(6) *CAPEXFUT* = 1 if an amount for future environmental capital expenditures is included, and 0 otherwise;

(7) *LIT* = 1 if environmental litigation is mentioned, and 0 otherwise;

Not all of the environmental disclosures we examine convey good news regarding a firm's environmental position. For example, being sued over an environmental issue is not likely good (for shareholders) news. However, prior research on disclosure and stock price responses to negative environmental news (e.g. Blacconiere and Patten 1994) generally interprets pre-event willingness to disclose negative items as indicative of greater desire and or ability to contend with potential future environmental costs.[27] Therefore, in our score (like in Blacconiere and Patten's 1994), the presence of each component increases the total score.

RATING's values range between zero and seven for each firm depending on how many of each of seven disclosures the firm makes (as explained above). *RATING* does not capture the informativeness of the disclosures themselves. Thus, *RATING* likely measures each firm's disclosure extensiveness with error. For example, firms with *RATING* values of seven do not necessarily provide a stronger signal of their ability to address future regulations and reduce spill likelihoods than firms with *RATING* values of six. However, firms with higher *RATING* values (e.g. values of six or seven) likely do provide a stronger signal than firms with lower *RATING* values (e.g. values of one or two). Therefore, it may be possible to mitigate the consequences of this measurement error by breaking *RATING* into a binary variable--one for

[27] We repeated the analyses we report below after dropping *ENVLIAB* and *LIT* from the computation of *RATING*. This specification produced generally weaker statistical significance for the coefficient on *RATING* in equation (3), which supports the notion that it is the willingness to disclose that informs investors about the firm's preparedness for future environmental incidents and regulatory costs.

values above the sample median and zero for values below.[28] While reducing the number of categories can help mitigate the consequences of measurement error, the tradeoff is a loss of information. Whether the reduced form variable provides more power than the original depends on whether the reduction of measurement error more than offsets the loss of information. Therefore, we conduct our analysis using both the categorical and binary versions of *RATING*.

To test H2, i.e. whether firms with more environmental disclosure experience less of a negative stock price reaction to the BP spill, we estimate the following regression:

$$CAR_i = \alpha + \gamma_1 RATING_i + \gamma_2 SIZE_i + e_i \qquad (3)$$

where

CAR_i = cumulative abnormal return for firm *i* over the event window

$SIZE_i$ = either: (1) total annual revenues for firm *i* at the end of 2009 (*REVENUES*), or (2) the natural log of total annual revenues for firm *i* at the end of 2009 (*lnREVENUES*)

All other variables are as defined previously.

We expect either a positive sign for γ_1, indicating that firms with greater environmental disclosure experience less of a negative equity stock price reaction to the spill, or a negative sign for γ_1, indicating that firms with greater environmental disclosure experience a *more* negative equity stock price reaction to the spill. A positive γ_1 would be consistent with the incremental information perspective, while a negative γ_1 would be consistent with the impression management perspective. We include firm size in the model, which we proxy by both *REVENUES* and *lnREVENUES*, following Blacconiere and Patten (1994). Additionally, Lang and Lundholm (1993) provide evidence that disclosure is increasing in firm size. We also estimate equation (3) without *SIZE*, which we explain further below.

[28] Addressing measurement error in a continuous variable by replacing it with a categorical variable constructed from its ranks is discussed more thoroughly in Biddle and Lindahl (1982). Although *RATING* is already categorical (ranging from zero to seven), reducing the number of categories from seven to two is an application of the instrumental variables approach discussed in Biddle and Lindahl (1982).

Results

Table 3 shows the Pearson correlations among the disclosure variables for the full sample of firms. Several significantly positive correlations exist among the disclosure variables. For instance, the disclosure of environmental capital expenditures (*CAPEX*) is positively associated with environmental liabilities (*ENVLIAB*), future capital expenditures (*CAPEXFUT*), and environmental litigation (*LIT*). This suggests that firms who make environmental capital expenditures and are willing to disclose these amounts are also more active and transparent regarding other aspects of environmentalism, supporting our (and prior researchers') decision(s) to code each of these as positive contributors to the overall rating score.

Table 4 provides the results from estimating equation (3).[29] Panels A and B show the results for the full and U.S. offshore samples, respectively, for both eight-day windows.[30] For the full sample, *RATING* is insignificant for all specifications. For the U.S. offshore sample, *RATING* is positive in all 12 specifications and significantly different from zero at the five percent level or better for all but two. *RATING* is positive and significant at the 10 percent level for the eight-day-a window when *SIZE* is the natural log of revenues and *RATING* is binary. *RATING* is insignificant for the eight-day-a window when *SIZE* is the natural log of revenues and *RATING* is categorical.[31, 32] The *RATING* coefficients and t-

[29] We include a test of the impact of disclosure for the full sample for completeness, even though we did not conclude the full sample of firms experienced a price reaction to the spill. We exclude a cross-sectional examination using the 71-day window because the stock price reaction this period was not significantly different from zero for either the full or U.S. offshore samples.

[30] We do not tabulate the results for the 7-day window because they are quantitatively similar to the results of the 8-day windows.

[31] Significance levels in Table 4 are based on OLS t-statistics. We generated an empirical distribution of t-statistics from non-event periods in a manner analogous to that we describe in Section 2. p-values for *RATING* based on these empirical distributions are as follows: 0.014 for columns (2), (5), (6), (8), (11), and (12) of Table 4; 0.041 for columns (9) and (10); 0.068 for columns (1) and (4); and 0.095 for column (7); and greater than 0.10 (i.e. insignificant) for column (3).

[32] For consistency with later methods (See Section 4), we also estimate a single interaction model: $CAR_i = \alpha + \gamma_1 USOFF_i + \gamma_2 RATING_i + \gamma_3 SIZE_i + \gamma_4 USOFF * RATING_i + e_{it}$and test whether $\gamma_1 + \gamma_4 = 0$. *USOFFi* is an indicator variable equaling one if firm *i* if from our U.S. offshore sample. This model does not produce statistically significant estimates of $\gamma_1 + \gamma_4$ but suffers from multicollinearity, so we do not tabulate results from it.

statistics are generally slightly larger in magnitude when *RATING* is binary rather than categorical, providing some support for the notion that the binary version mitigates some measurement error.

We note that the coefficient on *SIZE* is insignificantly different from zero regardless of whether we use total revenues or the natural log of revenues to measure size. Therefore, we estimate equation (3) with two additional size proxies: total assets and the natural log of total assets. The results (not tabulated) are similar, but not identical to those in Table 4. Specifically, the *RATING* coefficient is always positive. It is virtually always insignificant for the full sample and generally significant at the five percent level for the U.S. offshore sample when total assets is the size proxy. It is generally insignificant when the natural log of total assets is the size proxy. Again, however, the coefficient on *SIZE* is always insignificantly different from zero for both proxies (total assets and the natural log of total assets). Because *SIZE* never has any explanatory power, we also estimate equation (3) after dropping *SIZE* from the equation. In this specification, *RATING* is always positive and significant at the one percent level (columns (9) through (12) in Panel B of Table 4).

Considering all of our analyses and results, we conclude that our evidence supports that superior environmental disclosures mitigated equity share price declines following the BP spill. We interpret this evidence as consistent with the notion that pre-negative-environmental-event-disclosures inform investors that firms with more extensive environmental disclosures are better prepared to handle potential future regulatory and disaster costs. Our conclusion is similar to that of Blacconiere and Patten (1994), despite the different setting (different industries and different disclosures). They also conclude that disclosure mitigates the negative share price reaction to negative environmental news, but only when they use revenues to measure size and not when they use the natural log of revenues. It is in this aspect that our results differ from those of Blacconiere and Patten (1994). Our analyses generally consistently suggest environmental disclosures mitigate negative share price reactions to a negative environmental event. However, our evidence of a mitigating effect of disclosure is limited to our U.S. offshore sample, but we found a negative share price reaction to the spill only among the U.S. offshore sample. We believe our analysis and results provide important confirmation of Blacconiere and Patten's (1994) inference in a very different setting.

4. Change in Disclosure

Did Firms Increase Disclosures After the Spill?

We next investigate whether the managements of our sample of oil and gas firms alter their environmental disclosures in their post-spill 10-Ks compared to their pre-spill 10-Ks. Prior literature suggests a variety of settings in which firms choose to alter their disclosure policy, such as for strategic reasons, in response to regulation changes, or in response to investor demand or investor sentiment. We explore each of these possibilities further below.

Evidence exists that firms use voluntary disclosure strategically. Frankel, McNichols and Wilson (1995), for example, find that firms increase the amount of good news released prior to equity offerings in order to generate a higher dollar value of proceeds. Moreover, Aboody and Kasznik (2005) find that firms accelerate bad news and decrease good news prior to stock option grant dates in order to lower the exercise price of the option. These studies suggest that firms alter their disclosures to their advantage based on knowledge of certain upcoming events. Similarly, it is plausible that oil and gas firms change their disclosures based on the expectation of future regulation prompted by the BP spill.

Additionally, research suggests firms adjust their disclosure policy based on investor sentiment. Bergman and Roychowdhury (2008) find that during periods of low sentiment, firms increase both the frequency of management earnings forecasts and the number of management forecasts that "walk up" current forecasts of long-horizon earnings. The BP spill likely moved investor sentiment more towards negative for firms in the oil and gas industry, and this negative sentiment is specific to environmental issues. That is, the BP spill made investor sentiment more negative with respect to the potential environmental consequences (and the associated potential costs of those consequences) of the spill on oil and gas operations. Thus, we conjecture that managers will respond to the shift toward negative sentiment about potential environmental impact by increasing their environmental disclosures. This hypothesis, stated in alternative form, is:

***H3**: Oil and gas firms increased environmental disclosure in the post-spill period.*

To test this hypothesis, we collect from each firm's post-spill 10-K the same disclosures collected from the pre-spill 10-K.[33] We also collect, from both pre- and post-spill periods, the following two variables:

> *LOBBY* = Total amount of political lobbying expenses from Q1 2008 – Q1 2010, scaled by market value of equity at the end of Q1 2010 (prior to the quarter of the event).[34]
>
> *PLAN_CAT* = 0 if no mention of a disaster recovery plan, 1 if the environmental laws or regulations that require a disaster recovery plan are mentioned, 2 if the firm's personalized disaster recovery plan is mentioned, 3 if a detailed description of a disaster recovery plan is provided

We use a paired t-test and the Wilcoxon signed rank sum test to examine whether the change in disclosure for each disclosure category is significant. The results are displayed in Table 5. Panel A provides the results for the full sample of firms and indicates that the changes in *PLAN_DUM* (a binary variable equaling 1 if the firm mentions a disaster recovery plan) and *PLAN_CAT* (a categorical variable representing the extent to which firms provide detail regarding their disaster recovery plan, as described above) are significant at the 1% level, and *RATING* is significant at the 5% level. Panel B shows that, for the sample of U.S. offshore firms, the changes in *PLAN_DUM*, *PLAN_CAT*, and *RATING* are significant at the 5%, 1%, and 5% (5%, 1%, and 5%) levels, respectively, for the paired t-test (signed rank test). Based on these results, we can reject the null hypothesis and conclude that oil and gas firms increased

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[33] The sustainability report (*SR*) variable remains unchanged for this analysis since a firm's decision to issue a sustainability report may not occur on an annual basis. Firms may use the same report over many years, or only update the report once every few years.

[34] We collect lobbying expenditures from the U.S. Senate Office of Public Records LDA (Lobbying Disclosure Act) reports (http://www.senate.gov/legislative/Public_Disclosure/LDA_reports.htm).

environmental disclosure following the BP spill. This increase in disclosure, however, is largely limited to a change in disclosure regarding disaster recovery plans, consistent with the conjecture that managers were most concerned about investor (and regulator) perceptions about their abilities to prevent and mitigate future environmental incidents. It is plausible managers believed disclosing information about disaster plans would not only help allay investor concerns, but also reduce the extent (and costliness) of future regulation.

Our evidence suggesting an increase in disclosure following the BP spill is similar in tenor to prior research, but differs considerably in specifics. Patten (1992) examines whether oil and gas firms increase environmental disclosure following the Exxon Valdez oil spill. He finds an increase in a disclosure score constructed from seven components. Patten (1992) does not investigate changes in individual components of the composite score. Perhaps more importantly, a disaster recovery plan is not one of the components of his composite score. Thus, our inference that firms increase disclosure of largely only their disaster plans differs considerably from Patten's (1992) inference.

Cross-Sectional Determinants of Disclosure Changes: Motivation

In this section, we investigate the cross-sectional determinants of our sample firms' changes in environmental disclosures. The determinants of disclosure choices have been examined in various settings throughout the accounting literature. We focus on five cross-sectional variables—litigation risk, information asymmetry, political lobbying expenses, institutional ownership, and ownership concentration because, as discussed below, the disclosure literature suggests these five constructs are potentially important in explaining changes in disclosure in our setting. We form predictions related to each of these variables below.

Accounting researchers have long debated the relation between litigation risk and disclosure. Some studies argue managers face incentives to increase disclosure when litigation risk is high in order to warn the market about bad news. For example, Skinner (1994) finds evidence that managers preempt, rather than remain silent regarding large negative earnings surprises by issuing management earnings forecasts prior to a bad-news earnings announcement. He attributes this preemptive behavior to the increased likelihood of shareholder litigation following large negative earnings surprises. Also, Johnson, Kasznik, and Nelson (2001) find that firms increase voluntary disclosure following the passage of the Private Securities Litigation Reform Act, and that the change is positively related to a firm's ex ante litigation risk. Field, Lowry, and Shu (2005) use a simultaneous equations methodology to address the endogeniety between litigation risk and disclosure. They conclude that, at least for some types of litigation, disclosure deters litigation. Overall, these studies suggest the higher the litigation risk, the higher the level of disclosure. However, evidence also exists suggesting managers disclose less when litigation risk is high. Francis, Philbrick, and Schipper (1994) find that firms that disclosed more were more often litigation targets, while firms with presumably high ex ante litigation risk that did not disclose were generally not litigation targets. Additionally, Baginski, Hassell, and Kimbrough (2002) find that Canadian firms, which exist in a far less litigious environment than U.S. firms, issue more precise management earnings forecasts more frequently. Finally, Rogers and Van Buskirk (2009) find that in the period immediately following shareholder litigation, firms reduce voluntary disclosure. This result is consistent with the notion that high litigation risk firms choose to decrease the issuance of disclosures for which they may later be held responsible.

In total, considering the unresolved nature of the relation between litigation risk and disclosure, our litigation hypothesis is two-sided, which we state in alternative form as follows:

***H4**: Potential litigation risk is related to a change in environmental disclosure.*

The separation of the management and owners of a firm generates asymmetric information, which is often the source of investor demand for disclosure. Research regarding the link between information asymmetry and disclosure generally suggests that when firms provide disclosure, they experience information asymmetry reductions (Diamond and Verrecchia 1991). Brown, Hillegeist, and Lo (2004), for example, find that firms with higher conference call activity experience sustained reductions in information asymmetry. Botosan and Harris (2000) find that, during the two years ending prior to the year of an increase in segment disclosures, firms that increase their disclosure experience a decline in liquidity and an increase in information asymmetry. This suggests a positive relation between past information asymmetry and change in disclosure. Chen, Chen, and Cheng (2008) find that family firms, with lower information asymmetry between managers and owners, issue fewer management earnings forecasts and hold fewer conference calls than nonfamily firms. Based on the findings of the above studies, in our setting, we suspect that firms with higher levels of information asymmetry face higher investor demand for environmental information, and these firms will subsequently increase environmental disclosure in their post-spill 10-K. Thus, our fifth hypothesis, stated in alternative form, is:

H5*: Information asymmetry is positively related to a change in environmental disclosure.*

Firms have incentives to influence political processes since both shareholder and management wealth may be impacted by public policy. Firms potentially influence political processes through the use of paid lobbyists. Research in the accounting literature regarding the relation between lobbying expenditures and disclosure is scarce. A negative relation appears feasible since firms that largely participate (do not participate) in political lobbying have less (more) of a need to use disclosure to help protect themselves from litigation or to meet shareholder demands. Patten and Trompeter (2003), for example, use the Union Carbide Bhopal chemical leak to investigate whether earnings management, a reactive tool, is related to pre-event environmental disclosure, a proactive tool, both of which are potential actions taken to reduce political exposures. They find that firms with more extensive pre-spill environmental disclosures had less incentive to use income-reducing accruals in the year of the spill. In other words, firms use disclosure as a tool for managing public pressure, but earnings management is part of a larger firm political strategy. In our setting, it is plausible that firms that increase environmental disclosure following the BP spill do so because they do not have a proactive strategy, such as political lobbying expenditures, to help manage political costs.

On the contrary, a positive relation between lobbying expenses and disclosure is possible if firms that are active lobbyists also take an active environmental disclosure strategy. Cho, Patten, and Roberts (2006) examine the association between firms' political expenditures and environmental disclosures. They find a positive relation between political spending and the extent of environmental disclosures, which suggests that firms use the two as complementary strategies to address their political exposure. Moreover, Patten (2002) finds poor environmental performers have more expansive voluntary disclosure. He infers that firms facing higher political costs have an incentive to create an appearance of environmental awareness via disclosure. By this theory, oil and gas firms that increase environmental disclosures potentially do so because they face higher political costs, and such firms likely lobby more.

Because of the plausibility of either a positive or a negative relation, and because prior research does not clearly suggest the dominance of one, we make our political lobbying hypothesis two sided:

H6*: Political lobbying expenditures are related to a firm's change in environmental disclosure.*

Prior research (outside of environmental disclosure research) suggests that a firm's level of institutional ownership influences management's disclosure decisions. Firms often seek to attract large institutional investors with long investment horizons in order to generate a stable ownership base, and these investors demand higher disclosure levels (Bushee and Noe 2000). Ajinkya, Bhojraj, and Sengupta (2005) find that firms with greater institutional ownership are more likely to provide management earnings forecasts and to issue more frequent, specific, accurate, and less optimistically-biased forecasts. Healy, Hutton, and Palepu (1999) find that firms that expand their voluntary disclosures garner an increase in institutional ownership. Thus, we predict that firms with an ex ante higher level of institutional ownership will be more likely to increase environmental disclosure following the BP spill. Our seventh hypothesis, stated in alternative form, is:

H7: *Institutional ownership is positively related to a change in environmental disclosure.*

While institutional owners are often considered outsiders demanding more information, institutional investors can act as insiders (Ajinkya et al. 2005). When ownership is concentrated in a few institutions, for instance, these institutions are likely to have greater influence over management, greater access to private information, and less of a need to demand public disclosures. Ajinkya et al. (2005) find that concentrated institutional ownership is negatively related to disclosure frequency and specificity. Guedhami and Pittman (2006) find that among 190 privatized firms from 31 countries, firms subject to extensive disclosure standards exhibit less ownership concentration. Based on these findings, our eighth hypothesis, stated in alternative form, is:

> ***H8***: *Institutional ownership concentration is negatively related to a change in environmental disclosure.*

Cross-Sectional Determinants of Disclosure Changes: Research Design and Results

To test the above hypotheses, we estimate the following regression:

$$\Delta DISCL_i = \alpha + \mu_1 LITRISK_i + \mu_2 SPREAD_i + \mu_3 LOBBY_i + \mu_4 INSTOWN_i + \mu_5 INSTCONC_i + \mu_6 SIZE + e_i \quad (4)$$

where

ΔDISCL = either change in *RATING* (*ΔRATING*) or change in *PLAN_CAT* (*ΔPLAN_CAT*), where the change is from pre- to post-spill, calculated as: *DISCL_post-spill –DISCL_pre-spill*

PLAN_CAT = 0 if no mention of a disaster recovery plan, 1 if the environmental laws or regulations that require a disaster recovery plan are mentioned, 2 if the firm's personalized disaster recovery plan is mentioned, 3 if a detailed description of a disaster recovery plan is provided.

LITRISK = **-5.738** + **.141****lnMVE* + **.284****TURN* + **.012****BETA* - **.237****BHR* - **3.161****MIN_RET* - **1.34****STD_RET* + **.011****SKEW_RET*

lnMVE = the natural log of the 2009 average daily market value of equity, where market value of equity = price*shares outstanding;

TURN = the average 2009 daily share volume divided by the average 2009 shares outstanding;

BETA = the slope coefficient from the market model for the year 2009, where a firm's daily 2009 returns are regressed on the daily CRSP equal-weighted market index;

BHR = buy and hold return beginning the first trading day of 2009 and ending the last trading day of 2009;

MIN_RET = the minimum daily return of all 2009 daily returns;

STD_RET = the standard deviation of all 2009 daily returns;

SKEW_RET = the skewness of all 2009 daily returns;

SPREAD = (*ASK–BID*) / [(*ASK*BID*)/2], retrieved from the CRSP database

INSTOWN = number of shares held by institutions / total shares outstanding

INSTCONC = number of shares held by top 5 institutional investors / total shares outstanding

SIZE = either: (1) total annual revenues for firm *i* at the end of 2009 (*REVENUES*), or (2) the natural log of total annual revenues for firm *i* at the end of 2009 (*lnREVENUES*)

All other variables are as defined previously.

Following Krishnan and Lee (2009), we obtain the coefficient estimates used to compute *LITRISK* from Rogers and Stocken (2009). To calculate *SPREAD*, we use the *ASK* and *BID* variables from CRSP.[35] We obtain institutional ownership data from Thomson-Reuters Institutional (13f) Holdings database. We estimate equation (4) with *ΔPLAN_CAT* as the dependent variable (in addition to *ΔRATING* as the dependent variable) because the disaster plan is the one environmental disclosure we investigate that significantly increased from the pre- to post-spill periods.[36]

Table 6 provides the results of estimating model (4) for the full sample. Panel A displays results using $REVENUES_i$ as the measure of size and Panel B displays results using $lnREVENUES_i$. To address the possibility of heteroscedastic errors, we base t-statistics on White's (1980) heteroscedasticity-consistent covariance matrix. Based on White's t-statistics, virtually none of the cross-sectional variables

[35] Chung and Zhang (2009) provide evidence that, for measuring daily spread, the CRSP-based bid-ask spread is an appropriate substitute for the TAQ-based bid-ask spread.

[36] Note that we do not use the binary version of *RATING* nor *PLAN_DUM* as dependent variables in this analysis. When a variable is an independent variable, it can be worthwhile to trade loss of information in favor of reducing measurement error (by reducing the number of categories) (Biddle and Lindahl 1982). However, the benefits of that trade-off are likely smaller and the costs likely higher when that variable is the dependent variable. Reducing the number of categories in a dependent variable potentially throws away information that could be explained. Further, random measurement error in an *independent* variable biases its coefficient toward zero, while random measurement error in a dependent variable produces no coefficient biases, as long as the measurement error is not correlated with an independent variable. Thus, we use the binary version of *RATING* in Table 4 and the categorical version of *RATING* (and of *PLAN*) in Tables 6 and 7.

representing our hypotheses are significant for the full sample, regardless of the dependent variable or how we measure size. Only *SPREAD* is significant and only at the 10% level.

Table 7 shows results using the U.S. offshore sample. When *ΔRATING* is the dependent variable, none of the variables representing our hypotheses have coefficient estimates that are significantly different from zero. When the dependent variable is *ΔPLAN_CAT*, different variables produce significant coefficient estimates, depending on whether size is *REVENUES* or *lnREVENUES*. The coefficient on *INSTCONC* is significant in both size specifications and with a consistent negative sign. Therefore, we infer that managers of firms with higher ownership concentration saw less of a need to change environmental disclosure.[37] Significance versus non-significance for the remaining variables depends on how we measure size. Residual plots suggest residuals display a more random pattern when *lnREVENUES* is the measure of size, suggesting we should place more confidence in that specification. *INSTOWN* is significantly positive when *SIZE* is *REVENUES*, but not when *SIZE* is *lnREVENUES*. *LOBBY* is negative and significant when *SIZE* is *lnREVENUES*, suggesting firms with greater lobbying expenditures changed disclosures less. One final word regarding our firm size proxy: The measurement of firm size is imprecise, and choosing an appropriate proxy is arbitrary. When we use the natural log of assets in place of the natural log of revenues we generally lose significance (untabulated) on all variables (including the size proxy). We note, however, that the natural log of revenues is statistically significant in our change in disclosure regressions for both the full and U.S. offshore samples while the natural log of assets is not. This suggests that the natural log of revenues is important in explaining the variation in disclosure changes while the natural log of assets is not, which implies the natural log of revenues is likely a better choice as a control. That the hypothesis-related variables attain significance when the natural log of revenues is a control is likely attributable to the increase in power obtained by including a control that explains some of the variance in the dependent variable (Greene 1997, pp. 403-404).

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[37] Note that a negative coefficient on a variable (e.g. *INSTCONC*) does not necessarily mean that firms with high ownership concentration reduced their disclosure level. For example, if all firms increased disclosures, a negative *INSTCONC* coefficient would simply mean that firms with high ownership concentration increased their disclosures less than firms with low ownership concentration.

Considering the dependent variable (*ΔDISCL*) is categorical and not continuous, ordinary least squares assumptions are violated. An ordered logistic model avoids these violations. Logit test statistics, however, can be biased when the sample size is small (Stone and Rasp 1991). To increase the sample size (at the cost of producing additional parameters to estimate) we construct an interaction model which includes all sample observations. The model includes the indicator variable $USOFF_i$, which equals one if the firm has deep water drilling operations in the U.S. waters and zero otherwise. In particular, we estimate the following logit regression:

$$\Delta DISCL_i = \alpha + \mu_1 USOFF_i + \mu_2 LITRISK_i + \mu_3 SPREAD_i + \mu_4 LOBBY_i + \mu_5 INSTOWN_i + \mu_6 INSTCONC_i + \mu_7 SIZE_i + \mu_8 USOFF * LITRISK_i + \mu_9 USOFF * SPREAD_i + \mu_{10} USOFF * LOBBY_i + \mu_{11} USOFF * INSTOWN_i + \mu_{12} USOFF * INSTCONC_i + e_i \quad (5)$$

To confirm our inferences in Tables 6 and 7, we test whether $\mu_2 + \mu_8 = 0$, $\mu_3 + \mu_9 = 0$, $\mu_4 + \mu_{10} = 0$, $\mu_5 + \mu_{11} = 0$, and $\mu_6 + \mu_{12} = 0$ (untabulated). Similar to the results in Tables 6 and 7, the interaction model produces no significant coefficients when *ΔRATING* is the dependent variable. Accordingly, we focus our discussion on results when *ΔPLAN_CAT* is the dependent variable. When size is *REVENUES*, *INSTOWN* is significantly positive at the one percent level, and *INSTCONC* is significantly negative at the ten percent level. Similar but weaker results obtain when size is *lnREVENUES*, such that *INSTOWN* and *INSTCONC* are significant at the five percent and fourteen percent levels, respectively. For completeness, we also estimate (5) with *ΔPLAN_CAT* as the dependent variable using OLS. *INSTOWN* and *INSTCONC* remain significantly positive at the five percent level and negative at the ten percent level, respectively, regardless of firm size proxy.

Overall, we infer that the results of our analyses generally allow us to reject hypotheses 7 (*INSTOWN*) and 8 (*INSTCONC*). The finding that *INSTOWN* is significantly positive suggests that firms with high institutional ownership experience greater investor demand for voluntary environmental disclosure, consistent with Ajinkya et al. (2005). The negative coefficient on *INSTCONC* suggests that firms with high institutional ownership concentration face less investor demand for voluntary environmental disclosure, consistent with research in other disclosure settings (e.g. Ajinkya et al. 2005).

We do caution, however, that our sample size is small and our inferences are somewhat sensitive to specification choice.

5. Conclusion

This study examines the impact of the BP spill on (1) the stock returns of firms in the oil and gas industry, (2) whether environmental disclosures mitigate any negative shareholder wealth effects, (3) whether firms increase disclosure following the spill, and (4) the cross-sectional determinants of any change in disclosure. We provide evidence that the oil and gas industry as a whole did not suffer negative returns following the BP spill, but those firms with offshore operations in the United States experienced significant negative returns following the spill. These negative returns are consistent with increased risk of regulatory costs or disaster costs for the oil and gas firms operating in U.S. waters. We find that more extensive environmental disclosure mitigates disaster-induced shareholder wealth declines for firms operating in United States waters. We provide strong evidence that oil and gas firms increased disaster plan disclosures, but not other environmental disclosures, in their post-spill annual filings. Disclosure increases appear stronger for firms with high institutional ownership and low ownership concentration.

This study provides several contributions. First, it contributes to the stream of literature regarding the intra-industry stock price effects of an unfavorable environmental news event for one firm to other firms in the same industry. We investigate the largest marine oil spill in history and a sample of firms in the oil and gas industry. Our stock price results are similar to most of the prior studies of intra-industry stock price responses to corporate disasters, but ours is the first to find negative returns for oil and gas firms—an arguably more politically favored industry than the industries in most past studies. Second, this study contributes to the environmental disclosure literature and provides insight into the discussion regarding the incremental information and impression management perspectives of environmental disclosure. We provide robust evidence that firms with more expansive environmental disclosure suffer less negative stock price declines following the spill—an inference only weakly supported in past research (e.g. Blacconiere and Patten 1994). Next, our evidence that firms increase disaster plan disclosures, but not other environmental disclosures, differs from evidence from the Exxon Valdez spill (Patten 1992). Finally, we provide new evidence regarding the determinants of managers' disclosure choices following an environmental disaster. A caveat to our results is that most of our inferences are based on a small sample of oil and gas firms with deep water offshore operations in the United States. Nonetheless, we believe our findings are potentially of interest to investors, managements, and regulators, as they assess the consequences of and decide on responses to corporate environmental disasters. Overall, our study extends both the environmental and disclosure streams of literature in accounting.

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Table 1
Firms mentioning BP spill in post-spill 10-Ks

	Non-US Offshore firms	US Offshore firms	Difference in proportions Z-statistic
Mention of the spill	19	23	
Total firms	130	27	
Proportion that mention the spill	0.1462	0.8519	-7.54***

This table provides the number of non-U.S. offshore firms (no U.S. offshore deep water drilling operations) and U.S. offshore firms (U.S. offshore deep water drilling operations) that mention the BP spill in their most recent 10-K following the spill. *** denotes significance at the 1% level.

Table 2
Cumulative abnormal returns for oil and gas firms following the BP spill

Panel A - Full Sample

Window	CAR	t-statistic		Number of pseudo event replications	Actual t-statistic rank within pseudo t-statistic distribution	Pseudo t-statistic distribution based p-value
8-day-a	-0.0069	-0.70		-	-	-
8-day-b	-0.0176	-1.50	*	39	11	0.269
7-day	-0.0123	-1.59	*	45	10	0.211
71-day	0.0646	1.84	**	-	-	-

n=162

Panel B – U.S. Offshore Sample

Window	CAR	*t*-statistic				
8-day-a	-0.0565	-4.56	***	39	1	0.013
8-day-b	-0.0544	-4.72	***	39	1	0.013
7-day	-0.0555	-4.87	***	45	1	0.011
71-day	-0.0088	-0.15		-	-	-

n=29

This table shows abnormal returns cumulated across either eight or 71 days following the BP spill. Abnormal returns are the prediction errors from the market model with an added factor for the return on oil. The 8-day-a window *CAR* for each firm is the simple algebraic sum of the firm's abnormal returns across the eight trading days following the spill. The 8-day-b window *CAR* is also the sum across the same eight trading days, but we reverse the sign (see Section 3) of the abnormal return on April 23. The 7-day window *CAR* is the same as the 8-day windows, but we exclude the abnormal return on April 23.See Figure 1 for a timeline of events. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. The p-values in the right-most column are percentiles computed using the linear interpolation method.

Table 3
Pearson product-moment correlations and descriptive statistics for variables comprising the disclosure score (*RATING)*

	PLAN_DUM		*CAPEX*		*SR*		*ENVLIAB*		*REGUL*	*CAPEXFUT*		*LIT*
PLAN_DUM	1.000											
CAPEX	0.045		1.000									
SR	0.046		0.300	***	1.000							
ENVLIAB	0.080		0.314	***	0.366	***	1.000					
REGUL	0.539	***	0.034		0.060		0.140	*	1.000			
CAPEXFUT	-0.028		0.657	***	0.447	***	0.406	***	0.043	1.000		
LIT	0.059		0.315	***	0.137	*	0.264	***	0.045	0.368	***	1.000
MEAN	0.642		0.123		0.105		0.179		0.815	0.093		0.241
STD	0.481		0.33		0.307		0.385		0.39	0.291		0.429
N	162		162		162		162		162	162		162

All variables in this table are binary, equaling 1 or 0. *PLAN_DUM* equals 1 if the firm's 10-K (1) mentions the environmental laws or regulations that require a disaster recovery plan, (2) mentions the firm's personalized disaster recovery plan, or (3) provides a detailed description of a disaster recovery plan ; *CAPEX* equals 1 if the firm's 10-K includes an amount of capital expenditures for environmental protection; *SR* equals 1 if the firm's 10-K mentions a sustainability report or if the firm provides a standalone sustainability report on their company website; *ENVLIAB* equals 1 if the firm's 10-K includes an amount for environmental liabilities; *REGUL* equals 1 if the firm's 10-K mentions current or future environmental regulation; *CAPEXFUT* equals 1 if the firm's 10-K includes an amount for future environmental capital expenditures; *LIT* equals 1 if the firm's 10-K mentions environmental litigation. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 4
Influence of disclosure on cumulative abnormal returns following BP oil spill

Panel A: Full Sample (N=162)

	RATING Categorical				*RATING* Binary				*RATING* Categorical		*RATING* Binary	
	SIZE = Revs		*SIZE* = ln(Revs)		*SIZE* = Revs		*SIZE* = ln(Revs)		No Size	No Size	No Size	No Size
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	8-day-a	8-day-b	8-day-a	8-day-b	8-day-a	8-day-b	8-day-a	8-day-b	8-day-a	8-day-b	8-day-a	8-day-b
	Coef Est (t-stat)	Coef Est (t-stat)	Coef Est (t-stat)	Coef Est (t-stat)	Coef Est (t-stat)	Coef Est (t-stat)	Coef Est (t-stat)	Coef Est (t-stat)	Coef Est (t-stat)	Coef Est (t-stat)	Coef Est (t-stat)	Coef Est (t-stat)
Intercept	-0.008	-0.037	-0.008	-0.028	-0.013	-0.024	-0.005	-0.018	-0.008	-0.035	-0.013	-0.024
	(-0.46)	(-1.72)	(-0.43)	(-1.24)	(-1.08)	(-1.67)	(-0.25)	(-0.82)	(-0.47)	(-1.67)	(-1.08)	(-1.67)
RATING	0.001	0.010	0.001	0.015	0.021	0.021	0.028	0.025	0.001	0.008	0.019	0.019
	(0.10)	(1.09)	(0.06)	(1.28)	(0.93)	(0.79)	(1.06)	(0.81)	(0.09)	(1.00)	(0.90)	(0.77)
SIZE	0.000	0.000	0.000	-0.005	0.000	0.000	-0.002	-0.002				
	(-0.03)	(-0.45)	(0.01)	(-0.82)	(-0.25)	(-0.20)	(-0.57)	(-0.32)				

Panel B: U.S. Offshore Sample (N=29)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Intercept	-0.124	-0.123	-0.138	-0.108	-0.082	-0.080	-0.119	-0.081	-0.118	-0.110	-0.082	-0.080
	(-3.85)	(-4.11)	(-4.33)	(-3.57)	(-5.80)	(-6.23)	(-3.63)	(-2.64)	(-4357)	(-4.57)	(-5.89)	(-6.35)
RATING	0.025**	0.026**	0.011	0.021**	0.063**	0.069***	0.048*	0.067***	0.022***	0.020***	0.067***	0.067***
	(2.02)	(2.27)	(0.88)	(1.70)	(2.38)	(2.89)	(1.63)	(2.55)	(2.64)	(2.57)	(2.97)	(3.29)
SIZE	0.000	0.000	0.007	-0.001	0.000	0.000	0.006	0.000				
	(-0.34)	(-0.72)	(1.06)	(-0.12)	(0.34)	(-0.15)	(1.24)	(0.02)				

This table reports results from OLS estimation of $CAR_{it} = \alpha_{it} + \gamma_1\ RATING_{it} + \gamma_2\ SIZE_{it}$. Abnormal returns are prediction errors from the market model with an added factor for the return on oil. *CAR* is the algebraic sum of daily abnormal returns across the eight days in the windows. For the 8-day-b window, we reverse the sign of the abnormal returns on Friday, April 23. *RATING* Categorical is a disclosure score that ranges from 0-7 depending on the how many of the seven following items the firm discloses: *CAPEX*, *PLAN_DUM*, *SR*, *ENVLIAB*, *REGUL*, *CAPEXFUT*, and *LIT* (all disclosure score variables defined in Table 3). *RATING* Binary equals 1 if a firm's *RATING* Categorical score is above the sample median, and equals 0 otherwise. *SIZE* is either total revenues or the natural log of total revenues. *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 5
Results of paired *t*-test Wilcoxon signed rank sum test and of a change in disclosure

Panel A - Full Sample

Variable	Post mean – pre mean	*t*-statistic		Signed rank statistic	
PLAN_DUM	0.070	3.14	***	38.5	***
PLAN_CAT	0.198	3.78	***	139.5	***
CAPEX	-0.006	-0.45		-1.5	
SR	-	-		-	
ENVLIAB	-0.019	-1.00		-7.5	
REGUL	0.032	1.51		15.0	
CAPEXFUT	0.013	0.63		5.5	
LIT	0.026	1.00		17.0	
RATING	0.115	2.21	**	192.0	**

n=157

Panel B – U.S. Offshore Sample

Variable	Post mean – pre mean	*t*-statistic		Signed rank statistic	
PLAN_DUM	0.222	2.73	**	10.5	**
PLAN_CAT	0.852	3.69	***	42.5	***
CAPEX	0.037	0.57		1.0	
SR	-	-		-	
ENVLIAB	-0.037	-1.00		-0.5	
REGUL	0.000	-		-	
CAPEXFUT	0.037	0.44		1.5	
LIT	0.074	1.00		2.5	
RATING	0.300	1.87	**	19.5	*

n=27

This table provides the results of multiple paired t-tests for the difference in means and Wilcoxon sign-rank tests for the difference in medians of each disclosure variable from the pre- to post-spill period. *PLAN_CAT* equals 0 if no mention of a disaster recovery plan, 1 if the environmental laws or regulations that require a disaster recovery plan are mentioned, 2 if the firm's personalized disaster recovery plan is mentioned, 3 if a detailed description of a disaster recovery plan is provided. All other variables are as defined in Table 3. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. *SR* is not available annually, and so cannot change from pre- to post-spill.

Table 6
Determinants of pre- to post-spill changes in disclosure: Full sample

Panel A: $SIZE_i = REVENUE_i$

Panel A1: $\Delta DISCL_i = \Delta RATING_i$				Panel A2: $\Delta DISCL_i = \Delta PLAN\_CAT_i$				
Variable	Parameter estimate	OLS *t*-statistic	White's *t*-statistic	Parameter estimate	OLS *t*-statistic		White's *t*-statistic	
INTERCEPT	0.089	0.57	0.77	0.126	0.84		1.22	
LITRISK	0.008	0.31	0.34	-0.006	-0.23		-0.18	
SPREAD	0.282	0.12	0.16	0.602	0.27		0.52	
LOBBY	276.9	0.64	0.63	-229.6	-0.56		-1.00	
INSTOWN	-0.079	-0.19	-0.17	0.655	1.69	**	1.04	
INSTCONC	0.232	0.24	0.21	-1.109	-1.23		-0.79	
REVENUES	0.000	1.29	1.03	0.000	3.87	***	2.02	**
n=128								
Adjusted R^2	-0.028			0.122				

Panel B: $SIZE_i = lnREVENUE_i$

Panel B1: $\Delta DISCL_i = \Delta RATING_i$				Panel B2: $\Delta DISCL_i = \Delta PLAN\_CAT_i$				
Variable	Parameter estimate	OLS *t*-statistic	White's *t*-statistic	Parameter estimate	OLS *t*-statistic		White's *t*-statistic	
INTERCEPT	0.057	0.28	0.44	-0.257	-1.31		-1.57	
LITRISK	0.005	0.18	0.19	-0.014	-0.54		-0.42	
SPREAD	0.353	0.14	0.20	2.430	1.04		1.59	*
LOBBY	320.1	0.73	0.75	-254.5	-0.61		-0.96	
INSTOWN	-0.035	-0.08	-0.07	0.311	0.72		0.53	
INSTCONC	0.056	0.06	0.05	-0.944	-1.02		-0.73	
LNREVENUES	0.012	0.41	0.40	0.099	3.53	***	3.15	***
n=128								
Adjusted R^2	-0.041			0.106				

This table reports results from OLS and White's Standard Error estimation of $\Delta DISCL_i = \alpha_0 + \alpha_1 LITRISK_i + \alpha_2 SPREAD_i + \alpha_3 LOBBY_i + \alpha_4 INSTOWN_i + \alpha_5 INSTCONC_i + \alpha_6 SIZE_i + e_i$ for the full sample of firms. $\Delta DISCL_i$ is the change in $DISCL_i$ from before to after the spill. $DISCL_i$ is either $RATING_i$ or $PLAN\_CAT_i$. $RATING_i$ is a disclosure score that ranges from 0-7 depending on the how many of the seven following items the firm discloses: *CAPEX*, *PLAN_DUM*, *SR*, *ENVLIAB*, *REGUL*, *CAPEXFUT*, and *LIT* (all defined in Table 3). $PLAN\_CAT_i$ equals 0 if the firm makes no mention of a disaster recovery plan, 1 if the firm mentions environmental laws or regulations that require a disaster recovery, 2 if the firm mentions a firm-specific disaster recovery plan, and 3 if the firm provides a detailed description of a disaster recovery plan. *LITRISK* = **-5.738** + **.141****lnMVE* + **.284****TURN* + **.012****BETA* - **.237****BHR* - **3.161****MIN_RET* - **1.34****STD_RET* + **.011****SKEW_RET*; *lnMVE* is the natural log of the 2009 average daily market value of equity; market value of equity = price*shares outstanding; *TURN* is the average 2009 daily share volume divided by the average 2009 shares outstanding; *BETA* is the slope coefficient from the market model for the year 2009, where a firm's daily 2009 returns are regressed on the daily CRSP equal-weighted market index; *BHR* is the buy and hold return beginning the first trading day of 2009 and ending the last trading day of 2009; *MIN_RET* is the minimum daily return of all 2009 daily returns; *STD_RET* is the standard deviation of all 2009 daily returns; *SKEW_RET* is the skewness of all 2009 daily returns; *SPREAD* is (*ASK*–*BID*) / [(*ASK***BID*)/2], retrieved from the CRSP database. *INSTOWN* is the number of shares held by institutions / total shares outstanding. *INSTCONC* is the number of shares held by top 5 institutional investors / total shares outstanding. *SIZE* is either: (1) total annual revenues for firm *i* at the end of 2009 (*REVENUES*), or (2) the natural log of total annual revenues for firm *i* at the end of 2009 (*lnREVENUES*). *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 7
Determinants of pre- to post-spill changes in disclosure: U.S. Offshore sample

Panel A: $SIZE_i = REVENUE_i$

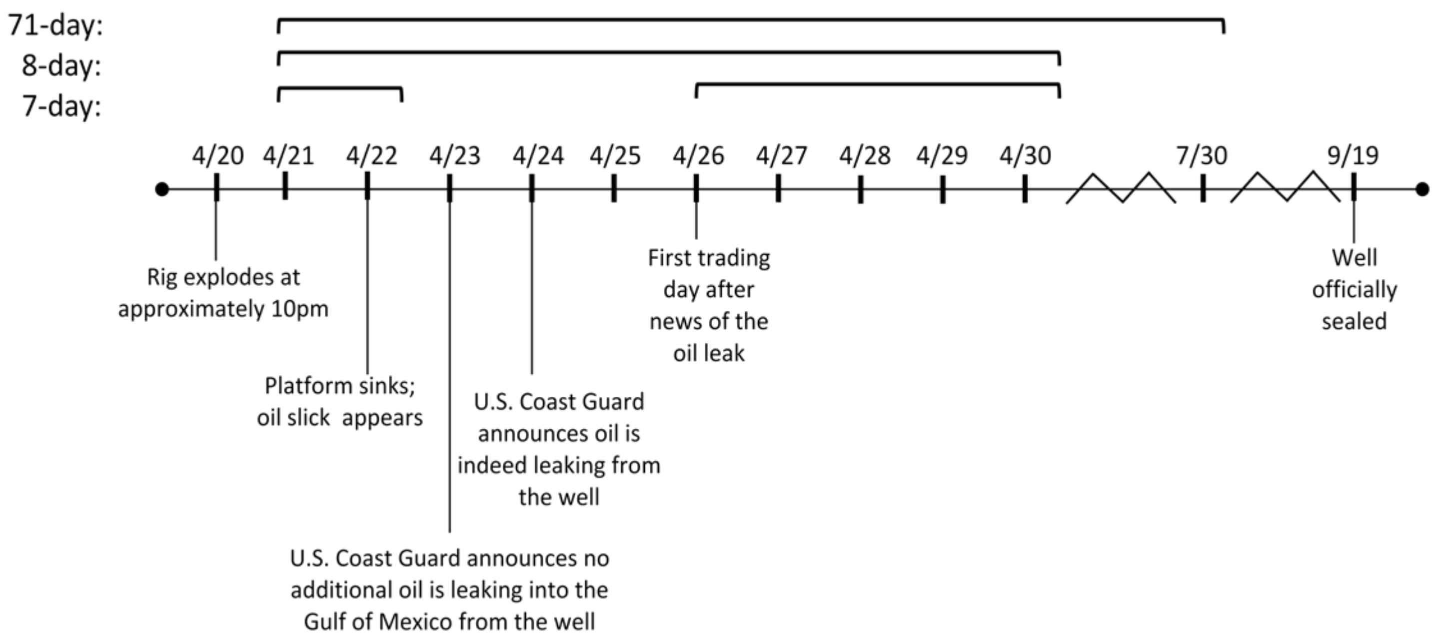
	Panel A1: $\Delta DISCL_i = \Delta RATING_i$				*Panel A2*: $\Delta DISCL_i = \Delta PLAN\_CAT_i$				
Variable	Parameter estimate	OLS t-statistic		White's t-statistic	Parameter estimate	OLS t-statistic		White's t-statistic	
INTERCEPT	0.441	0.72		1.47	0.735	0.94		1.39	
LITRISK	0.005	0.06		0.12	0.071	0.76		0.93	
SPREAD	7.77	0.32		0.63	13.10	0.47		0.91	
LOBBY	-658.3	-0.33		-0.31	-1932.1	-0.76		-1.07	
INSTOWN	0.455	0.41		0.43	2.613	1.83	**	1.95	**
INSTCONC	-1.897	-0.57		-0.58	-6.664	-1.56	*	-1.80	**
REVENUES	0.000	0.51		0.61	0.000	1.20		1.35	
n=26									
Adjusted R^2	-0.264				0.020				

Panel B: $SIZE_i = lnREVENUE_i$

	Panel B1: $\Delta DISCL_i = \Delta RATING_i$				*Panel B2*: $\Delta DISCL_i = \Delta PLAN\_CAT_i$				
Variable	Parameter estimate	OLS t-statistic		White's t-statistic	Parameter estimate	OLS t-statistic		White's t-statistic	
INTERCEPT	0.287	0.40		0.73	-0.027	-0.03		-0.05	
LITRISK	0.005	0.07		0.14	0.081	0.93		1.00	
SPREAD	8.32	0.38		0.68	14.48	0.56		1.07	
LOBBY	-886.6	-0.43		-0.40	-3158.3	-1.28		-1.99	*
INSTOWN	-0.118	0.09		0.10	01.132	0.74		0.80	
INSTCONC	-1.782	-0.53		-0.53	-5.746	-1.44	*	-1.71	*
LNREVENUES	0.054	0.60		0.85	0.229	2.14	**	2.75	***
n=26									
Adjusted R^2	-0.257				0.150				

This table reports results from OLS and White's Standard Error estimation of $\Delta DISCL_i = \alpha_0 + \alpha_1 LITRISK_i + \alpha_2 SPREAD_i + \alpha_3 LOBBY_i + \alpha_4 INSTOWN_i + \alpha_5 INSTCONC_i + \alpha_6 SIZE_i + e_i$ for the sample of U.S. offshore firms. $\Delta DISCL_i$ is the change in $DISCL_i$ from before to after the spill. $DISCL_i$ is either $RATING_i$ or $PLAN\_CAT_i$. *RATING* is a disclosure score that ranges from 0-7 depending on the how many of the seven following items the firm discloses: *CAPEX, PLAN_DUM, SR, ENVLIAB, REGUL, CAPEXFUT*, and *LIT* (all disclosure score variables defined in Table 4). *PLAN_CAT* equals 0 if no mention of a disaster recovery plan, 1 if the environmental laws or regulations that require a disaster recovery plan are mentioned, 2 if the firm's personalized disaster recovery plan is mentioned, 3 if a detailed description of a disaster recovery plan is provided. *LITRISK* = -**5.738** + **.141***lnMVE* + **.284***TURN* + **.012***BETA* - **.237***BHR* - **3.161***MIN_RET* - **1.34***STD_RET* + **.011***SKEW_RET*; *lnMVE* is the natural log of the 2009 average daily market value of equity; market value of equity = price*shares outstanding; *TURN* is the average 2009 daily share volume divided by the average 2009 shares outstanding; *BETA* is the slope coefficient from the market model for the year 2009, where a firm's daily 2009 returns are regressed on the daily CRSP equal-weighted market index; *BHR* is the buy and hold return beginning the first trading day of 2009 and ending the last trading day of 2009; *MIN_RET* is the minimum daily return of all 2009 daily returns; *STD_RET* is the standard deviation of all 2009 daily returns; *SKEW_RET* is the skewness of all 2009 daily returns; *SPREAD* is (*ASK*–*BID*) / [(*ASK***BID*)/2], retrieved from the CRSP database. *INSTOWN* is the number of shares held by institutions / total shares outstanding. *INSTCONC* is the number of shares held by top 5 institutional investors / total shares outstanding. *SIZE* is either: (1) total annual revenues for firm *i* at the end of 2009 (*REVENUES*), or (2) the natural log of total annual revenues for firm *i* at the end of 2009 (*lnREVENUES*). *, **, *** denote significance at the 10%, 5%, and 1% levels, respectively.

Figure 1
Timeline of Events



APPENDIX

Excerpts from firms' post-spill 10-Ks regarding the impact of the BP spill

Apache Corporation

As has been widely reported, on April 20, 2010, a fire and explosion occurred onboard the semisubmersible drilling rig Deepwater Horizon, which lead to a significant oil spill that affected the Gulf of Mexico. In response to this incident, the BOEMRE ceased issuing drilling permits pursuant to a series of moratoria, and all deepwater drilling activities in progress were suspended. Although the moratoria have been lifted, the DOI has not issued any permits related to the drilling of new exploratory wells in the deepwater Gulf of Mexico as of January 31, 2011. In 2010 the DOI issued new rules designed to improve drilling and workplace safety, and various Congressional committees began pursuing legislation to regulate drilling activities and increase liability.

In January 2011 the President's National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling released its report, recommending that the federal government require additional regulation and an increase in liability caps. The European Commission has recommended that new legislation be enacted to enhance the safety of offshore oil and gas activities. Additional legislation or regulation is being discussed which could require companies operating in the Gulf of Mexico to establish and maintain a higher level of financial responsibility under its Certificate of Financial Responsibility, a certificate required by the Oil Pollution Act of 1990 which evidences a company's financial ability to pay for cleanup and damages caused by oil spills. There have also been discussions regarding the establishment of a new industry mutual insurance fund in which companies would be required to participate and which would be available to pay for consequential damages arising from an oil spill. These and/or other legislative or regulatory changes could require us to maintain a certain level of financial strength and may reduce our financial flexibility.

The BOEMRE is expected to continue to issue new safety and environmental guidelines or regulations for drilling in the Gulf of Mexico, and other regulatory agencies could potentially issue new safety and environmental guidelines or regulations in other geographic regions, and may take other steps that could increase the costs of exploration and production, reduce the area of operations and result in permitting delays. We are monitoring legislation and regulatory developments; however, it is difficult to predict the ultimate impact of any new guidelines, regulations or legislation. A prolonged suspension of drilling activity in the U.S. and abroad and new regulations and increased liability for companies operating in this sector could adversely affect Apache's operations in the U.S. Gulf of Mexico as well as in our other locations.

Murphy Oil Corporation

In April 2010, a drilling accident and subsequent oil spill occurred in the Gulf of Mexico at the Macondo well owned by other companies. In May 2010, the U.S. President placed a temporary moratorium on new drilling in the Gulf of Mexico that forced the Company to defer planned exploration drilling in the Gulf of Mexico, and to renegotiate a drilling contract to move a deepwater drilling rig to Republic of the Congo. Further impacts of the accident and oil spill include added delays in deepwater Gulf of Mexico drilling activities, and additional future regulations covering offshore drilling operations, plus expected higher costs for future drilling operations and offshore insurance. The restrictions associated with drilling and similar operations in the Gulf of Mexico are expected to have an adverse affect on the Company's, and likely many other companies', volume of oil and natural gas production in this area.

Petroquest Energy, Inc.
Changes in laws and governmental regulations, increases in insurance costs or decreases in insurance availability, and delays in our offshore exploration and drilling activities that may result from the April 22, 2010 sinking of the Deepwater Horizon and subsequent oil spill in the Gulf of Mexico.

Venoco, Inc.
In general, our current insurance policies covering a blowout or other insurable incident resulting in damage to one of our offshore oil and gas wells provide up to $50 million of well control, pollution cleanup and consequential damages coverage and $250 million of third party liability coverage for additional pollution cleanup and consequential damages, which also covers personal injury and death. We expect the future availability and cost of insurance to be impacted by the Gulf of Mexico Deepwater Horizon incident. In particular, we expect that less insurance coverage will be available and at a higher costs.