

2015

Managing Environmental Risk in the Oil and Gas Industry

Haley Conner
Claremont McKenna College

Recommended Citation

Conner, Haley, "Managing Environmental Risk in the Oil and Gas Industry" (2015). *CMC Senior Theses*. Paper 1121.
http://scholarship.claremont.edu/cmc_theses/1121

This Open Access Senior Thesis is brought to you by Scholarship@Claremont. It has been accepted for inclusion in this collection by an authorized administrator. For more information, please contact scholarship@cuc.claremont.edu.

CLAREMONT MCKENNA COLLEGE

MANAGING ENVIRONMENTAL RISK IN THE OIL AND GAS INDUSTRY

SUBMITTED TO

PROFESSOR WILLIAM ASCHER

AND

DEAN NICHOLAS WARNER

BY

HALEY CONNER

FOR

SENIOR THESIS

FALL 2014/ SPRING 2015

APRIL 25, 2015

Acknowledgements

I would like to take this time to express my gratitude to the individuals who were vital to the completion of this thesis. To Bill Ascher, thank you for your continued support and patience throughout this process. Your input and humor has been invaluable in not only this thesis, but also my time at Claremont Mckenna College.

To my loving parents, thank you for the numerous hours you have put into raising me and encouraging me to enjoy myself. I would especially like to thank my mom for spending my nights with editing papers and working through ideas. Thesis the end Madre.

To my wonderful friends, teammates, and CM, thank you for always challenging me and putting a smile on my face when the going got tough. I wouldn't have been able to make it through this process without you.

Finally, to CMC, thank you for teaching me how to live my life to the fullest. Even though our time in college is coming to an end, I hope for all the seniors that you take away the "work hard, play hard" CMC mentality.

Table of Contents

Introduction	1
1.1 Environmental Threats from Oil and Gas Operations	1
1.2 Environmental Risk Management Integration	2
Chapter 1: Goals of Environmental Risk Management	6
1.1 Addressing Environmental Business Risks	7
1.2 Implementing Risk Management Approaches.....	7
1.3 Strategies for Integrating Environmental Considerations.....	9
Chapter 2: Approaches to Controlling Environmental Risks	15
2.1 Internal Risk Management.....	16
2.1.1 OEMS	16
2.1.2 Emergency Response Programs.....	19
2.1.3 ESHIA.....	20
2.1.4 Employee Training.....	21
2.2 Corporate Incentives	21
2.3 External Risk Management.....	22
Chapter 3: Consequences of Poor Environmental Risk Management	24
3.1 The Deepwater Horizon Spill	24
3.2 Factors Contributing to the Gulf Spill	25
3.3 Preventing Future Spills - Addressing the Fallacies in the BP Approach	27
Conclusion	29
References	33
Notes	39

Introduction

1.1 Environmental Threats from Oil and Gas Operations

Oil and gas industry operations occur in every corner of the globe, in a diverse range of habitats and ecosystems. These operations often place large pressures on the local environment and inhabitants, and as global population growth continues to rise, so too does the demand for useable energy and resources. In 2013, consumption and production increased for all fuel types, surpassing previously record high levels for all fuels except nuclear.¹ For fossil fuels, global consumption rose more rapidly than overall production, resulting in further production pressure for oil and gas companies. Meeting the rising global energy demand comes with high risks and costs to both society and the environment. Oil and gas companies are thus faced with the challenge of meeting the world's expanding energy demands while minimizing the negative externalities associated with these operations.

While there are both international and national regulations regarding best practices, many of the risks these corporations face are site specific, requiring detailed background research and precautionary measures that cannot be solved using a generalized framework. To address these concerns, oil and gas companies must develop their risk management systems and operational practices to minimize harmful environmental impacts and incidents. By embedding environmental concerns into all aspects of daily operations, these companies can achieve socially beneficial outcomes, while avoiding potential disasters and more stringent legislation.

Inserting environmental proactivity is crucial because unsustainable business practices pose serious threats to the environment at both local and global levels. Oil and

gas exploration often threatens to destroy habitats, cause biodiversity loss and produce harmful air emissions.² Incidents and oil spills can result in soil and groundwater contamination as well as marine and freshwater discharges. These accidents can occur in diverse locations with impacts varying in severity based on the stage of operation. The UN reports that corporate environmental damage costs \$2.2 trillion annually, with an estimated global cost of \$28 trillion by 2050.³ Anthropogenic greenhouse gas emissions constitute for 50 percent of this total with local air and water pollution accounting for the remaining 50 percent.⁴ High concentrations of carbon dioxide resulting in greenhouse gases (GHGs) have been proven to increase atmospheric temperatures and sea levels as well as cause alterations in precipitation patterns.⁵ The incidents that arise from these multinational oil operations threaten more than just environmental quality, causing dramatic changes in the condition of the exploited habitat. These habitats are critical to local populations whose traditional culture and lifestyles are often affected. Exploration of these resources threatens to alter land use patterns in agriculture, fishing, logging and hunting.⁶ The highly integrated nature of societal health and safety with the environment poses dangerous consequences to humanity as whole. To decrease the negative effects of these operations on society and the environment, oil and gas companies need to improve their practices and objectives to incorporate all of the costs associated with the environmental risks.

1.2 Environmental Risk Management Integration

Firms must incorporate environmental concerns into daily operations because external sources have not proven to be effective in changing corporate environmental risk valuation procedures. Over the years, international frameworks, declarations, and

treaties have been developed to combat the challenges associated with protecting the environment. Unfortunately, these international agreements have not proven to be an effective method to compel large oil and gas companies to manage their environmental impact. This is primarily due to the fact that the frameworks and treaties are not accepted and subsequently adopted by all countries. The Earth Summit UNCS D Conference held in Rio in 2012 brought together a large international audience to discuss green economies and the implementation of sustainable development.⁷ Without a 100 percent participation rate, agreements made at these international meetings are not strong enough to combat these global environmental issues. Similar challenges arose with the Kyoto Protocol, which was intended to cap emissions through binding reduction targets.⁸ Although many international players supported the protocol, several large countries, including the United States and Canada, were unwilling to accept and adopt it. The lack of unanimous voluntary participation for numerous international regulations has created gaps that minimize the effectiveness of the legislation. Discussions and revisions of programs such as the United Nations Environment Programme (UNEP) indicate there is an international agreement over the importance of addressing these environmental issues.⁹ However, the lack of compliance and enforcement by all countries implies that international protocols and conferences are not sufficient enough in addressing these environmental challenges.

Traditional strategies of implementing national policies also lack the ability to eliminate incidents caused by energy exploration and production. While the Bureau of Safety and Environmental Enforcement (BSEE) is in place to regulate and enforce safety rules on offshore oil and gas activities, the legislation is not stringent enough to prevent

disasters such as the Deepwater Horizon Spill of 2010.¹⁰ The National Environmental Policy Act (NEPA) does require environmental impact statements prior to the commencement of drilling at a site; however, these safeguards do not garner power in contrast to the rising national oil and gas subsidies.¹¹ As of July 2014, an estimated \$37.5 billion was spent on subsidies for the fossil fuel industry in the United States.¹² Since 2009, fossil fuel production and exploration subsidies have increased in value by nearly 45 percent, from \$12.7 billion to \$18.5 billion.¹³ The growth can be attributed to the increase in domestic production, set to match the constantly growing global energy demands. National legislation may not be strong enough to mitigate environmental concerns as long as government subsidies for oil and gas operations are present. This indicates an alternative route is necessary for addressing the challenges associated with corporate environmental performance.

Integrating environmental risk management procedures may prove to minimize the vast number of challenges companies face with oil and gas production and exploration. Combating environmental issues through foreign and domestic legislation has been met with limited success, indicating that it is easy for energy corporations to ignore environmental risks unless they are explicitly embedded into daily operations. Approaching decisions regarding environmental risks in the same fashion as any other risk incurred by the company serves multiple purposes. Making environmental goals part of the business plan as opposed to a secondary task helps align the internal values and actions of company employees with the external views of the corporation as a whole.

The five major oil companies - BP, Exxon, Chevron, Shell and ConocoPhillips - may greatly benefit from adjusting the decision making process to place a higher

emphasis on preventive measures instead of alleviation methods. Unfortunately, environmental risks are accompanied by a high degree of uncertainty, making it challenging for corporations to predict the precise benefits from preventing the occurrence of an incident.¹⁴ Addressing these issues thus requires a high degree of judgment by the company's management team. By aligning corporate and environmental goals, oil companies can create a flexible, company-specific framework that can be applied at each operation site. Site managers could be responsible for enforcing this framework, ensuring compliance and the correct application in accordance with site specificities.

Ultimately, the oil and gas industry is faced with the challenge of aligning short-term financial goals with the long-term environmental risks. As global energy requirements escalate, so does the demand for improved environmental efforts. Oil and gas companies are thus faced with the pressure to deliver both high returns to their shareholders while still producing social good. If these companies place a higher emphasis on avoiding disasters, then they will have to spend less money in the long-term cleaning up environmental messes and repairing their brand image. After the gulf oil spill, BP was fined \$43 billion for gross negligence,¹⁵ a cost that could have been avoided if pre-emptive measures had been taken.

Challenges to incorporating these environmental risks into all activities may include adjusting the company image and matching internal values with external views of the company. Monetizing environmental risks through cost-benefit analyses may also assist in garnering shareholder support for spending extra corporate dollars on environmental risk prevention measures. Ultimately, the highly integrated nature of

human health and safety with the environment suggests that environmental risks should not be secondary to other business concerns, rather the three should be considered with equal standing.

The combination of international and national regulations with internal risk management approaches may prove to mitigate the negative externalities associated with oil and gas activities. While one approach has not proven to be stringent enough on its own, the combination of environmental risk management frameworks may be sufficient. This embedding of environmental concerns could be a possible solution to ensuring that oil and gas companies do not engage in these highly damaging business practices.

Chapter 1: Goals of Environmental Risk Management

The primary goal of internalizing environmental risks is to reduce corporate environmental impacts by limiting the number and severity of incidents that occur from the exploration, production and refining of oil and gas. Minimizing the number of incidents and mitigating their environmental impacts if and when they do occur may help address environmental concerns such as pollution, industrial accidents and global climate change. There is a large capacity for oil and gas companies to internally improve their practices to prevent future stringent legislation as well as increase profitability by restricting the number of fines paid annually for environmental degradation. Integrating risk management practices into all aspects of business should be an industry-wide objective as improving environmental performance has proven to create a competitive advantage for oil and gas corporations.¹⁶ Energy companies should seek to align internal business values and environmental goals with external perceptions of the company,

which can be accomplished by explicitly embedding environmental risks into daily processes.

1.1 Addressing Environmental Business Risks

Traditional approaches of addressing environmental business risks is comparable to the manner in which corporation must tackle financial risks. Before undertaking a project, the company should determine all possible risks associated with operations at the specific site and the probability of each adverse event occurring. Using a cost-benefit analysis, the company can then estimate the total social burden of an event occurring. Using American Petroleum Institute regulations and international guidelines, the firm should then determine the total amount of the environmental burden that it is responsible for. While this risk analysis method is fairly ridged, adopting company specific valuation measures and considerations will help improve the flexibility of this framework. The quality of information provided for the assessment does pose a challenge for corporations, as the impacts and probability of an event occurring are often uncertain. Oil and gas companies looking to tackle environmental challenges therefore may need to incorporate less traditional approaches to their risk management systems.

1.2 Implementing Risk Management Approaches

In addition to traditional risk based approaches like cost-benefit analyses, there are various other strategies companies can utilize to embed environmental considerations into daily operations. Companies have the option of exhorting employees in complying with corporate risk management strategies. Through annual publications and company statements on the importance of considering environmental threats from operations, the

company can bring these concerns to the front of the employees' minds and to a top priority for operational awareness.

There are also several kinds of incentive based approaches available for oil and gas companies to use. One option is to include environmental performance in to the promotion process. Evaluating an employees' ability to adhere to and advance corporate environmental initiatives may encourage individuals to pay more attention to these environmental objectives. If job retention and promotion is based on environmental performance, there is a higher likelihood that individuals will adhere to the environmental risk management framework.

Underscoring the importance of the input an output stages of operations as opposed to the ultimate outcome of the process may be another solution to the challenges associated with embedding environmental risks. Often, operating units are able to get away with minimal attention to environmental risks due to the low probability of an incident occurring. Unfortunately, these low probability events are highly costly, which means that limited attention to detail can result in disaster, like the Exxon-Valdez spill of 1989 or more recently, the Deepwater Horizon spill. If operating units are measured and rewarded on their ability to manage inputs and outputs of a project, as opposed to the overall outcome of that product, then these catastrophic events are less likely to occur. This preventative approach may prove to be more beneficial to reducing the number of environmental incidents and the associated costs than addressing situations after they occur.

By placing a monetary value on environmental good works through bonus-based incentives, companies can emphasize the importance of considering environmental risks

before initiating operations. Bonus based incentives may encourage employees to place a higher value on environmental performance. Unfortunately, a bonus based incentive system is accompanied by a few severe pitfalls that make its implementation detrimental. By placing a monetary value on environmental accomplishments, employees have the option to decide whether to future the environmental goal or another goal of the company. The environment's value cannot be traded off against financial valuations; meaning energy companies must rely on one of the other two incentives based approaches.

1.3 Strategies for Integrating Environmental Considerations

Incorporating environmental risk considerations into daily operations may be achieved through a variety of routes. Initially, the company may need to restructure corporate policies and goals to establish a greater emphasis on precautionary measures and environmental good works. Adjusting the business plan to integrate environmental risks and goals with both the social and economic objectives of the corporation may prove to be the simplest way to accomplish this task due to the high degree of interconnectivity between society, the economy and the environment. Externally promoting the changes in company objectives holds the corporation liable for their actions. Advertising and public statements can help the company inform shareholders, consumers and the government of their new corporate policies and objectives. This corporate transparency may help develop business relations if the company adheres to these promises, but this new prestige can also come at the cost of losing business if the corporation fails to meet these explicitly stated standards.¹⁷

One major challenge with public statements regarding corporate environmental practices is that they may pose a credibility issue for the company. The company may proudly report their strong environmental practices to their stakeholders and the government, but without constant internal regulation of these practices the statements maintain minimal accuracy. The misalignment between external corporate advertisements and internal management has the potential to cause extreme environmental damages, as was the case with BP and the Deepwater Horizon Spill.¹⁸ Solely providing public statements about environmental practices is not enough and they therefore must be made in conjunction with additional, consistently monitored risk management approaches.

Restructuring corporate objectives can also require internal integration of the new mission into daily activities. One possible option is for companies to implement a formal incentive mechanism that rewards employees with promotions rather than monetary compensation for adhering to and advancing the new environmental agenda. There are two main reasons behind the promotion-based incentive system. First, promotions do not allow employees to weigh environmental tasks against corporate tasks.¹⁹ Placing a monetary value on environmental performance would enable employees to take an “either or” approach to accomplishing tasks and could possibly be based on entire company performance as opposed to individual success. Second, the promotion process is already inherently judgment based.²⁰ It is apparent that there are challenges associated with placing monetary values on unquantifiable actions such as environmental incident prevention. Therefore, considering environmental performance in the promotion process is the most logical solution. Ultimately, if managers are held

accountable for environmental performance, they are more likely to hold subordinates accountable to the same performance standards, thus integrating environmental goals through all levels of the business.²¹ Constantly discussing the newly placed environmental goals can aid in focusing employee attention on these considerations and continuous exposure to the environmental mission can ease the transition of new policies into daily operations.

Environmental considerations have proven to be challenging to address due to the high degree of uncertainty associated with determining the monetary benefit of preventing an incident. For this reason, the decision making process centered around environmental criteria cannot be purely analytical. More specifically, environmental risks cannot be considered with explicitly quantitative criteria, it also requires the influence of managerial judgments. Embedding environmental concerns may take a top-level approach, where c-suite executives hold the power to make overarching decisions regarding the corporate framework for environmental risk management. Embedding environmental projects into the daily decision making process requires that these issues are discussed in the same terms as other risks the corporation may face. Environmental projects must then be considered in terms of monetary gains and losses, similar to the manner in which capital investment projects are considered. To accomplish this, the energy company should develop an analytical model that combines explicit quantitative materials with judgment calls from the upper level management.²² Including opinionated managerial judgments in the decision making process may help nullify some of the uncertainty surrounding environmental risks.

Allowing managers and executives to insert judgment into environmental decisions does place a degree of responsibility into the hands of these employees, which enables the company to judge these individuals on their ability to adhere to the internally set environmental standards. If job retention is based on environmental performance in addition to other criteria, then top-level executives will have an incentive to further the environmental agenda.²³ The objective of this approach is to have environmental goals filter down from the top through all units of the organization. Managerial judgment calls will also fall more specifically on the shoulders of site managers who hold the ultimate power in deciding whether or not to move forward with a project. This responsibility should be given to site managers who have a vast knowledge of the site-specific risks.

Ultimately decisions should be made by the leaders and most informed individuals of the corporation with environmental considerations in mind. While the combination of analytical risk measurement and informed judgment calls may not enable firms to eliminate environmental risks completely, it can aid in embedding environmental risk considerations into various aspects of oil and gas exploration, production and refining.

Successful implementation of environmental risk consideration rides on the company's ability to monitor and report newly designed initiatives.²⁴ Consistently evaluating and acquiring updates on managers' environmental performance is an obvious way to ensure environmental risks are considered at every phase of operation. Internal regulation also enables the company to guarantee all sites are in compliance with environmental rules as well as guiding principles and management practices. Once corporate environmental goals and standards are established, it is critical each unit of the

organization is constantly monitored to ensure a 100 percent participation rate and the correct implementation of the corporate environmental risk management framework. A company's ability to enforce policies and regulations will greatly enhance the success of their risk management practices.

Adapting new environmental practices may require additional investments before company-wide implementation of the procedures is possible. Oil and gas companies may need to consider investing in employee training and education programs to establish a unified understanding of the environmental initiatives. Training programs can help employees develop the attitudes and skills necessary for reducing harmful incidents.²⁵ These programs can also aid in training the individuals who handle the equipment and are located at the sites where disasters are likely to occur. Employee education requires initial upfront spending, but minimizing the likelihood of a worst-case scenario incident is justifiable. Addressing the importance of precautionary measures and risk response programs in the event of an emergency may improve both internal and external reactions to these events.

Utilizing internal insurance may prove to be another beneficial action for oil and gas corporations looking to embed environmental risk concerns. Companies have the option of self-insuring operations up to a specified capital level. Self-insurance makes managers inclined to act for a practical purpose as if there was no insurance at all.²⁶ Oil and gas companies cannot afford to self-insure catastrophic events such as the Exxon Valdez oil spill of 1989 which cost the corporation \$6.3 billion after inflation adjustments.²⁷ While footing the expenses related to insurance shows that corporations are inclined to take responsibility for and preventative measures against environmental

damages, alone it is not enough to combat the environmental challenges associated with these oil and gas activities.

Implementing environmental risk management approaches may also be accomplished by the installation of collaborative environmental units within the corporation. These units maintain the responsibility of assessing and addressing environmental concerns at various levels of the corporation and at numerous operating sites. These groups may be beneficial for broad reaching environmental concerns such as external risk management and the purchase of additional insurance as well as company-wide training. Other forms of environmental risk management must occur at an operational level on a site-by-site basis due to the high variability in ecosystems and specificities unique to each site. Ground level managers should hold the main responsibility in terms of environmental framework implementation because of their deep understanding of the inherent risks at each operation location.

While global corporations are often decentralized due to the high degree of variability in operation sites and site-specific guidelines, there should be an extent of collaboration between internal environmental management units. Requiring the company to collaborate on all aspects of operations is unreasonable, however, developing specialized units responsible for the promotion process as well as measuring, monitoring and enforcing corporate environmental standards could prove to be beneficial in mitigating the impacts of environmental incidents.²⁸

There are many possible routes to embedding environmental considerations into daily operations for oil and gas companies. While no single route will solve the problems

associated with these damaging activities, a combination of these approaches may help allay the environmental impacts of these operations.

Chapter 2: Approaches to Controlling Environmental Risks

The origin of Chevron, one of the world's largest producers of energy can be traced back over 100 years to the Pacific Oil Company.²⁹ Like many other energy producers, Chevron started out as a highly profit motivated corporation with little regard for the environment or associated operational risks. Since the transition from the Standard of California in the 1980's to what is commonly known today as Chevron Inc.,³⁰ the company has adopted an entirely new set of internal risk management policies that marry environmental concerns with business objectives. Chevron's successful transition from purely an oil and gas company to the industry leader in environmental initiatives suggests that adopting advanced risk management approaches may be beneficial for addressing corporate oil and gas operating concerns.

Chevron, like many other large oil companies, spends large sums of corporate funds on investing and operating expenses aimed at minimizing environmental burdens and improving environmental quality.³¹ In 2013, Chevron spent approximately \$2.7 billion on environmental management activities alone.³² Environmental capital expenditures constituted \$1 billion of this spending while the remaining \$1.7 billion went to the prevention and elimination of pollutants from operating sites.³³ Many of the environmental management activities adopted by Chevron as well as other companies in this industry are based on the definitions and guidelines established by the American Petroleum Institute.³⁴ Chevron, however, has proven to gain a competitive advantage in the oil and gas industry by operating along more stringent, company specified guidelines.

2.1 Internal Risk Management

In 1997, Chevron adopted a new set of ethical principles that enabled the corporation to position itself both publically and internally as a responsible steward of the natural environment.³⁵ These principles, which became known as “The Chevron Way”, detail the company’s environmental and social objectives. The documents underscores “protecting people and the environment” as well as Chevron’s ultimate goal “to be the industry leader in safety and health performance and to be recognized worldwide for environmental excellence.”³⁶ The Chevron Way remains a key driver of corporate policies and establishes a company standard for safe practices.

Chevron’s risk management practices are often reliant upon managerial judgment, which helps address the uncertainty of issues associated with environmental risks. To enable managers to utilize judgment approaches, Chevron adopted policy 530, which emphasized corporate creativity and innovation when addressing risks.³⁷ Policy 530 eventually became what is known more commonly as Chevron’s Operational Excellence Management System.³⁸ This system provides detailed implementation processes and guidance for line managers at operating sites.

2.1.1 OEMS

Chevron relies heavily upon its Operational Excellence Management System (OEMS) as a framework for achieving outstanding environmental performance. The OEMS establishes operational guidelines from the two leading corporate principles, “do it safely or not at all” and “there is always time to do right.”³⁹ These guiding tenets provide employees and contractors with a code of conduct to use and a system that supervisors and managers can reinforce. The complex multi-dimensional management

system helps Chevron address all potential risks as well as causes of incidents that may impact employees, the environment or corporate assets.⁴⁰ The OEMS ultimately helps Chevron reduce the risk of environmental incidents by establishing business unit expectations and emphasizing leader behaviors that prioritize these objectives.⁴¹

The Operational Excellence Management System is conducted through a series of simple steps. First, the approach requires periodic site evaluations that push managers and employees to continually improve their practices. The evaluations consist of detailed analyses of operation sites that identify potential risks. Managers at Chevron are required to conduct self-evaluations in terms of management practices and submit these evaluations to the head of the Health Safety and Environmental unit (HSE) of the company. Consistent evaluation and acquiring updates on managers' environmental performance is a key way to ensure environmental risks are considered at every phase of operation. These analyses are then used to develop action plans that will establish the necessary, site-specific procedures that must be adopted to reduce possible risks.⁴² The effectiveness of the program's implementations is reviewed annually at the corporate, operating company and business unit levels.⁴³ The data obtained from these yearly reviews is used to prioritize company improvement efforts, which are then integrated into Chevron's business plan.

Corporate operating priorities and processes are determined by internal steering committees whose responsibility it is to review performance. These steering committees are in place to ensure compliance with the OEMS standards and improve upon efficient practices.⁴⁴ One of the main drivers of the system's success is the high degree of involvement of Chevron's leadership in managing and monitoring operational risks.

These individuals are responsible for all aspects of operational governance, at every level of the corporation, from operating companies to corporate departments.⁴⁵

The Operational Management System also involves key stakeholders in the decision process, which helps garner shareholder support for environmental expenditures. Chevron's board of directors, for example, "receives periodic reports on safety, risk management, process safety, environmental performance and any significant incidents in that period."⁴⁶ Employees are also highly involved in operational excellence activities. As of 2014, more than 14,000 of the company leaders had participated in the OE certification program.⁴⁷ The inclusive nature of the OEMS underscores Chevron's valuation of improved operational performance.

Corporate compliance assurance of the OEMS is driven by self-audits of operating units and corporate departments.⁴⁸ Operations associated with production and manufacturing undergo audits every three years.⁴⁹ The auditing teams are composed of both internal employees and external parties who have a vested interest in and extensive knowledge of the risks associated with each operating site. Auditing teams work to ensure that operational efficiency is maximized and that site managers are constantly adhering to the standard corporate operating procedures.⁵⁰

In addition to internal regulation of the operational management system, Chevron also utilizes an external quality assurance organization to ensure compliance with international environmental standards. In 2011, Chevron was qualified as a corporation whose risk management practices align with the International ISO 14001 standards.⁵¹ This qualification makes it easier for Chevron to initiate operations at new sites due to the exceptional operating standards they adhere to. International countries are more

likely to allow oil and gas exploration and production from Chevron because of their strong environmental track record and internationally acknowledged practices.

2.1.2 Emergency Response Programs

Chevron's OEMS focuses on more than just risk alleviation, it also addresses processes for potential emergencies. The four main categories of emergency management include prevention, preparedness, response and recovery.⁵² Chevron's emergency management process utilizes a tiered approach to enable flexible decision making for site-specific responses. Each operating unit is required to develop these responses as well as a business continuity plan for all significant risks.⁵³ At a higher level, the corporate emergency response team is in place to provide guidance and expertise to these operating units. This team's main tasks include the development of emergency notification procedures and conducting drills to train employees on how to mitigate the probability and severity of an environmental incident.⁵⁴ The regional response team provides assistance to the operating site in the event of a global emergency.⁵⁵ This tiered approach to emergency preparedness allows Chevron to develop a generalized risk framework that can become more specific at each subsequent level. The three separate levels of response teams creates a system of checks and balances that maximizes operational efficiency as well as provides an in-depth understanding of global Chevron's environmental challenges.

OEMS has proven to be a successful risk management tool for Chevron Corporation. The highly integrative nature of OEMS places environmental safety at the forefront of daily operations and helps leaders assess the gaps and strengths necessary

for improved performance. By regularly reviewing operating units' audits and evaluations, Chevron is able to reduce risk and continually improve practices.

2.1.3 ESHIA

Chevron also applies an Internal Environmental Social Health Impact Assessment (ESHIA) to all of its capital projects. ESHIA helps to identify, assess and manage significant impacts through a systematic risk-based approach.⁵⁶ The ESHIA process relies heavily on input from stakeholders, including local communities and partners to ensure projects are carried out in the safest manner possible. The impact assessment process is an internal tool of the Operational Excellence Management system that helps the company conduct baseline assessments of environmental conditions which ultimately assists in the prevention of potentially significant impacts.⁵⁷ ESHIA is aimed at protecting human health and the environment as well as minimizing potential liabilities from operation and promoting consistencies within and between processes.

The ESHIA process consists of five different stages: screening, scoping, impact assessment, stakeholder engagement and the creation of a management plan.⁵⁸ The screening stage helps Chevron determine if a full site assessment is needed based on a checklist guided process. If the assessment is warranted, the scoping stage of identifying, scaling and prioritizing the identified issues is then undertaken.⁵⁹ The impact assessment includes an evaluation of all potential impacts as well as mitigation measures to determine the best course of action for the specified project. Throughout the ESHIA process, local, regulatory and business stakeholders are constantly consulted with to obtain feedback on operating performance and site viability.⁶⁰ Finally, a management plan is produced. This end plan links the impact and mitigations assessments with the

project's construction and operational practices to ensure sites are compliant with the pre-determined processes and standards.⁶¹ The ESHIA process is extremely valuable to Chevron as it provides a better understanding of potential environmental and social impacts associated with operations.

The combination of the Operational Excellence Management System and the ESHIA process helps Chevron to justify spending on environmental risk prevention. While short-term environmental expenditures may curtail cash flows and investment payoffs, these management systems place a monetary value on risk prevention to estimate long-term gains from disaster avoidance. The broad sets of decision-making tools developed by Chevron have the flexibility to be implemented on a site-by-site basis but are stringent enough to be periodically monitored by the leadership.

2.1.4 Employee Training

Chevron invests a large amount of its corporate funding on training and educating its employees on the importance of managing environmental risks at every stage of oil and gas operations. The company relies on internal units like the Corporate Emergency Response team to develop response systems and to teach employees proper response techniques in the event of a severe incident. These training initiatives are critical to developing employee attitudes and skills that are necessary to mitigate the impacts of environmental incidents and hopefully prevent these incidents from occurring at all. Chevron is a company that consistently looks to improve operational efficiencies, which it accomplishes through its employee education programs.

2.2 Corporate Incentives

Chevron's initial incentive based approach had little to do with environmental risk management objectives and was mainly based on the overall profitability of the corporation.⁶² The main reason behind this system was that executives wanted operational unit managers to set aggressive environmental and safety goals as opposed to trading off these goals for monetary bonuses. The challenge with implementing a bonus-based system was also furthered by the strain between long-term environmental protection and short-term financial gains.⁶³ For these reasons, aligning promotion considerations with environmental performance proved to be the best incentive approach at Chevron. The promotion-based incentive system is specifically used to evaluate the senior management's ability to further the corporation's environmental objectives. Constant evaluations ensured that environmental goals were pushed down through the organization, as managers were held accountable for the environmental performance of their teams. By embedding a manager's environmental track record into the promotion process, Chevron ensures that all aspects of the company are constantly aware of the environmental risks associated with operations. While the promotion incentives lacked explicit punishments for lapses in compliance, employees faced the risk of losing their job if they willingly neglected an environmental objective.⁶⁴

2.3 External Risk Management

Chevron also employed external risk management approaches to integrate environmental considerations into daily business operations. The company made the decision to implement a self-insurance policy that would provide coverage up to \$200-300 million. When incidents incurred costs higher than what was covered by the self-insurance, the company relied on purchases on external insurance.⁶⁵ Chevron justifies

this insurance policy because as a corporation, it cannot afford to self-insure catastrophic events, like the BP Deepwater Horizon Spill. The cost of this specific incident went well into the billion-dollar range, which is impossible for a corporation of any size to completely cover on its own. External insurers of oil and gas companies often provide umbrella insurance that covers protection against a series of operational liabilities.⁶⁶

Chevron combines a variety of environmental risk management approaches to obtain a competitive advantage in the oil and gas industry. Internal regulation like OEMS, ESHIA and the employee training and company wide emergency response programs help Chevron identify potential risks, and develop specific response to these risks. Relying on internal systems that constantly enforce the corporate environmental response framework ensures that all units of the company are operating under the same specified standards. The promotion based incentive approach matches employees desires to move up in the corporation with environmental objectives. This incentive system is crucial in embedding environmental considerations into daily activities as managers are evaluated for their own environmental performance and the performance of their subordinates. This top down approach to risk integration has proved to be an effective implementation strategy for Chevron. Chevrons external efforts at integrating environmental concerns include the self-insurance policy and public declaration of being an industry leader in environmental performance. Chevron's transparency with their environmental objectives holds them accountable to their actions and is reinforced by the internal management systems in place. Chevron's success both providing energy and social good works indicates that the integration of risk management approaches may be

the most efficient and effective way for companies to address the environmental challenges associated with oil and gas operations.

Chapter 3: Consequences of Poor Environmental Risk Management

Chevron provides an exemplary case of the benefits that can be reaped from successfully developing an integrated environmental risk management, however, other companies in this industry have yet create and implement such a stringent approach to addressing these environmental challenges in their operations. Unfortunately, neglecting site-specific risks and the risks of associated projects has proven to be extremely detrimental to the environment, society and the global economy, as was the case with Deepwater Horizon Spill of 2010.

3.1 The Deepwater Horizon Spill

In April of 2010, gross negligence on the part of both British Petroleum (BP) and the offshore drilling company, Transocean, led to the catastrophic oil spill that broke all previous global records of environmental, economic and social damages associated with an oil spill. Forty-one miles off the coast of Louisiana, the Deepwater Horizon platform was located with operations occurring at depths of approximately 18,000 feet.⁶⁷ Unfortunately, operations in extreme conditions such as these are often accompanied by extreme risks, and without proper monitoring and transparency events like the Gulf spill are likely to occur.

The spill that occurred in 2010 was the result of a surge in natural gas that blasted through the previously installed concrete core.⁶⁸ The blast and subsequent clean up efforts took the lives of 11 employees and injured another 17.⁶⁹ Initial attempts to

halt oil expulsion were unsuccessful due to a malfunction in the rig's blowout preventer (BOP). Reports after the incident indicated that this malfunction was due to a faulty switch and a flat battery that prevented the system from operating properly.⁷⁰ The failure of either company or the rig's employees to recognize the faulty equipment may have been a major cause of the catastrophe.

Following the use of the BOP, BP and other clean up crews attempted to stop the leak through a number of other approaches, all of which were unsuccessful. About a month after the initial explosion, BP used one of its low marine riser packages, which was successfully installed as a temporary cap for the leak.⁷¹ It was not until July 12th, that a permanent stacking cap was implemented and the leak was closed. An estimated 4.9 million barrels of crude oil leaked into the gulf during this three-month time span, with clean up crews only successfully capturing approximately 800,000 barrels.⁷²

The federal government was forced to shut down nearly 1/3 of the United States' water due to contamination concerns for the months during and immediately following this disaster. This moratorium put nearly 12,000 US citizens out of work and greatly impacted the international fishing markets. At the end of the 2010 fiscal year, British Petroleum had lost a quarter of its market value and was paying upwards of \$40 billion in clean up recovery costs and fines.

3.2 Factors Contributing to the Gulf Spill

The Deepwater Horizon Spill was not an accident. Upon further investigation carried out by the United States Coast Guard and the Joint Investigation Team of the Bureau of Ocean Energy Management determined that the spill was attributed to a

variety of controllable factors. The most critical factor pointed to poor risk management practices on the part of the operating companies, British Petroleum and Transocean Offshore Drilling.⁷³ Without having specific approaches to monitoring the challenging activities associated with drilling in deep waters, the companies put themselves at a major risk. Deep water drilling occurs at extreme depths with limited light and visibility. As a fairly new form of crude oil extraction, there are still very few reports and regulations that exist to monitor risks and address catastrophes if they do happen, as was the case with the Gulf Spill.

The lack of risk management approaches and project oversight allowed for last minute changes in operating plans.⁷⁴ The unexpected project changes created a disconnect between the operating companies, workers on the oilrig and the government regulation agencies. If BP had been transparent about the oil flow rates and the specific direction of the plan, there may have been an additional external monitoring system that may have noticed the warning signals at the Macondo well. Procedural changes also meant that government emergency response teams were not prepared to handle extent of the incident at this site.

Failure on the part of both crewmembers and the companies to observe and respond to critical indicators was another main driver of this catastrophe. While there was a malfunction with the onboard gas alarm system, which would have alerted the crew to changes in gas pressures, additional surveys of the well pressures and oil flow rates also indicated extreme irregularities in the hours preceding the explosion. Investigations following the catastrophe indicate that the lead engineer who detected these abnormalities ignored the warnings signs and

proceeded with business as usual. This gross negligence on the part of the engineer was a critical lapse in judgment in ultimately cost 11 individuals their lives.

However, other individuals of the crew and company were also alerted to excessive flow rates and chose to continue operating as if nothing was wrong. If there had been more stringent oversight on this project, the risks associated with increase flow rates could have been flagged and the disaster as a whole may have been avoided or at least minimized.

Inadequate well control responses and insufficient emergency response training on the part of BP contributed significantly to the extensive environmental destruction that resulted from this disaster. The incongruence between risk management and operational responses is another major problem that contributed to the extensive damage of this oil spill.

Ultimately, both BP and Transocean were fined billions of dollars for the destruction caused by the Deepwater Horizon Spill, but these dollar amounts may not cover the total costs, with externalities, of this catastrophe. As of 2012, 1,700 sea turtles were found dead and millions of other organisms were killed.⁷⁵ The tragic event cost the lives of 11 employees, a loss which some may argue, cannot be reimbursed.

3.3 Preventing Future Spills - Addressing the Fallacies in the BP Approach

The ineffective and unapparent risk management approaches BP utilized in 2010 and the resulting Gulf Spill disaster indicates the extreme risks oil and gas companies face when operations fail. Following the spill, the EPA suspended BP

from entering into new contract. This suspension was upheld until March of 2014. Failure to properly manage environmental risks poses huge financial threats to the corporation in terms of associated clean up costs, business interruption and loss of shareholder support. If BP had been careful about monitoring these risks and strictly enforcing national laws and regulations, the entire incident may have been avoided. The apathetic nature of the top-level management may have been another driving factor for this disaster. The company culture in 2010 placed such a high emphasis on profit maximization that environmental risks were almost neglected entirely. Environmental considerations were obviously not incorporated into the decision-making process as environmental risks associated with operations were willfully neglected. The complete lack of a response process and emergency preparedness team created even more challenges for BP and ultimately tarnished their brand reputations.

In 2015, BP is attempting to shift public perceptions of their operations through dramatic advertising campaigns and far-reaching statements regarding the environmental good works the company is accomplishing.⁷⁶ BP's 2013 consumer report makes remarks about integrating environmental risk management approaches and the importance of adopting safe practices. After the harsh criticisms faced by the BP and extensive economic toll the Deepwater Horizon Spill the company took, the corporation may actually be attempting to integrate environmental considerations into their operations. BP has a far way to go before it can mitigate the impacts of the Gulf disaster on its brand reputation and before it is able to re-gain the public's trust over the connection between public statements

and internal environmental risk management actions. At this point, the best option for BP may be to take a step back and restructure the corporate culture to ensure all operations are highly focused on preventing future environmental catastrophes. The company may not be able to afford another disaster like the Deepwater Horizon spill and if another event of a comparable magnitude does occur, the company may be banned internationally from offshore operations.

Conclusion

Oil and gas companies often face extreme pressures to provide the world with its global energy needs while maintaining an excellent environmental performance record. While international and national regulations provide a partial solution to addressing global environmental threats from oil and gas exploration, production and refining activities, the degree of success of this legislation has been limited. As environmental issues become a more integral concern of the global community, the increased pressure is put onto these energy companies to adjust practices in a way that minimizes threats to the environment.

Companies like Chevron have found a way to successfully tackle the environmental issues associated with daily energy activities. By embedding environmental considerations into all units within and operations of the company, Chevron is able to focus employee attention on minimizing the probability of a detrimental incident. Chevron is further prepared because in the event that an environmental situation does arise, the internal emergency response team is knowledgeable of the operational risks and has a plan in place to alleviate the impacts as

quickly and fully as possible. By creating an integrated risk management approach, Chevron is able to marry the objectives publicized to its employees and shareholders with the daily risk management approaches that are carried out by all member of the corporation. Chevron continues to excel in terms of its environmental performance as it now sets a company wide objective of having “zero incidents” occur at each operating unit.

While Chevron is just one player in the oil and gas industry, the continued success of its internal environmental risk management approaches has caused other large corporations to embrace similar objectives practices. ExxonMobil has adopted comparable risk prevention approaches, referred to as its Operational Integrity Management System (OIMS). As more companies adopt systematic environmental analysis approaches, companies that have yet to adapt are pressured into compliance with these newly established voluntary standards. Ensuring compliance with voluntary standards within the oil and gas industry is much more simple than globally enforcing and monitoring international regulations because companies are competing to efficiently produce energy while maintaining a positive environmental reputation. As was the case with Chevron when it revealed the stringent Chevron Way and OIMS requirements, companies that drive environmental regulations within the industry gain a competitive advantage over the other energy companies in the market.

While uncertainty is a major challenge with all risks pertaining to business operations, environmental risks pose some of the greatest threats to corporations. Even though the likelihood of an event is low, the consequences of an incident are extremely high. The occurrence of such an event has the ability to halt business production and

thus stifle revenue streams, taint brand image from negative publicity and increase the number of industry watchdogs, making it challenging for the corporation to stay ahead of industry regulations. Therefore, addressing environmental concerns at early stages when prevention costs are low as opposed to dealing with the consequences and excessive fines after an event is critical for these large energy corporations to maintain a competitive edge in this industry.

It is important to note that improved environmental practices by the companies that pose the largest threats to the environment has resulted in a decrease in green house gas levels, putting 2014 emissions at the lowest recorded point since 1994.⁷⁷ Even with these improvements there is more to be done on behalf of all players involved. This includes industry leaders as well as national and international governments and players. As the acquisition of unconventional resources, such as hydraulic fracturing of natural gas and oil found in shale, increases so too do the risks associated with these procedures. As was the case with the BP's Deepwater Horizon Spill, utilizing new exploration and drilling technologies may come at high environmental and social costs.⁷⁸ If the company and subsequent operating units fail to fully understand the operational risks and inadequately address these threats, extreme environmental, social and economic consequences as a result of these activities will continue to occur.

Embedding environmental considerations into daily operations may continue to be an effective route to dealing with the environmental risks associated with oil and gas operations. Energy companies will constantly face the challenge of minimizing environmental impacts while maximizing shareholder value and therefore need to adopt a process that effectively and efficiently enables them to do both. Integrating

environmental risk management processes into all aspects of oil and gas activities may be challenging for some corporations, but if these companies approach environmental risks in the same manner as other business risks and capital projects, then developing, implementing and enforcing a company specific management framework should not be a challenge. Although it is complicated to eliminate all risks affiliated with energy related activities, the addition of internal environmental risk management approaches with existing national and international regulations may prove to be an effective method for combating global environmental concerns.

References

- "2013 Corporate Sustainability Report." *Chevron*. Chevron, 2014. Web. 21 Apr. 2015.
<http://www.chevron.com/documents/Pdf/CorporateResponsibility/Chevron_CR_Report_2013.pdf>.
- "Assurance." *BP*. 2014. Web. 3 Apr. 2015.
<<http://www.bp.com/en/global/corporate/sustainability/about-our-reporting/assurance.html>>.
- Berry, Michael A., and Dennis A. Rondinelli. "Proactive Corporate Environmental Management: A New Industrial Revolution." *Academy of Management Executive* 12.2 (1998): 38-50. Print.
- Borthwick, Ian. "Environmental Management in Oil and Gas Exploration and Production." *Words and Publications*, 1997. Web. 10 Mar. 2015.
- Breeze, R. "Legitimation in Corporate Discourse: Oil Corporations after Deepwater Horizon." *Discourse & Society* 23.1 (2012): 3-18. Print.
- "Business Conduct and Ethics Code." *Chevron*. 2014. Web. 19 Feb. 2015.
<<http://www.chevron.com/documents/pdf/chevronbusinessconductethicscode.pdf>>.
- "Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling." *The Encyclopedia of Earth*. Ed. Cutler J. Cleveland. 16 Jan. 2011. Web. 4 Apr. 2015.
<<http://www.eoearth.org/view/article/162358/>>.
- Colton, Bill. "The Outlook for Energy: A View to 2040." *ExxonMobil*. 9 Dec. 2014. Web. 7 Feb. 2015.
- "Corporate Citizenship Report 2013." *ExxonMobil*. ExxonMobil, 2013. Web. 26 Apr.

2015. <[http://cdn.exxonmobil.com/~media/Reports/Corporate Citizenship Report/2013/news_pub_ccr2013-2.pdf](http://cdn.exxonmobil.com/~media/Reports/Corporate%20Citizenship%20Report/2013/news_pub_ccr2013-2.pdf)>.

Davis, Keith. "The Case for and Against Business Assumption of Social Responsibilities." *Academy of Management Journal* 16.2 (1973): 312-22. Print.

"Environment." *Environment*. 1 May 2014. Web. 7 Feb. 2015.

<<http://www.chevron.com/globalissues/environment/>>.

"Environmental Risk Management." *Chevron*. 21 Aug. 2013. Web. 26 Apr. 2015.

<[http://sache.org/workshop/2013Faculty/files/Environmental Risk Management at Chevron.pdf](http://sache.org/workshop/2013Faculty/files/Environmental%20Risk%20Management%20at%20Chevron.pdf)>.

"Environmental Risk Management." *Harvard Business Review*. 10 June 2013. Web. 8

Feb. 2015. <<http://www.ferma.eu/app/uploads/2013/10/environmental-risk-management-report.pdf>>.

Fallon, D Archibald, and Ji Nin Loh. "Oil and Gas Regulation in the United States: Overview." *Practical Law*. 2014. Web. 8 Feb. 2015.

"Fortune 500 2014." *Fortune*. 2 June 2014. Web. 26 Apr. 2015.

<<http://fortune.com/fortune500/exxon-mobil-corporation-2/>>.

"Fossil Fuel Subsidies: Overview." *Oil Change International*. 2014. Web. 26 Apr. 2015.

<<http://priceofoil.org/fossil-fuel-subsidies/>>.

Friedman, Milton. "The Social Responsibility of Business Is to Increase Its Profits." *New York Times*. Print.

Godfrey, Paul C., Craig B. Merrill, and Jared M. Hansen. "The Relationship Between Corporate Social Responsibility And Shareholder Value: An Empirical Test Of The Risk Management Hypothesis." *Strategic Management Journal* 30.4

(2009): 425-45. Print.

Gough, Janet. "Environmental Decision Making and Risk Management for Groundwater Systems." *Environmental Decision Making and Risk Management*. 1994. Web. 18 Feb. 2015.

Kaplan, Robert S., and Annette Mikes. "Managing Risks: A New Framework." *Harvard Business Review*. 1 June 2012. Web. 20 Apr. 2015.
<<https://hbr.org/2012/06/managing-risks-a-new-framework>>.

Konar, Shameek, and Mark A. Cohen. "Does The Market Value Environmental Performance?" *Review of Economics and Statistics* 83.2 (2001): 281-89. Print.

"Kyoto Protocol." *United Nations Framework Convention on Climate Change*. 2012. Web. 26 Apr. 2015. <http://unfccc.int/kyoto_protocol/items/2830.php>.

Makhjani, Shakuntala. "Cashing in on All of the Above: U.S. Fossil Fuel Production Subsidies under Obama." *Oil Change International*. 9 July 2014. Web. 12 Apr. 2015.

"Managing Our Impact on the Environment." *BP*. 2014. Web. 4 Apr. 2015.
<<http://www.bp.com/en/global/corporate/sustainability/environment/managing-our-impact-on-the-environment.html>>.

Mandelli, Monica M. "Environmental Risk Management at Chevron Corporation." *Harvard Business School*. Harvard Business School Publishing, 1 Apr. 1999. Web. 7 Feb. 2015.

Manna, Dean R., Gayle Marco, Denise Letterman, and Jesse Mullen. "Sustainable Case Study: Chevron Corporation." *The Clute Institute* (2014): 153-56. *The Clute Institute*. Web. 18 Apr. 2015. <<http://cluteinstitute.com/conference->

proceedings/2014SAPapers/Article 251.pdf>.

McMillen, Sara J. *Risk-based Decision-making for Assessing Petroleum Impacts at Exploration and Production Sites*. Washington, D.C.: U.S. Dept. of Energy, 2001. Print.

Nidumolu, Ram, C.K Prahalad, and M.R. Rangaswami. "Why Sustainability Is Now the Key Driver of Innovation." *Harvard Business Review*. 1 Sept. 2009. Web. 9 Mar. 2015.

"Operational Excellence Management System: An Overview of the OEMS." *Chevron*. 2010. Web. 26 Apr. 2015.
<http://www.chevron.com/documents/pdf/OEMS_Overview.pdf>.

Park, Jeryang, Thomas P Seager, and P Suresh C Rao. "Lessons in Risk- versus Resilience-based Design and Management." *Integrated Environmental Assessment and Management* 7.3 (2011): 396-99. Print.

Porter, Michael E. "From Competitive Advantage to Corporate Strategy." *Harvard Business Review* 65.3 (1987). Print.

Porter, Michael E., and Mark R. Kramer. "Creating Shared Value - How to Reinvent Capitalism and Unleash a Wave of Innovation and Growth." *Harvard Business Review*. 2011. Web. 6 Jan. 2015.

"Pricing Environmental Damage: US\$ 28 Trillion by 2050." *Principles for Responsible Investment*. 6 Oct. 2010. Web. 27 Apr. 2015.
<<http://www.unpri.org/press/pricing-environmental-damage-28-trillion-by-2050-2/>>.

"Reducing the Risk of Incidents." *Chevron*. 1 Apr. 2012. Web. 26 Apr. 2015.

<<http://www.chevron.com/about/operationalexcellence/managementsystem/reducingincidents/>>.

Reinhardt, Forest L. "An Overview of Risk Assessment: Four Factors That Influence Risk." *Down to Earth: Applying Business Principles to Environmental Management*. Boston, Mass.: Harvard Business School, 2000. Print.

Russo, Michael V., and Paul A. Fouts. "A Resource-Based Perspective On Corporate Environmental Performance And Profitability." *Academy of Management Journal* 40.3 (1997): 534-59. Print.

Sinclair-Desgagne, Bernard. "Corporate Strategies For Managing Environmental Risk." *The International Library of Environmental Economics and Policy* 20 (2004): 1-13. Print.

Solomon, S., G.-K. Plattner, R. Knutti, and P. Friedlingstein. "Irreversible Climate Change Due To Carbon Dioxide Emissions." *Proceedings of the National Academy of Sciences* (2009): 1704-709. Print.

"Statistical Review of World Energy 2014." *BP*. BP P.l.c, 2014. Web. 26 Apr. 2015.

<<http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy.html>>.

Sylves, R. T., and L. K. Comfort. "The Exxon Valdez and BP Deepwater Horizon Oil Spills: Reducing Risk in Socio-Technical Systems." *American Behavioral Scientist* 56.1 (2012): 76-103. Print.

"The Art of Risk Management." *Boston Consulting Group Perspectives*. Boston Consulting Group. Web. 15 Apr. 2015.

<https://www.bcgperspectives.com/content/articles/financial_management_art_

of_risk_management/?chapter=2>.

"Unconventional Resources Development - Managing the Risks." *ExxonMobil*. 1 Sept. 2014. Web. 26 Apr. 2015.

<<http://corporate.exxonmobil.com/en/engineering/hydraulic-fracturing/environment-and-safety/unconventional-resources-development-risk-management>>.

"United Nations Conference on Sustainable Development, Rio 20." *Sustainable Development Knowledge Platform*. 1 June 2012. Web. 26 Apr. 2015.

<<https://sustainabledevelopment.un.org/rio20.html>>.

"United States Energy Policy." *ExxonMobil*. 2013. Web. 26 Apr. 2015.

<<http://corporate.exxonmobil.com/en/current-issues/energy-policy/united-states-energy-policy/overview>>.

Notes

¹ Statistical Review of World Energy 2014. (2014). Retrieved April 26, 2015, from <http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy.html>

² 2013 Corporate Sustainability Report. (2014). Retrieved April 21, 2015, from http://www.chevron.com/documents/Pdf/CorporateResponsibility/Chevron_CR_Report_2013.pdf

³ Pricing environmental damage: US\$ 28 trillion by 2050. (2010, October 6). Retrieved April 27, 2015, from <http://www.unpri.org/press/pricing-environmental-damage-28-trillion-by-2050-2/>

⁴ Nidumolu, R., Prahalad, C., & Rangaswami, M. (2009, September 1). Why Sustainability Is Now the Key Driver of Innovation. Retrieved March 9, 2015.

⁵ Solomon, S., Plattner, G., Knutti, R., & Friedlingstein, P. (2009). Irreversible Climate Change Due To Carbon Dioxide Emissions. Proceedings of the National Academy of Sciences, 1704-1709.

⁶ Reducing the Risk of Incidents. (2012, April 1). Retrieved April 26, 2015, from <http://www.chevron.com/about/operationalexcellence/managementsystem/reducingincidents/>

⁷ United Nations Conference on Sustainable Development, Rio 20. (2012, June 1). Retrieved April 26, 2015, from <https://sustainabledevelopment.un.org/rio20.html>

⁸ Kyoto Protocol. (2012). Retrieved April 26, 2015, from http://unfccc.int/kyoto_protocol/items/2830.php

⁹ United Nations Conference on Sustainable Development, Rio 20.

¹⁰ United States Energy Policy. (2013). Retrieved April 26, 2015, from <http://corporate.exxonmobil.com/en/current-issues/energy-policy/united-states-energy-policy/overview>

¹¹ Ibid

¹² Makhjani, S. (2014, July 9). Cashing in on All of the Above: U.S. Fossil Fuel Production Subsidies under Obama. Retrieved April 12, 2015.

¹³ Ibid

¹⁴ Reinhardt, F. (2000). An Overview of Risk Assessment: Four Factors that Influence Risk. In *Down to Earth: Applying Business Principles to Environmental Management*. Boston, Mass.: Harvard Business School Press.

¹⁵ Cleveland, C. (Ed.). (2011, January 16). Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling. Retrieved April 4, 2015, from <http://www.eoearth.org/view/article/162358/>

¹⁶ Environmental Risk Management. (2013, August 21). Retrieved April 26, 2015, from [http://sache.org/workshop/2013Faculty/files/Environmental Risk Management at Chevron.pdf](http://sache.org/workshop/2013Faculty/files/Environmental%20Risk%20Management%20at%20Chevron.pdf)

¹⁷ Kaplan, R., & Mikes, A. (2012, June 1). Managing Risks: A New Framework. Retrieved April 20, 2015, from <https://hbr.org/2012/06/managing-risks-a-new-framework>

¹⁸ Sylves, R., & Comfort, L. (2012). The Exxon Valdez and BP Deepwater Horizon Oil Spills: Reducing Risk in Socio-Technical Systems. *American Behavioral Scientist*, 56(1), 76-103.

¹⁹ Manna, D., Marco, G., Letterman, D., & Mullen, J. (2014). Sustainable Case Study: Chevron Corporation. *The Clute Institute*, 153-156. Retrieved April 18, 2015, from [http://cluteinstitute.com/conference-proceedings/2014SAPapers/Article 251.pdf](http://cluteinstitute.com/conference-proceedings/2014SAPapers/Article%20251.pdf)

²⁰ Mandelli, M. (1999, April 1). Environmental Risk Management at Chevron Corporation. Retrieved February 7, 2015.

²¹ Ibid

²² Ibid

²³ Kaplan, R., & Mikes, A. (2012, June 1). Managing Risks: A New Framework. Retrieved April 20, 2015, from <https://hbr.org/2012/06/managing-risks-a-new-framework>

²⁴ Gough, J. (1994). Environmental Decision Making and Risk Management for Groundwater Systems. Retrieved February 18, 2015.

²⁵ Porter, M. (1987). From Competitive Advantage to Corporate Strategy. *Harvard Business Review*, 65(3).

²⁶ Ibid

²⁷ Cleveland, C. (Ed.). (2011, January 16). Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling. Retrieved April 4, 2015, from <http://www.eoearth.org/view/article/162358/>

²⁸ Mandelli, M. (1999, April 1). Environmental Risk Management at Chevron Corporation. Retrieved February 7, 2015.

²⁹ Ibid

³⁰ 2013 Corporate Sustainability Report. (2014). Retrieved April 21, 2015, from http://www.chevron.com/documents/Pdf/CorporateResponsibility/Chevron_CR_Report_2013.pdf

³¹ Mandelli, M. (1999, April 1). Environmental Risk Management at Chevron Corporation. Retrieved February 7, 2015.

³² 2013 Corporate Sustainability Report. (2014). Retrieved April 21, 2015, from http://www.chevron.com/documents/Pdf/CorporateResponsibility/Chevron_CR_Report_2013.pdf

³³ Ibid

³⁴ Mandelli, M. (1999, April 1). Environmental Risk Management at Chevron Corporation. Retrieved February 7, 2015.

³⁵ Ibid

³⁶ The Chevron Way. (2014). Retrieved January 27, 2015, from <http://www.chevron.com/about/chevronway/>

³⁷ Mandelli, M. (1999, April 1). Environmental Risk Management at Chevron Corporation. Retrieved February 7, 2015.

³⁸ Business Conduct and Ethics Code. (2014). Retrieved February 19, 2015, from <http://www.chevron.com/documents/pdf/chevronbusinessconductethicscode.pdf>

³⁹ Operational Excellence Management System: An Overview of the OEMS. (2010). Retrieved April 26, 2015, from

http://www.chevron.com/documents/pdf/OEMS_Overview.pdf

⁴⁰ Ibid

⁴¹ 2013 Corporate Sustainability Report. (2014). Retrieved April 21, 2015, from http://www.chevron.com/documents/Pdf/CorporateResponsibility/Chevron_CR_Report_2013.pdf

⁴² Operational Excellence Management System: An Overview of the OEMS. (2010). Retrieved April 26, 2015, from http://www.chevron.com/documents/pdf/OEMS_Overview.pdf

⁴³ Mandelli, M. (1999, April 1). Environmental Risk Management at Chevron Corporation. Retrieved February 7, 2015.

⁴⁴ Operational Excellence Management System: An Overview of the OEMS. (2010). Retrieved April 26, 2015, from http://www.chevron.com/documents/pdf/OEMS_Overview.pdf

⁴⁵ Ibid

⁴⁶ Ibid

⁴⁷ Ibid

⁴⁸ Assurance. (2014). Retrieved April 3, 2015, from <http://www.bp.com/en/global/corporate/sustainability/about-our-reporting/assurance.html>

⁴⁹ Ibid

⁵⁰ Operational Excellence Management System: An Overview of the OEMS. (2010). Retrieved April 26, 2015, from http://www.chevron.com/documents/pdf/OEMS_Overview.pdf

⁵¹ Assurance. (2014). Retrieved April 3, 2015, from <http://www.bp.com/en/global/corporate/sustainability/about-our-reporting/assurance.html>

⁵² Operational Excellence Management System: An Overview of the OEMS. (2010). Retrieved April 26, 2015, from http://www.chevron.com/documents/pdf/OEMS_Overview.pdf

⁵³ Ibid

⁵⁴ Ibid

⁵⁵ Ibid

⁵⁶ 2013 Corporate Sustainability Report. (2014). Retrieved April 21, 2015, from http://www.chevron.com/documents/Pdf/CorporateResponsibility/Chevron_CR_Report_2013.pdf

⁵⁷ Ibid

⁵⁸ Reducing the Risk of Incidents. (2012, April 1). Retrieved April 26, 2015, from <http://www.chevron.com/about/operationalexcellence/managementsystem/reducingincidents/>

⁵⁹ Ibid

⁶⁰ 2013 Corporate Sustainability Report. (2014). Retrieved April 21, 2015, from http://www.chevron.com/documents/Pdf/CorporateResponsibility/Chevron_CR_Report_2013.pdf

⁶¹ Ibid

⁶² Mandelli, M. (1999, April 1). Environmental Risk Management at Chevron Corporation. Retrieved February 7, 2015.

⁶³ Ibid

⁶⁴ Ibid

⁶⁵ Ibid

⁶⁶ Mandelli, M. (1999, April 1). Environmental Risk Management at Chevron Corporation. Retrieved February 7, 2015.

⁶⁷ Pallardy, Richard. "Deepwater Horizon Spill of 2010." Encyclopedia Britannica Online. Encyclopedia Britannica, 20 Apr. 2015. Web. 23 Apr. 2015.

⁶⁸ Broder, John M. "BP Shortcuts Led to Gulf Oil Spill." The New York Times. The New York Times, 14 Sept. 2011. Web. 11 Apr. 2015.

⁶⁹ Ibid

⁷⁰ Pallardy, Richard. "Deepwater Horizon Spill of 2010." Encyclopedia Britannica Online. Encyclopedia Britannica, 20 Apr. 2015. Web. 23 Apr. 2015.

⁷¹ Ibid

⁷² Broder, John M. "BP Shortcuts Led to Gulf Oil Spill." The New York Times. The New York Times, 14 Sept. 2011. Web. 11 Apr. 2015.

⁷³ Broder, John M. "BP Shortcuts Led to Gulf Oil Spill." The New York Times. The New York Times, 14 Sept. 2011. Web. 11 Apr. 2015.

⁷⁴ Pallardy, Richard. "Deepwater Horizon Spill of 2010." Encyclopedia Britannica Online. Encyclopedia Britannica, 20 Apr. 2015. Web. 23 Apr. 2015.

⁷⁵ Ibid

⁷⁶ Managing Our Impact on the Environment. (2014). Retrieved April 4, 2015, from <http://www.bp.com/en/global/corporate/sustainability/environment/managing-our-impact-on-the-environment.html>

⁷⁷ Corporate Citizenship Report 2013. (2013). Retrieved April 26, 2015, from [http://cdn.exxonmobil.com/~/_media/Reports/Corporate Citizenship Report/2013/news_pub_ccr2013-2.pdf](http://cdn.exxonmobil.com/~/_media/Reports/Corporate%20Citizenship%20Report/2013/news_pub_ccr2013-2.pdf)

⁷⁸ Cleveland, C. (Ed.). (2011, January 16). Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling. Retrieved April 4, 2015, from <http://www.eoearth.org/view/article/162358/>