Environmental Risk Explored Through Oil Spills and Hydraulic Fracturing: Attempting Environmental Protection through Policy

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Abstract:

History demonstrates the dangers of ignoring the environmental risks that correspond to resource extraction, especially in precarious locations. This project analyzed three cases: (1) the 1989 *Exxon Valdez* oil spill, (2) the 2010 *Deepwater Horizon* oil spill, and (3) the current question of hydraulic fracturing in New York's Marcellus Shale. The case studies assessed whether policies for protecting the environment from the risks of human activity have improved and whether such policies can be made both economically efficient and environmentally less risky. While the *Exxon Valdez* case demonstrated the dangers of not planning for disaster, it did result in the 1990 Oil Pollution Act [OPA]. Although OPA is requiring BP to fund cleanup of the *Deepwater Horizon* spill, OPA alone did little to prevent this event from happening. Using these historical examples, New York now has a chance to put better policies in place for the risk-laden technique of hydraulic fracturing. Economic pressures mean hydraulic fracturing is almost a certainty. This project argues that the State must require that extremely precautionary policies and strict regulations be implemented before drilling.

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Introduction/Methods:

In March 1989, the *Exxon Valdez* oil spill devastated the Prince William Sound, forever altering the ecosystems and the society in the surrounding area. Influenced by our country's need for domestic oil, the Trans-Alaskan pipeline was installed prior to the spill, illustrating the United States' extreme dependence on oil. Approximately twenty years later, the *Deepwater Horizon* oil spill continued for eighty-six days, depositing millions of barrels of oil into the Gulf of Mexico. From these two events, multiple questions can be raised concerning the United States' environmental policies and practices when it comes to resource extraction for energy usage. Did our country learn anything from past mistakes or is our reliance on and need for oil more important above all else? What role does risk assessment and policy planning play in oil extraction and dealing with the possibility of disaster? Will we ever be able to properly assess risk and define it in environmental policies to ensure the protection of the environment for future generations? Two case studies will be conducted in order to gain a better understanding of the events that unfolded at each of the oil spills. A Human Subject Review-approved interview of Mary Landry, Rear Admiral of the United States Coast Guard, will be included to gain a well-rounded and first-hand perspective of the BP *Deepwater Horizon* oil spill.

This work will then examine the practice of hydraulic fracturing. What lessons learned from the two oil spills can be applied to the proposed hydraulic fracturing of the Marcellus Shale in New York State? Are we setting ourselves up for disaster by extracting natural gas through a practice that may forever contaminate the groundwater that many people utilize? I hope to apply what I learn from the two case studies of oil

spills and the way in which policies impact planning for disaster to hydraulic fracturing and come up with my suggestion of how New York State should address hydraulic fracturing through policy. A talk with an engineering professor who is in favor of hydraulic fracturing, Professor Ashraf Ghaly, will be utilized in obtaining a supportive perspective on hydraulic fracturing in order to balance the assessment of this practice. In sum, the fundamental question of this thesis is, is it a good idea to go ahead with hydraulic fracturing to gain additional sources of energy from natural gas or is the environmental risk too great to implement hydraulic fracturing?

Chapter 1: Literary Review of Environmental Risk and Human Error

Introduction

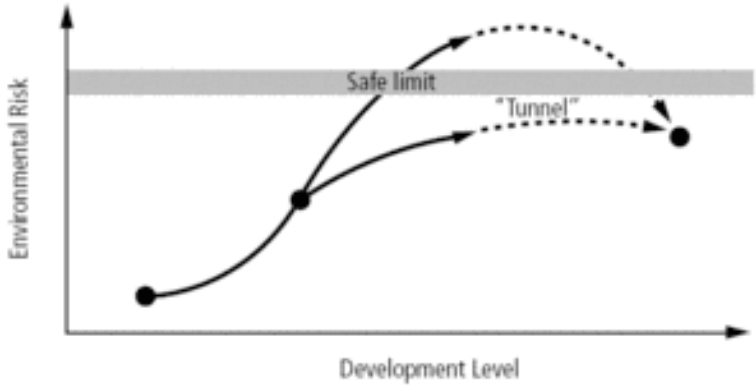
American society relies on oil in order to maintain activities central to everyday living: pumping gas into cars, heating homes, and producing many products in the consumer market. This continued dependency on oil has resulted in a serious depletion in its supply. Oil is a nonrenewable resource. As a result, many experts believe that society is approaching, if has not already reached, the point of peak oil. Peak oil is the concept that there will no longer be an increase in the amount of oil obtainable, but rather the amount of available oil will begin to decrease. We are also facing a shift from conventional means of extracting oil to using more difficult mechanisms of extraction and accessing oil located in more vulnerable environments. Simple domestic oil, oil that is traditionally extracted from basic oil fields, no longer exists because the traditional and standard approaches to extricating the oil from singular wells or fields all follow a similar pattern. The oil source undergoes a pattern of an increase in yield, followed by a peak, and then a decline, demonstrating that oil fields are not infinite and have limits (Kerr 2011). According to an article in *Science*, output from non-OPEC oil industries throughout the world, which make up approximately 60% of total yield, has not expanded a notable amount since 2004, and experts believe that it will never climb again (Kerr 2011). Therefore, companies are drilling for oil in increasingly risky environments and using different approaches to obtain oil, such as offshore deepwater oilrigs, placing more wells on current sites, turning towards marginal deposits such as the Alberta tar sands, as well as attempting to shift energy use to other resources such as natural gas by harvesting the resource from the Marcellus Shale (Garver 2011). It is riskier to drill for oil in these

environments due to their vulnerability. We must ask, therefore, whether it is possible to adequately assess these risks and therefore protect the environment? Furthermore, how much does risk affect decisions made to drill and abstract oil from vulnerable environments and how can this risk be managed through policies?

Defining Risk

Common sense would say that risk is an easy concept to define; however, this is not the case. There is no overarching, simple definition of risk because the concept of risk is extremely multifaceted; many aspects need to be considered in order to correctly define risk in each individual case. Kammen and Hassenzahl (1999) provide a basic definition of risk as the likelihood a result will happen multiplied by the possible repercussions, or extent of effect, if the result does indeed take place (Kammen and Hassenzahl 1999). For example, if deepwater drilling is to occur, what is the probability that some type of oil spill will occur, thus resulting in contamination of water to a certain degree? Lupton (1999) presents a technico-scientific model in defining risk, called the cognitive science perspective, where risks are inherent in society and can be calculated and thus managed (Lupton and ebrary 1999). However, Lupton also examines a more culturally based definition of risk, where society has a significant impact on the levels of risk, which also considers the sociologist Beck's (2009) idea of a "risk society." Beck defines the concept of a "risk society" by showing that, as a result of industrialization, our society has become more affluent and thus creates more potential risks. He includes two factors, chance and danger, when defining risk (Beck 2009). The sociologist goes on to further demonstrate the disconnect between the defining of risk and the way in which the public perceives it, at times magnifying the risks and at other points disparaging the risk, the

overall result being an inaccurate means of defining and assessing risk (Lupton and ebrary 1999). Kasperson (2001) further defines risk through his model of the structure of environmental risk by using arrows that illustrate the following: human driving forces lead to environmental stress and socio-economic vulnerability; socio-economic vulnerability leads to adverse consequences which has a give and take relationship with ecosystem fragility; environmental stress is also caused by natural variability and leads to socio-economic vulnerability, and ecosystem fragility, which also leads to adverse consequences (Kasperson and Kasperson 2001).



(Kasperson and Kasperson 2001)

The above figure portrays a relatively simple structure for defining risk. The sequence of events is seemingly obvious, yet at the same time, the figure demonstrates the complex nature of assessing risk in an environmental setting. Even the most seemingly benign human action, such as pumping gas in a car to give it power, has a long-term impact on ecosystem vulnerability through global warming and the consequences of it, such as a decrease in biodiversity and overall climate change. Therefore, the definition of risk must consider additional elements to fully encompass all the possible consequences and outcomes of risky behavior. Having considered all of the basic definitions of risk

provided by various scholars, an attempt to provide an overall definition of risk must include the possible results of a given action and the effects that the result would have on other entities, taking into account the scientific, cultural, societal, and technological factors that have an impact on the event that is occurring. Providing a "simple" definition of risk is, however, virtually impossible as mentioned earlier because of the many factors and impacts that are required to be considered, demonstrating the complexity of the concept of risk as a whole.

The definition of risk can be explored in even more depth by including important concepts such as vulnerability, established by Kasperson (2001) as:

> The degree to which a system, or a part of a system, may react adversely to the occurrence of a hazardous event. The degree and quality of that adverse reaction are partly conditioned by the system's resilience the measure of a system's, or part of a system's, capacity to absorb and recover from the occurrence of a hazardous event (Kasperson and Kasperson 2001, 25).

The concept of vulnerability within risk can directly be applied to encompass the environment in relation to the delicate nature of ecosystems, the close relationship between maintaining the health of the environment and the prosperity of the economy, societal responsiveness, independent choices, and human qualities (Kasperson and Kasperson 2001, 25). A similar example can be used with the additional aspect of vulnerability in examining how susceptible an area is to environmental disaster: if an oil spill does occur, what will the impacts be on the surrounding ecosystems, what effect will the spill have on the economy of a nearby community, and how will the society be influenced by the negative consequences of the spill? In addition, when vulnerability is taken into account concerning environmental risk, the complexity of assessment only increases because the environment itself is very susceptible to human impact.

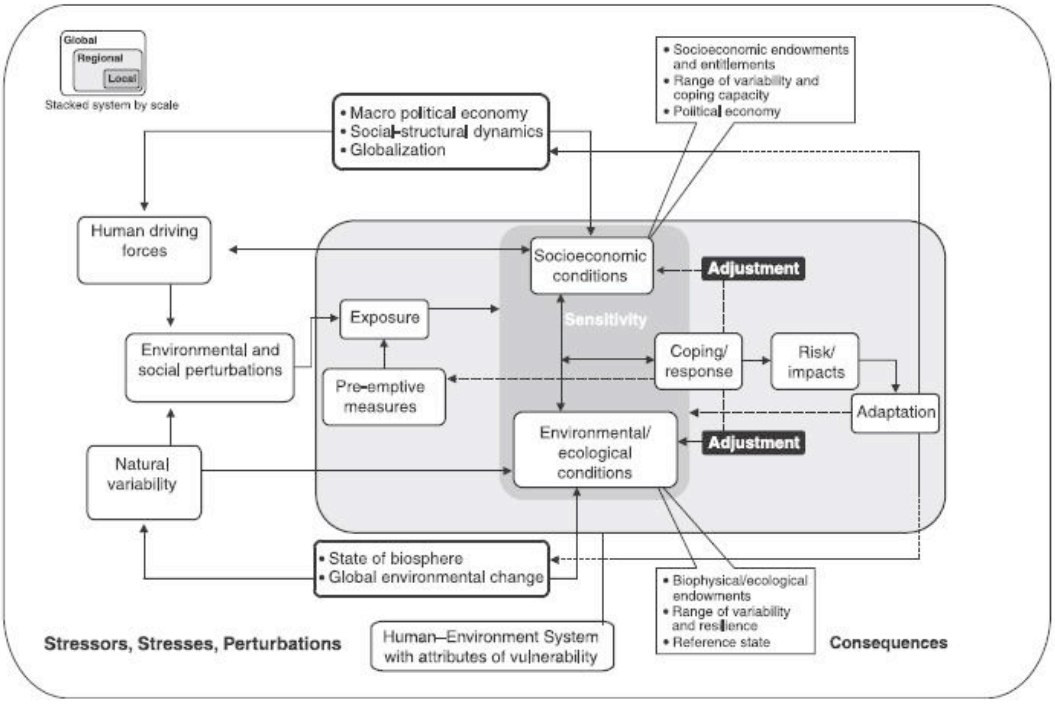


Figure 6.1. A Framework for Analyzing Vulnerability

(Kasperson and Kasperson 2001)

As shown through the above image, many additional factors come into play when addressing vulnerability. The framework illustrates how all aspects of a given society can be affected, including the socio-economic consequences and the destruction of ecosystems resulting from human driving forces, showing the importance of accurately assessing and evaluating environmental risks.

Environmental Risk

Furthermore, risk can be defined strictly in terms of the environment. Environmental risks can be assessed through "terms of instability or destruction of (a) natural resources, (b) their productivity potential, and (c) the processes represented by the biophysical functions and flows" (Kasperson and Kasperson 2001, 310). Because natural resources are for the most part nonrenewable, risk to their levels must be taken into account not only for present consumption but also in preserving the resources for use by

future generations. Certain natural resources such as fossil fuels (coal, petroleum, oil, and natural gas) have limited amounts available throughout the world that will not increase over time. During the harvesting of these natural resources, the habitats that the resources are located in need to be taken into consideration in any risk evaluation because of the negative impacts the resources tend to have on surrounding environments after their exposure. Additionally, the rate at which the resources are currently being depleted is another risk accompanying the consumption and extraction of nonrenewable energy sources.

The concept of the future only complicates the assessment of the environmental risk. Conceptually, the future is difficult to comprehend for many members of society. Some individuals believe that their actions will not have detrimental effects on the environment in the current day, let alone the future. Even though it is common knowledge that there are long-term repercussions to human-nature relations, many believe that because we will not be alive in the future, there is no inherent need to protect the environment and preserve nonrenewable resources. This view held by far too many individuals results in the future health of the environment taking a back seat to maintaining the current materialistic advantages our society receives today from consumption of resources, further complicating risk assessment.

Risk In Terms of Societal and Cultural Impacts

Society is still struggling to accept the notion that we have responsibilities to protect the environment for the future. One author, William B. Griffith, believes that individuals would better comprehend the importance of protecting the environment and change their actions towards it if they had a more thorough understanding of the effects

of their current actions, both short and long term, and how changing their actions would preserve and better protect the future environment (Light and De-Shalit 2003). For example, rather than publicizing the mere fact that renewable energy is better than oil and traditional forms of natural resources used for energy, Public Service Announcements could provide facts and actual statistics about the effects and risks of using natural resources: global warming, limited supplies, and the advantages of renewable energies. Most individuals within society do not understand that their actions are risky to the environment, as people rarely take into account that by filling their automobiles up with fuel they are actually a part of the chain that increases the risk for oil spills. Rather, many individuals are unaware of the risks that their daily activities engender and take an "out of sight, out of mind" approach, even further complicating the issue of environmental policy and risk assessment.

Furthermore, society tends to assume that certain actions will simply not happen. This results in the notion that when assigning environmental risks, there is a continual absence of acknowledgement and sound recognition for actions that will undoubtedly have negative effects on the environment (Light and De-Shalit 2003). It is possible that this is because the assessment of environmental risk is a relatively new practice. As Kasperson states, "how nature-society relations are being altered, risk distributions and vulnerabilities reshaped, coping systems altered, and overall resilience to environmental change, are only beginning to become apparent" (Kasperson and Kasperson 2001). Another possible cause of the indifference within society concerning risks is the free rider problem. The free rider problem occurs when people take advantage of a benefit without having to incur the cost. This concept can be applied to environmental issues such as risk.

For example, the people that use the oil for every day practices may not live in the areas that the oil is being extracted from, thus are not at risk for destruction of their environment if a spill were too occur, yet still obtain the benefits of using the oil.

On the contrary, however, there are some members of society that fully acknowledge the risks that their actions are inflicting upon the environment, but ignore them because it is more difficult to take action and change rather than continue in their ways. This is especially true if the risk is not having a negative impact on their personal health, but rather the health of the environment, something they do not value as much. Overall, the lack of unity within society concerning the assessment of environmental values and what is deemed most important to preserve leads to the same absence of agreement when assessing risk and acting upon it. If society cannot always gauge risk in the same way, it only complicates the role that policymakers play in protecting the environment.

Risks are viewed differently depending on their consequences, whether direct or indirect. The human race tends to value its own health over the health of the environment, therefore taking risks to health more seriously than risks to the environment. For example, when considering hydraulic fracturing, there is the obvious risk to the environment in terms of the wastewater having a negative effect on the surrounding ecosystems, possibly causing extinctions and thus decreasing biodiversity and the overall healthy functioning of the environment. There is, however, also a direct risk to humans who could possibly consume contaminated water as a result of the wastewater not being treated properly which is then put back into the natural system. Anthony Ingraffea, a professor at Cornell University who has had much experience in this area and attended

several conferences (including the EPA and the NYS DEC), has developed his own opinions on hydraulic fracturing and the impact it will have on the health of surrounding water. Overall, Ingraffea concludes that the long term affects of hydraulic fracturing will most likely have an impact on the drinking water and could lead to serious contamination issues (Mooney 2011). When there are possible detrimental effects to human health, risks are taken more seriously, even if the risk to the environment was already inherent. Therefore, if individuals were more aware of risks to the environment that could also present risk to human health, more attention would be paid to such actions that serve to protect both humans and the environment.

Risk in Environmental Policies and the EPA

The manner in which risk is addressed through the government and policy makers is not always adequate enough to thoroughly preserve nature and the environment. There is somewhat of an impact from existing environmental legislation that limits the amount of risk analysis included in policies. Although studies conducted by the EPA and the Science Advisory Board concerning environmental risk prioritization in 1990 show that the laws in place limit the EPA's current course of action concerning environmental risk, it has been suggested that the EPA itself should place a higher value on risk analysis (Kammen and Hassenzahl 1999). Currently, there are certain mechanisms that exist in order to address protecting the environment to some degree.

Environmental Impact Statements (EIS) are required under the National Environmental Policy Act, which "requires federal agencies to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions" (Environmental

Protection Agency 2011). While the impacts on the environment are examined through EIS, risk is only indirectly addressed. An example can be found on the EPA's website in a letter from the EPA commenting on an environmental impact statement concerning the TransCanada Keystone XL Project. The letter comments on oil spill and pipeline risks, recommending further investigations concerning the probability for oil spills to occur in addition to the possible consequences and ramifications for necessary clean-up and remediation if a pipeline malfunction, such as a leak or rupture, were to transpire (Giles 2011). Here, the environmental risks are being discussed; however, the EPA is merely making recommendations rather than implementing a policy dictating the way in which the risk must be analyzed for each case. Thus, it seems as if there is no overarching, uniform environmental policy requiring a determination of risk, which raises the question of how can one determine environmental risk and how can that risk calculation be deemed adequate prior to decision making. Summarized differently, are environmental issues too complex to fully and uniformly assign a level of risk?

The EPA has historically attempted to develop risk assessment, including actively participating in the Annapolis Conference, which was one of the first meetings held in order to begin discussing the prioritization risk in an environmental context. Yet difficulties in consistently defining and analyzing risk still plague the government and society. Attempts have been made by the EPA to establish key fundamental concepts. Currently, protecting the environment is reactive (society waits for problems to unfold and then responds accordingly) as opposed to being proactive. Additionally, the public needs to be informed and included in the prevention of environmental problems, and the environment needs to be approached as a single entity for which human actions can have

detrimental effects on both it and the health of the human race and its future generations. Finally, the health of the environment needs to be a priority for both the EPA and the nation as a whole (Finkel and Golding 1994). The difficulty then lies in applying the key principles to practice. Theories and suggestions are helpful, but the concepts need to be administered and applied through policies in order to make a difference. In the late 1980's and early 1990's, the EPA observed a disconnect between the public and Congress in the way they perceive risk and value the environment, realizing that environmental risks were not adequately assessed and appropriate budgeting left a great deal to be desired. Currently, the EPA evaluates risk through the comparative risk assessment, but it does not take into account the balance between the "citizen's values" and the issues that the government deems important (Finkel and Golding 1994).

Forms of Risk Analysis

There are two commonly used forms of risk analysis. One form has been created by Harte (1999) to assess risk in environmental problems (Kammen and Hassenzahl 1999). Harte's method investigates primarily the bigger picture by forming a qualitative comprehension of the procedure or process under analysis. He then determines a thorough quantitative interpretation, derived from applied data, and finally, he assesses the legitimacy of his results on the grounds that the suppositions he declared are altered or removed (Kammen and Hassenzahl 1999). Although seemingly complicated, the equation provides a fairly adequate risk analysis and can be applied to answer several environmental questions. Harte's approach acknowledges both the quantitative and qualitative aspects of a problem as well as addresses various assumptions, resulting in a fair and balanced assessment of environmental problems. For example, Harte's analysis

may be applied to an oil spill scenario, particularly concerning the construction of a deepwater oilrig. The analysis serves to answer questions such as: what is the likelihood for technological failure, how would this failure impact the surrounding environment by taking into account dispersal rates, and are the advantages of oil extraction more significant than the disadvantages of a disaster?

Margolis (1996) created another, more conceptual form of risk analysis through use of a risk matrix that demonstrates the differences in how the public and the experts perceive risk. Margolis compares the concepts of "better safe than sorry" versus "waste not, want not." The first belief, "better safe than sorry," indicates proactive attentiveness whereas the second theory, "waste not, want not" moreso suggests the notion of continuing everyday life, yet giving a further consideration to the disadvantages of delay and missed possibilities for better living (Margolis 1996). In order to compare these two concepts, Margolis uses two dimensions to assist in the calculation of risk: when undertaking a risk, the harm and hazard that goes along with the decision that accepts the risk is realized, and if the risk is avoided, what was given up in order to prevent the risk from occurring at all is understood. Therefore, the elements of the risk matrix are complete, examining concepts including fungibility, "waste not, want not," "better safe than sorry," and indifference in terms of danger and opportunity. Risks would not be risky if there was no danger involved, and also actions would not be explored if there were no possibility for opportunity, further demonstrating the problem of risk, particularly concerning the environment. For example, drilling for oil is risky because of decreasing levels of natural resources as well as the chance for detrimental effects on the surrounding environment. Yet drilling also has the opportunity for economic gain and

providing a source of power, thus illustrating the difficulty of balancing the costs and benefits. Furthermore, some areas in which continual drilling occurs are more susceptible to the negative impacts of "natural disasters," as demonstrated by Perrow (2007). The repercussions of Hurricane Katrina are usually discussed in terms of damage to infrastructure and destruction of the society. However, Hurricane Katrina also resulted in approximately 575 separate spills of petroleum or hazardous waste, thus indicating another factor that could amplify risk considerations when natural disasters occur in areas that have existing systems that could have negative effects on the environment if a disaster would occur (Perrow 2007). Margolis concludes his argument of the risk matrix by commenting that the way in which the risk is perceived and managed thoroughly relies on the framing of the risk. For example, the risk of the levees breaking as a result of Hurricane Katrina was not framed in terms of the possible oil spills that could have occurred from such a natural disaster. Yet, the society still had to incur the consequences from the spills on top of the other issues from the hurricane because the oil tanks were not taken into account when planning for the levees and the possibility of their failure.

Risk Assessment

It is clear that while there are several techniques of, and theories for, identifying and defining risk, especially in regards to the environment, the way in which the risk is perceived by society and how important these risks are continues to impact risk assessment and make it increasingly difficult to quantify. Varying opinions on the assessment of risk may cause disagreements among policy makers, thus resulting in continual and ongoing environmental risk. Additionally, the public may view the risk entirely differently than the policy makers, resulting in further conflict and less direct

attention on the actual environmental issue at hand. Due to the democratic nature of our country, the policy makers are obligated to some degree to implement the wishes of the public; however, when risk is only an idealized concept, the public and the policy makers may assess risk in different ways. At times, situations unfold where there is a disconnect between society and knowledgeable authority and what is factual evidence concerning risk, yet there is a lack of force from the public on the authority to react to the uncertainties. Therefore, the public not only doubts the knowledgeable authority, but the authority continues to be concerned with the lack of consideration for possible risks (Margolis 1996).

In addition to the disconnect between the public and the experts, certain groups of the public may have varying opinions and assess risk to differing degrees based on lifestyles and the extent that their individual lives may be impacted by those risks. If the various groups have divided points of view on levels of environmental risk, then how will risk be taken into account to develop unified policies and restrictions concerning particular environmental issues? For example, certain business owners along the Florida coastline may not be in support of deepwater drilling for oil in the Gulf of Mexico due to the possibly of oil spills, and thus would contact their Congressional representative who then would voice their constituents' opinions and vote against deepwater drilling. However, the money acquired from the oil may be more desirable to a Texas oil company than the consequences of problems that would urge their representative to vote in favor of the drilling. This demonstrates the difficulty of an overarching risk policy. In such instances, there is a natural conflict in interest based on a particular group's perspective.

Several theories attempt to interpret the disconnection between the policy makers and the public, some of which suggest that the differences may go beyond risk analysis and assessment. Margolis (1996) argues that controversies are the result of differing ideologies, not directly concerning risk, but rather the result of the lack of faith of the public in the government and other establishments in power who attempt to affirm that the possibility of harm be kept as minimal as possible, leading to an overall difference in risk evaluation (Margolis 1996). In addition, he claims that the need to include human error in the assessment of risk further complicates risk analysis due to the fact that someone who has an immense amount of experience may minimize a potential problem because the system seems extremely familiar, whereas an unseasoned or untrained individual may be more attentive and catch an error when it occurs (Margolis 1996). A task as simple as monitoring a drilling system for an oilrig can become so systematic that human error may increase over time because of lack of attention to detail and too much comfort. If environmental risk is seemingly so arduous to agree upon, is assessing environmental risk the ideal way to address environmental issues? Would policy makers be better suited to include detailed and extensive regulations for the risk outcomes?

Overall, even if environmental risk may one day be able to be defined relatively successfully, the true problem lies in assessment of the risk and the translation into meaningful environmental policies. Is our society minimalistic in the way in which precautions are taken for environmental risk or does the problem lie merely in complete ignorance to the risk, setting us up for disaster? For example, the Exxon Valdez oil spill in the Prince William Sound had the possibility for disaster from the beginning, demonstrating the inability to correctly assess risk. Occurring on March 24, 1989, the

concerns were existent far before the spill. Gunn describes the route that the ships regularly traveled as being less than optimal, which including navigation through a great deal of rocks, a difficult climate, harsh meteorological circumstances, and restricted passageways, resulting in blocks of ice in the channels, which was dangerous for the continual boating traffic (Gunn 2003). Furthermore, the tankers that were traveling in these difficult surroundings had single hulls rather than double hulls, the latter capable of lessening the risk and being much more secure in such harsh conditions. The harsh conditions were another risk that was not accounted for, yet may have been minimized through more stringent and precautionary requirements (Gunn 2003). In retrospect, these risks seem relatively obvious; however, they were apparently ignored and directly resulted in a human-induced environmental disaster. If risk analysis does not result in protection of the environment, then the next step in environmental policy must be the prevention of disaster and elaborate plans for possible failures. There will always be risk when extracting natural resources, and the risk will only increase as the resources becomes increasingly difficult to extricate due to, for example, the precarious locations of oil. If society is not willing to expand and take advantage of renewable resources, the best option may be to plan for the worst and prevent spills from becoming immense environmental disasters.

Alternative Ways of Assessing Risk: Preventative Approach

Mary O'Brien and the Environmental Research Foundation (2000) suggest a shift from a more complacent theory of applying environmental risk assessment to a theory of alternatives assessment, which may be a more acceptable option to altering the way in which the country views environmental risk. O'Brien defines her own principles in

comparison to those dictated by the EPA above. Her approach provides yet another mindset in the way in which we view environmental problems. O'Brien states when there are sensible substitutes available damage should not be necessary to either humans or non-humans. For example, if renewable energy will not harm the environment, the damage that the use of fossil fuels causes is avoidable. Furthermore, acceptable harm cannot be defined by anyone other than the individual who the harm is being enacted upon; even if the actions of a single entity are considered private, there will be public environmental impacts. Global warming will affect the entire planet, and actions that result in global warming must be examined on a global scale. Additionally, because humans are the most detrimental factor in causing environmental damage, we need to examine alternatives that will have the least amount of damage and even restore the environment whenever it is possible. People are relatively stuck in the usual means of living within the environment, and some believe that there is no alternative to living, so there is no reason to change. Yet although it is hard to change, we need to change. To change, society needs to believe that there is the ability to change and that alternatives to the norm do exist. O'Brien's message is that there is an inherent need within society to apply and put to use policies that place a higher value on the health of the environment, and utilize the democracy that our country is based upon in order to accomplish such goals of protecting the environment and thus protecting our own health and futures (O'Brien and Environmental Research Foundation 2000). Additionally, O'Brien emphasizes the importance of individual participation within the system, taking into account varying opinions and values (O'Brien and Environmental Research Foundation 2000). Therefore, she calls on the government to use risks to the environment as a

mechanism for change throughout society. Not only does the government have to better assess risk, but it also needs to change the way in the risk is addressed through environmental policies.

Precautionary Principle

If preventative tactics to limit risk are too complicated to be included in environmental policies, the government's best bet has been to resort to precautionary politics, expecting and planning for the worst in various environmental scenarios. When examining risk, yet another aspect is this concept of the precautionary principle, decided upon at the Rio Declaration on Environment and Development in 1992 by the United Nations. The declaration proclaims that the precautionary principle should be the mechanism applied when making environmental decisions. Principle 15 states:

> In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation (United Nations Environmental Programme).

Therefore, in 1992 it was deemed by the United Nations that UN states were to follow the precautionary principle when the risks are uncertain in order to protect the environment from long-term damage and from countries experiencing economic losses. This was not the first or last time that the precautionary principle was supported on an international scale; the precautionary principle was also mentioned and suggested in the Montreal Protocol, Stockholm Convention on Persistent Organic Pollutants, and the Treaty on the European Union, to name a few (Randall 2011). However, as recent events show, the precautionary principle has not been applied to all, if any, of the practices with possibility of causing environmental damage. The United States has failed to include the

precautionary principle in many of its practices. The only well known example of its application by the United States is the protection of endangered species, which as Randall (2011) asserts, is not even always viewed as successful but rather too late and not taking into account risks (Randall 2011). Thus, policies must reassess the precautionary principle and apply it legislatively in order to protect the environment.

Unlike typical risk assessment and analysis, the precautionary principle does not require a definitive scientific rationale or consequence to allow for action hindering behaviors or practices that even have a possibility of deleterious effects on the environment, particularly if the preventative means are economically feasible. The precautionary principle actually results from recognition of our lack of scientific certainty and thus, preventative measures are implemented regardless. For example, if the precautionary principle had been applied to the Exxon Valdez oil spill outlined above, the double-hulled approach would have been ideal due to the fact that it would have provided additional security for the oil tankers. While it was possibly not an absolute necessity, double-hulled tankers would have facilitated additional protection for the environment. Furthermore, the precautionary principle stems from the concept "look before you leap," and can be viewed as common sense, whereas risk assessment is not due to its complexity (Randall 2011). As shown through the environmental issue report from the European Environmental Agency with the central theme of "late lesson from early warnings," we have already seen what can happen when precautions are not taken. Therefore, there must be a shift in the United States as well as globally in the way in which we approach decisions with environmental repercussions (Harremoës and European Environment Agency 2001). The argument for the precautionary principle will only be amplified as

global warming continues to gain attention. A shift will need to occur in order to protect the environment for future generations.

A comparison can be drawn between current risk assessment and a more precautionary approach with the addition of cultural elements and the way in which they alter society's perception of the environment and the effects that humans are having on it, usually belittling them (Whiteside 2006). Whiteside (2006) illustrates the notion that Americans value nature and the wildness of it, yet their obsession with gas-guzzling vehicles inhibits their ability to comprehend that their actions result in increased global warming and other harmful effects on the environment. This reveals society's difficulty in correctly assessing and evaluating risk (Whiteside 2006). Rather, the precautionary principle should be applied in order to have more of an impact on individuals' decisions. They need to actively partake in these choices because they then may feel as if they are more directly involved and affected (Whiteside 2006). The principle argues for a more meaningful relationship between humanity and nature and would result in a paradigm shift from our current treatment of the environment while maintaining a functioning economy, a challenging but achievable task (Cameron and Abouchar 1991). Overall, the economy actually benefits from applying the precautionary principle due to the fact that preventative measures are almost always more cost effective than the amount of money needed long-term for remediating environmental disasters (Harremoës and European Environment Agency 2001). Society has ignored a great many of these issues for far too long and has taken steps to solve some already existent problems, for example through the Clean Air and Water Acts. Applying the precautionary principle, however, would

limit the problems and plan for their correction in a shorter time line, thus resulting in more protection of the environment overall (Randall 2011).

Additionally, when the risk is not immediate or directly impacting the human race, policy makers as well as individuals within society find it more difficult to place a high value on the limitation of risks. For example, when risk is directly applied to oil spills, loss of jobs and monetary gains are not the primary aspect that individuals assess; however, an oil spill can damage an entire society as demonstrated through the Exxon Valdez oil spill. Dr. Riki Ott provides a detailed account of Cordova, Alaska in her book Not One Drop, which fully illustrates both the short-term and long-term detrimental effects that an oil spill can have on the environment and also the society. Cordova relied on fisheries for its economic benefits, yet with the Prince William Sound being contaminated as a result of an oil spill, the basis of its society was destroyed. Such consequences demonstrate that risks are extremely multifaceted; certain risks have primary results, such as the destruction of the surrounding environment. Yet the risk of the economy and general society that relies on the environment is important and may be difficult to include in environmental policies. This is where the need for the application of the precautionary principle comes into play.

Where Do We Go From Here?

Thus, risk assessment is vital when various projects with possible negative effects on the environment are being planned or executed. These are partially addressed through environmental impact statements; however, the way in which risk needs to be assessed must be either precautionary or include environmental policies that must plan for failures. A number of forms of risk analysis have been created in an attempt to take into account

more of the factors that need to be considered. Scientists and other risk analysts will be able to continue to modify the ways in which they determine risk for years to come, yet it is not likely that there will ever be an absolute determination of risk due to the fact that there are so many unpredictable factors such as human error, the changing nature of the environment, and the possibilities of technological failure. Risks will always exist, and if every action that had a certain amount of risk was not taken, society would not be able to properly function. Therefore, in order for the environment to be able to be protected for future generations as well as from having negative effects on current societies, the approach that policy makers must take has to be more preventative rather than only reactive to the environmental disasters that will inevitably happen. Perrow (1984) argues that accidents are in essence going to happen, and thus in order to function with high-risk technologies, such as the technology used for the extraction of oil, especially in areas where oil extraction is more difficult by nature, society must accept the problems and plan accordingly in order to avoid detrimental effects to the environment (Perrow 1984).

In conclusion, risks to the environment will only continue to increase and it is extremely unlikely that there will be an overarching policy that will adequately assess and prevent risks in all practices that impact the environment. The risks are too complicated and difficult to be assessed due to all of the factors that need to be taken into account as well as the varying opinions between society and the government in addition to the public and the experts. Therefore, the answer to the question of risk assessment may be the further and stricter application of the precautionary principle. Due to the nature of society, oil spills will occur; however, the spills should not continue for eighty-six days like the *Deepwater Horizon* oil spill. Rather, precautions should be taken in

order to sufficiently deal with the disasters that are inevitable within society. Thus, when looking ahead to current issues like hydraulic fracturing, the precautionary principle must be applied if the fracturing is to occur, or else the government and society are setting themselves up for disaster that may be widespread and cause irreversible damage to the water systems throughout the country.

Chapter 2: Case Study of the Exxon Valdez Oil Spill

Introduction

As Charles Perrow (1984) stated, accidents happen and occur naturally within society, especially one relying on technology (Perrow, 1984). But where does one draw the line between an accident, the lack of proper risk assessment, and human error? The first case study of the Exxon Valdez Oil Spill explores the events that unfolded in the Prince William Sound in hopes to better understand what went wrong and how precautions were not taken to avoid the incident. Did the negative impacts on the environment, economy, and society occur because precautions were not taken, or was it merely an inevitable result of the oil extraction occurring in Alaska that lacked proper risk assessment prior to beginning to drill?

On March 24, 1989 not long after midnight, the Exxon Valdez tanker ran into the Bligh Reef in Alaska's Prince William Sound and released 242,000 barrels (10,100,000 gallons) of crude oil into the water (Townsend, Heneman, & Center for Marine Conservation, 1989). The initial spill would eventually have an immensely negative impact on the surrounding environment, economy, and society and would be known for almost twenty years as the worst oil spill in the United States. Not long after the spill, as a result of an unfortunately timed storm, there would be a 1,300 square-mile oil slick and approximately 100,000 dead animals (Adubato 2008). Could this terrible environmental disaster have been avoided? Most likely not, as local marine biologist Riki Ott stated prior to the *Exxon Valdez* spill, "We are playing Russian roulette here. It's not a matter of 'if.' It's just a matter of when we get the big one," demonstrating the poor practices occurring in the area (Davidson 1990, 9). But even if a spill were inevitably going to

occur, why were there not additional, or any, precautions taken in order to help respond to such a disaster and protect the environment?

Events Leading Up To The Spill

The spill was likely to occur due to the fact that policies were put in place that not only allowed for risky practices, but also further encouraged them. Art Davidson gives a thorough account of the Exxon Valdez oil spill through his informative book In the Wake of the Exxon Valdez: the Devastating Impact of the Alaska oil spill. He states that approximately 10 billion barrels of oil were initially discovered in Alaska's North Slope in the year 1968 (Davidson 1990). This discovery directly resulted in the construction of the Trans-Alaskan Pipeline, which was designed to transport the oil. Many knew that the pipeline would result the alteration of the environment and also acknowledged the possibly of disaster, but both the state and national government believed the economic gains outweighed the environmental risks. Local fisherman, who saw the pipeline as a threat to their lifestyle, made efforts to fight its construction. However, Congress approved the pipeline after being pressured by oil companies (the association Alyeska was formed) to do so, with the condition that the oil companies would keep the safety of the environment as one of their main priorities (Davidson 1990). Construction on the pipeline began in December 1973 and oil began flowing through the pipeline in 1977 (Davidson 1990).

Legislatively, the Environmental Policy Act of 1969 was implemented in order to review environmental, social, and economic impacts of various actions, yet it did not require the most sound and environmentally friendly choice to be made (Davidson 1990). The act only required choices to be assessed, not selected. Problems began to arise as a

result of the ignored risk that came with both the drilling for oil and pipeline construction. Consequently, the policies and responsibilities surrounding drilling became skewed. Divides were apparent between both the state and national governments and with the oil companies as to who was responsible for oil spills and other problems concerning the extraction of the natural resource. If the minor oil spills were not warning signs enough, a larger oil spill occurred by the tanker the *Thompson Pass* two months earlier (Davidson 1990). Not only did the *Thompson Pass* spill demonstrate the possibility for oil spills to occur, but also served to demonstrate how the "responsible" party Alyeska would respond. Accidents were clearly apparent and happening continually after the discovery of oil. Although Alyeska was required to have an extensive response plan, it was clear that they did not. The EPA had reviewed Alyeska's oil spill response plan and notified the Coast Guard that the "EPA is not confident that Alyeska is prepared to efficiently respond to a major spill event" (Townsend, Heneman, and Center for Marine Conservation 1989, 15). The citizens of Alaska, particularly the fisherman relied on the Prince William Sound for their way of life and individuals, who appreciated the Sound for its natural beauty, began to worry. And sadly, their worst fears would soon become a harsh reality.

The Spill

The National Steel and Shipbuilding Company of San Diego, California built the *Exxon Valdez* in 1986. At the time, the company was unaware that its tanker would cause one of the worst oil spills in the history of the United States (Townsend, Heneman, and Center for Marine Conservation 1989). Not long after midnight on March 24, 1989, the *Exxon Valdez* struck the Bligh Reef, where the reef pierced the approximately inch thick

steel single hull and cut open eight of the eleven cargo holds on the tanker (Ott 2008). A calculated 115,000 barrels of oil, 4.1 million gallons, had been released from the tanker into the Prince William Sound from the initial collision (Ott 2008). Chaos then ensued. The Coast Guard who was supposed to be assisting in monitoring the ship was then contacted; however because of outdated technology, the monitoring of the location of the ship was insufficient. By three o'clock in the morning, at least 138,000 barrels had already been released and 20,000 were being discharged into the Sound every hour, a scene described by DEC member Dan Lawn as "a boiling caldron" (Davidson 1990). The legally responsible party Alyeska had stated in their contingency plans "that a vessel with containment boom and skimmers would arrive at the scene of a spill in no more than five and a half hours," a time period that had been exceeded (Davidson 1990, 28).

It was apparent that the response to the oil spill was lacking within the first few hours, but questions soon began to rise concerning why the *Exxon Valdez* tanker crashed into the Bligh Reef. Was it an accident? Davidson references the fact that attention began to be placed on Captain Joseph Hazelwood, a talented captain but one who was known to have struggled with an alcohol problem. The Captain had been sighted that evening smelling of alcohol. During a later investigation, Davidson mentions that it was calculated that Captain Hazelwood's blood alcohol content was higher than the legal limit for operating a ship and it was found that he was piloting the *Exxon Valdez* tanker with an invalid license (Davidson 1990).

Although it was clear that Hazelwood had to be at some fault for the accident, it was a matter that needed to be dealt with later because the immediate repercussions of the spill took precedent. However, pressing issues concerning who was truly responsible for

remediation of the area only resulted in continual oil spillage into the Prince William Sound. The continued release caused irreversible damage, but arguments concerning who was at fault wasted valuable time. Was it the state government's job to clean up the spill, Exxon, or Alyeska? The Commissioner of the Department of Environmental Conservation (DEC) Dennis Kelso continued to assume that Alyeska was responsible for responding to the spill, as the contingency plan stated, "Alyeska will maintain full responsibility and control in the even of an oil spill unless a government agency specifically notifies Alyeska that they have assumed responsibility and control" (Davidson 1990, 33). Because Kelso did not declare the government agency to be responsible, Alyeska's remained accountable to address the spill. This confusion was only the beginning of the uncertainty and doubt surrounding the moral, legal, and actual responsibilities (Davidson 1990).

Meanwhile, the oil continued to disperse. Although Alyeska eventually had began to implement part of its response plan, it was inadequate and was not delivered in a timely manner. Riki Ott's novel later referenced a Alaska Department of Environmental Conservation (ADEC) report that stated:

> 'Oil spill response is most effective when oil is on the water, rather than stranded on shorelines. The faster responders act, the better chance they have. The effectiveness of most on-the-water techniques drops substantially as the oil weathers, emulsifies, and large slicks break up' (ADEC 1993, 49) (Ott 2005, 11-13).

The question of how to clean up the oil, a matter that should have been thoroughly examined in the recovery and response plan, was unanswerable and vital time was quickly allotting. Dispersants had been a key part of the plan, but now seemed to have the possibility of causing more harm than good. Testing of various dispersants was

occurring; however, such tests should have been done prior to the event as part of the response plan. Then, the ocean literally caught on fire because of the dispersants and "response to the spill was becoming paralyzed by indecision, a struggle over authority, and vastly different and conflicting expectations as to which measures would work" (Davidson 1990, 45). To make matters worse, the weather took a turn for the worst and a spring blizzard hit the Prince William Sound.

The oil had spread somewhat before the storm, but once the blizzard hit the Bligh Reef area, the situation worsened tenfold. Oil diffused down the Kenai and Aleutian Peninsulas, upwards towards the Cook Inlet, through to the Gulf of Alaska, and surrounded the Kodiak Island resulting in 1,300 miles of coastline and 10,000 miles of seas becoming contaminated (Biel 2001). In an area known for its beauty and vast biodiversity, the storm hitting was one of the worst possibilities that could have occurred. Various types of birds, sea otters, harbor seals, sea lions, fur seals, killer, humpback, and gray whales, river otters, and minks were all in danger because of the destruction of their habitats (Townsend, Heneman, and Center for Marine Conservation 1989). Furthermore, commercial fisheries could be even more adversely impacted, which would result in the destruction of the ecosystem and could forever alter the lives of the people who relied on the fisheries for their way of life. Immense amounts of remediation required if the majority of the species had a fighting chance of surviving, yet the uncertainty of responsibility only caused increased the potential for damage beyond repair.

The Response and Aftermath: Confused and Distraught

The response to the *Exxon Valdez* spill was a direct representation of the disconnect between Exxon, Alyeska, the Alaskan DEC, the Alaskan State government,

the United States Coast Guard and the United States government. The inadequate required contingency plan may have been the greatest flaw during the spill and Alyeska seemed to be the entity to blame. Time and time again over a thirteen-year period, it was suggested and required by the Alaskan government and DEC that the Alyeska comply with several different conditions concerning a clean up plan in the event of an oil spill (Davidson 1990). However, various levels of government were also partially at fault. How was it possible that government regulations allowed Alyeska to not have a sufficient plan in place? Environmental attorney Patti Saunders believed that the DEC was intimated by the oil companies and lacked the strength to stand up to Alyeska and Exxon. Saunders stated, "The upper management in DEC was told everything that was wrong. They were told by citizens. They were told by fisherman. They were told by environmental groups. […] People at the DEC knew just how bad that contingency plan was. And they signed off on it anyway" (Davidson 1990, 92-93). The Alaskan DEC also did not inspect the equipment that was to be used in the event of an oil spill which played a role in the confusion in distinguishing who was responsible if a spill was to occur: was it Exxon or Alyeska? (Michalowski and Kramer 2006). Exxon and Alyeska did have contingency plans in place if a smaller oil spill were to take place. The lines then became blurred when a spill of such magnitude occurred, and the DEC failed to make the distinction of who was responsible for cleaning up the huge spill (Michalowski and Kramer 2006).

It was clear that Alyeska was not the only entity to blame. The oil companies were able to manipulate the government agencies, resulting in the lack of a definite contingency plan and sealing the fate of the environment if a spill were to occur. By

approving of the Trans-Alaskan Pipeline, the United States government was tacitly assuming environmental risks that they could not appreciate. The drive for domestic oil blinded both federal and state officials from the potential problems that would follow the construction and implementation of a pipeline and the Alaskan state government was at the will of the oil companies. Although they received an increase in revenue because of the oil, the money was not being properly allocated. This resulted in a lack of funding for important programs concerning environmental protection, such as the DEC (Michalowski and Kramer 2006). Funding continued to be an issue on a national scale as shown through the lack of funds that were required by the Hazardous Substance Superfund. The lack of funds directly culminated in the decision of the on duty Coast Guard Admiral Paul Yost to not federalize the spill. Yost stated:

> We are looking at a $100 million-$200 million [a day] spill. We are looking at a corporate giant who has been a good corporate citizen in their response so far, willing to open their checkbook, put no limits on it. I would be very reluctant to federalize this spill with four million dollars in my pockets when I know that we are spending over $100 million a day - by 'we,' Exxon is (Michalowski and Kramer 2006, 162).

Additionally, the local United States Coast Guard failed in setting appropriate regulations for tankers under Title II of the Ports and Waterways Safety Act of 1972, Public Law 92-340. The law stated, "The Coast Guard had the authority to require that tankers be constructed to certain specifications that would increase safety and prevent or minimize harm to the environment," yet there were no specific guidelines concerning the specifications (Michalowski and Kramer 2006, 158).

In terms of the spill and the need for immediate response, the problems were centered on the lack of responsibility and carrying out the proper actions needed to minimize the spill. Almost all of the entities involved made abhorrent mistakes

concerning the way in which they approached the spill. Lack of proper funding and extensive planning as well as ignorance of all of the environmental risks involved led to the most detrimental oil spill of its time. The negative impacts could be seen directly after the initial cracking of the single hulled tanker, but the ramifications of the spill only increased as time elapsed and the oil reached the shore. Effects on the ecosystems were already evident and all parties involved were embarking on an uphill battle to save an environment in dire need of help. After the storm hit, immediate clean up was no longer possible. There was no a quick fix for 1,300 miles of coastline and 10,000 miles of waters that were contaminated and scientists suggested that it would take approximately ten years for the Prince William Sound to be even relatively back to normal (Adubato 2008).

The Effects and Long-Term Impacts

The *Exxon Valdez* oil spill had detrimental impacts on all aspects of life in the Prince William Sound and the surrounding areas. Socially, environmentally, and economically, the Sound had a great deal of damages, some being immediate and others unknown until studies conducted several decades later. A quote stated by Chief Walter Meganack accurately sums up the events that unfolded in the Prince William Sound:

> The excitement of the seasons had just begun, and then, we heard the news, oil in the water, lots of oil killing lots of water. It is too shocking to understand. Never in the millennium of our tradition have we thought it possible for the water to die, but it's true (Biel 2001, 277).

The lives of the citizens living in the surrounding areas of the Prince William Sound were drastically changed. Economically, many of the communities relied on the fisheries for their income and overall livelihood. Suicide rates increased because people did not know how to react to such a horrible event after their businesses and their environment were destroyed. An area once known for its beauty was now covered with black oil. Animal

populations suffered resulting in a preliminary causality list of upwards of "300,000 birds, 3,500 sea otters, 300 harbor seals, 15 killer whales, and an unknown number of young fish" (Biel 2001, 384). The statistics only worsened as time elapsed, raising a question that the majority of citizens were asking, what is going to be done about this?

Environmentally, ecosystems were rapidly being destroyed by the presence of the oil. The manner in which oil was being cleaned up was only worsening the situation. The techniques that were utilized, such as various chemicals and hot pressurized water, were leading to the elimination of necessary microorganisms in the water that would be vital in ecosystem recovery (Biel 2001). In a published journal by Page Spencer, she illustrates her utter horror with the state of the ecosystems being impacted by the spill. Page states, "Not just the death of individual animals, plants, plankton, and lifestyles; but the total changes in the energy flow thought the system. The dynamic flow of energy, nutrients and life is altered, blocked" (Spencer 1990, 29). While the battle of responsibility of clean-up continued on, the oil proceeded to spread to Green, Naked, and Knight Islands and with the spring migration of birds in the area impending, scientists tried unsuccessfully to scare the birds away from the area (Davidson 1990). Knowledgeable bird enthusiast and Prince William Sound expert Kelly Weaverling was hired by a bird rescue center and described the setting as grim. He declared, "There was oil all over the place. Dying animals were floating around. Dead animals. Just the worst" (Davidson 1990, 136). Birds would fly down to the oil go under, demonstrating the difficulty of the clean-up as well as saving the animals that continually encountered the oil. Additional problems arose after the birds were cleaned because they could not released back into the wild because of the threat of becoming covered in oil again.

At this point, the oil was even altering the tides because of its thick nature and the pure volume of oil surrounding the area. Like the bird populations, sea otters were also hit extremely hard by the oil spill, with many dying within the first few days. As a consequence of their fur, the sea otters acted as sponges; because they often float on the surface of the water, they were forced to travel to the shore where they would then freeze and then need to return to the oiled water (Davidson 1990). Unlike birds, little was known about the effects on sea otters by oil spills and past assessment plans of their populations were flawed and inconsistent (Townsend, Heneman, and Center for Marine Conservation 1989). Additionally, there was limited space to keep the otters as Weaverling stated, "They had no place to receive the otters. They were just stacking them up in cages and kennels. Boxes of otters lined the hallways" (Davidson 1990, 154). The treatment of the sea otters only further illustrated the lack of planning for disaster and assessing risks that accompanied drilling for and transporting oil. There was no finite plan for remediating an oil spill and the Fish and Wildlife Service was in full denial of the emergency that was at hand. The community was forced to come together and volunteers ended up playing a major role in the survival of many of the species impacted by the oil spill.

In addition to the impact on the wildlife in the area, the shorelines were also hit hard by the oil, resulting in additional confusion about clean up plans and who the responsible parties were to administer them. Exxon delegated the majority of the clean up to a private contractor, VECO, who had worked for the oil companies in Alaska for a number of years and had a history of fighting environmental regulations (Davidson 1990). In addition, VECO had not dealt with a spill of this magnitude and at a loss of

what to do and how they were to approach so much oil. There was an additional disconnect between Exxon and VECO that frustrated the community members and a detachment from Exxon and EPA regulations in regards to how to clean up the shorelines (Davidson 1990). The fear was in choosing the correct approach to both clean up with shore and allow the ecosystems to eventually recover without incurring too much damage from chemicals involved in remediation. When it came to the coastlines, it was clear that the environment was severely negatively impacted by the oil but also further illustrated the lack of authority when time was of the essence.

The society at the Prince William Sound was turned upside down. In 1988, the fisheries industry was valued at more than $110 million and the year before ranked ninth in the country's ports for the value of catch (Townsend, Heneman, and Center for Marine Conservation 1989). Monetarily, the town of Cordova and the state of Alaska greatly relied on the fisheries for their economy and fair amounts of the population were fisherman, relying on the fisheries for their livelihoods. While the lawsuits were ensuing, the fisherman were out of their jobs and forced to be a major part of the clean up. People began to experience emotional conflicts as a direct result of the economic losses caused by the oil spill. One study by Cohen (1997) found that "rates of mental health and alcohol counseling during the post-accident period in two local clinics were significantly higher tan those recorded for the pre-oil spill years" (Michalowski and Kramer 2006, 168). Additionally, the fishermen would not be satisfied by compensation from Exxon. Armin Koernig, who has been credited in saving the hatcheries in Cordova after the spill, stated:

> We're not just producing income. We're producing food, supporting a lifestyle. And we're proud of it. A check from Exxon won't work. It will hurt our hearts. We produce about one pound of seafood for every American. We are not

> interested in having Exxon just pay us off on a straight dollar-and-cent loss (Davidson 1990, 103-104).

The fishing society was in turmoil. Furthermore, the clean up was extremely risky and dangerous and fell to the hands of the fisherman because they needed to somehow have a source of income. Both the chemicals involved in clean up and the oil itself had negative health effects on those working with them. Headaches, rashes, and red eyes as well as lung and respiratory problems began to plague those working to clean up the spill. The symptoms collectively became known as the "'Valdez Crud,' a term used by the VECO doctors to describe a variety of spill-related symptoms, including headache, sore throat, sinus infection, and cough" (Ott 2005, 33). Worker safety considerations were virtually nonexistent and issues such as lack of proper training and medical attention seemed to only make matters worse. Overall, the society surrounding the *Exxon Valdez* oil spill not only lost their jobs and had their lives turned upside down, but also were negatively impacted even further when the risky task of cleaning up the spill fell to them.

Economically, the oil supplied by the Trans-Alaskan Pipeline was producing a great deal of income for the area. Having domestic oil was important to the country and demonstrated independence from OPEC nations; however, the drilling for domestic oil clearly came with a price. After the spill, Exxon was involved in numerous lawsuits and although local citizens did not just want money thrown at the situation, money was needed if the environment had a fighting chance of surviving. The funds allocated by Exxon from out of court settlements from lawsuits from smaller entities, "about $130 million. The final settlement that resulted from the state and federal charges consisted of three parts: the criminal agreement, criminal restitution, and the civil agreement" (Michalowski and Kramer 200, 168). Additionally, the criminal plea agreement was $150

million, $100 million for the criminal restitution agreement, and the civil settlement was $900 million over the next ten years (Michalowski and Kramer 2006). Overall, Exxon was forced to pay for the actions that unfolded in the *Exxon Valdez* oil spill, but money would not change the damage that was done and the damage can still apparent today through long-term studies.

Regardless of the clean up that had initially occurred, the amount of oil spilled in March 1989 had very long-term repercussions. Even in the current day, there are still remnants of oil surrounding the Prince William Sound. Since the *Exxon Valdez* spill occurred twenty years ago, there are ample studies of the long-term impacts of the spill on the environment, the economy, and the society. A case study by Christopher L. Dyer entitled "Punctuated Entropy as Culture-Induced Change" explores the long-term implications of the oil spill, framing it as a population growth problem and a result of the continued reliance on resources and the technologies that extract them. Because of the stress on natural resources, companies and agencies "enter into new and often precarious states with their environments that increase risk and leave many vulnerable to disaster" (Hoffman and Oliver-Smith 2002, 159). For example, Alyeska and the government came into the area and established the Trans-Alaskan pipeline, an infrastructure that the local communities did not want. The pipeline threatened their wellbeing and led the people to feel out of control regarding the degradation of their environment and their everyday way of life. When examining the spill, the concept of punctuated entropy can be applied and is defined as "a permanent decline in the adaptive flexibility of a human cultural system to the environment brought on by the cumulative impact of periodic disaster events" (Hoffman and Oliver-Smith 2002, 164). The concept demonstrates the inability for

human systems to recover after an initial disaster because that disaster has long-term secondary impacts. For instance, the destruction of the fisheries, the money and time needed for clean up and the declines of the economy were ongoing and altered the adaptive flexibility of the society. Because nearly all aspects of life were in turmoil, the society itself had long-term repercussions of getting itself back on its feet.

Not only was the environment negatively impacted for years post-spill, but the society, too, needed ample time to recover in order to function again. The conclusions of Dyer's case study were as follows: "(1) the natural resource base has been compromised, (2) external assistance has been misdirected or withheld, (3) the post disaster political ecology of the region has hindered restoration of traditional patterns of human-environment interaction" (Hoffman and Oliver-Smith 2002, 184). As a result of the cultural chaos that ensued, the long-term ongoing legal battles, and the struggle to return to life before the spill, it can be seen how easily disasters can impact societies if risk is not properly taken into account. The *Exxon Valdez* oil spill provides a prime example of the complexity in determining and assessing risk. When constructing the pipeline, it is difficult to consider the fishermen that would lose their jobs as a result of the oil killing off parts of the fisheries if a spill were to occur. Therefore, policies must be in place to better plan and react to the inevitable risks and disasters in society until a shift away from natural resources occurs.

<u>What Can We Learn? Applying the Precautionary Principle</u>

With the continued rise in the human population comes an increasingly undeniable strain on the resources needed to support the population. As a result, the human race will "enter to new and often precarious states with their environments that

increase risk and leave many vulnerable to disaster" (Hoffman and Oliver-Smith 2002, 159). The persistent and growing need for domestic oil production led to the construction of the Trans-Alaskan Pipeline, setting the area up for disaster. When Exxon spokesman Don Cornett was questioned if the oil was worth the risk to the environment, his response was, "This [pipeline] has been a phenomenal success. It's hell to say that today, but this has been one of the greatest successes and one of the largest projects we've ever been involved with. But I would reconsider it…yeah, I would reconsider it" (Davidson 1990, 99-100). Although contingency plans were supposedly in place, the uncertainty regarding who was responsible for the spill wasted valuable time and only led to increased amounts of oil being released into the Prince William Sound. The persistent need and dependence on oil is what truly resulted in the spill and its magnitude. A combination of ignorance of risk and the lack of strict regulations in order for more oil to be extracted led to the eventual demise of the Prince William Sound.

Had a more precautionary approach been taken, such as ensuring that an adequate response plan was in place or choosing to use a double-hulled tanker, it is possible that the negative effects of the "inevitable" oil spill could have been lessened. If an adequate contingency plan had been administered in a proper time period, the spill might have been contained within the first three days, thus avoiding the spreading caused by the storm entirely. In essence, part of the risk was in the lack of policy that forced a single entity to take responsibility when an oil spill occurred. Because of the lack of authority, minimal enforcement of existing policies, and human error piloting mistakes, the aftermath of the spill was amplified.

Overall, the *Exxon Valdez* oil spill demonstrated the worst possible approach to disaster. As a direct result of the *Exxon Valdez* oil spill, legislation was enacted in attempt to change the way in which oil spills were handled through policy. The Oil Pollution Act (OPA) of 1990 was imposed "to establish limitations on liability for damages resulting from oil pollution, to establish a fund for the payment of compensation for such damages, and for other purposes" as well as "integrated contingency plans to enable a systematic approach to response" and a "30-fold increase in the trust fund for oil spill response" (Michalowski and Kramer 2006, 169). OPA was a necessary step in attempting to protect the environment from oil spills by requiring responsible parties to fund clean up, but it was not enough. Problems persisted throughout the oil industry, demonstrating the continued inability for systems to change and the recurrent obsession with oil. The implications on the future were unknown, but the way in which the *Exxon Valdez* spill was handled set the stage for twenty years later, when the largest oil spill in history occurred. What did we not learn from the *Exxon Valdez* oil spill twenty years earlier? How was it possible for the *Deepwater Horizon* oil spill to occur? And, is it impossible for policy to prevent disasters?

Chapter 3: Case Study of the BP *Deepwater Horizon* Oil Spill

Introduction

From the time of *Exxon Valdez* oil spill until the *Deepwater Horizon* oil spill, approximately twenty years time had elapsed. During those years, the population of the United States continued to grow, resulting in a continual increase in the need for oil and other natural resources to power various aspects of everyday lives of the citizens. The negative impacts of the *Exxon Valdez* spill were still eminent; however, a necessary environmental policy was enacted as a direct result of the disaster that ensued in the Prince William Sound. In 1990, the Oil Pollution Act was passed into law in order "to establish limitations on liability for damages resulting from oil pollution, to establish a fund for the payment of compensation for such damages, and for other purposes" (Environmental Protection Agency 2000). The act also required oil companies to take responsibility for any spills that occurred on their rigs as well as to plan for worst case discharge scenarios. Worst case discharge was defined in the act as "(A) in the case of a vessel, a discharge in adverse weather conditions of its entire cargo; and (B) in the case of a facility, the largest foreseeable discharge in adverse weather conditions" (Environmental Protection Agency 2000). Additionally, the Oil Spill Liability Trust Fund was created and funded for by the oil companies to secure a reserve of funds in case an oil spill occurred that it was unsure whom the responsible party was. As a result, much more extensive contingency plans were needed for possible oil spills, yet oil spills still occurred throughout the country. In any case when pressure is being put on a natural resource, there is the possibility for disaster, especially when the pressure is wrongfully increased for economic benefits. If a rig is continually pressured to extract more oil, there

is the inevitable possibility of disaster. This case study examines the events and aftermath of April 20, 2010 in the Gulf of Mexico, illustrating that minimal lessons were learned from *Exxon Valdez*. The BP *Deepwater Horizon* oil spill demonstrated to the entire country the severity of our oil addiction, the continued risk that comes along with the need for natural resources, and the inability of the country to change its ways when a practice is already in place. Although the *Deepwater Horizon* and Valdez spills happened for entirely different reasons, the two can be used together in order to demonstrate the detrimental effects of oil spills and lack of efficient planning when the continual push for oil is ranked higher than safety. Overall, the "Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling" Report to the President from the National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling is the most extensive reference concerning the spill and serves as a key resource in the case study of the event.

Events Leading Up To The Spill

Our country's oil dependency had only increased in the twenty years between the two major oil spills in the United States history coupled with the continual pressure to extract oil domestically. We had begun to drill for oil in increasingly precarious places such as in deepwater locations. In March 1938, offshore drilling in the Gulf of Mexico occurred for the first time when a freestanding structure was installed in the Creole field (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). Risks were apparent even in the early construction in the Creole field, where hurricanes destroyed newly installed rigs. Nevertheless, as time went on and the technology improved, the offshore industry was solidified as a key form of oil extraction, event though the risks continued to exist (United States National Commission

on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). Oil extraction from deepwater drilling continued to occur and was relatively successful. In the late 1950's, however, the rate of oil exploration had begun to decrease and some thought that offshore surveying had reached its maximum. Additional technological advancements resulted in the continued pressure to keep drilling, but the strains of offshore extraction were beginning to become recognized. Accidents increased, explosive blowouts occurred, and the lack of regulations allowed for prolonged unfavorable practices. Such events directly resulted in initial legislative measures being enacted in order to keep the deepwater drilling industry relatively under control. In 1953, the Outer Continental Shelf Lands Act was passed and the Department of the Interior began to play a key role in setting regulations (United States. National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). Demand for domestic oil only increased as the overall demand for oil expanded. Coupled closely with the economy and requiring reliance on other countries, oil was a very difficult entity to manage. Research and development grew throughout time and oil was discovered at high levels in deepwater locations, yet problems remained with the complications and difficulties of extracting the oil from such precarious positions that possessed very high levels of inherent risk.

In the late 1990's, BP (British Petroleum) commenced activity in the Gulf of Mexico in an attempt to become a central player in the deepwater oil industry. BP was extremely successful in discovering oil fields deep beneath the ocean and continued to dive into deeper and deeper water to locate and extract as much oil as possible. "From 2001 to 2004, operators found 11 major fields beneath water 7,000 feet deep or more," however, the deeper the wells were, the more risks surfaced (United States. National

Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011, 47). Additionally, BP was exceptionally aggressive in their simultaneous development of multiple fields, a number of which were adversely impacted by hurricanes, costing significant amounts of money for BP. As the decade came to a close, BP continued to advance in the industry:

> In September 2009, Transocean's *Deepwater Horizon* semisubmersible made a historic discovery for BP at the company's Tiber prospect in the Keathley Canyon. Drilling in 4,000 feet of water and to a world-record total depth of 35,055 feet, *Deepwater Horizon* tapped in a pool of crude estimated to contain 4 to 6 billion barrels of oil equivalent, one of the largest U.S. discoveries (United States. National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011, 51).

Although it was a very substantial supply, certain dangers came with the extraction of the oil such as salt- and tar-zone formations that are compacted and result in difficultly of oil flow through pipelines, making the Gulf of Mexico a more complex arena for oil extraction (United States. National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). Furthermore, the increasing depth complicated the drilling: risers need to be lengthened, blow out prevention becomes increasing difficult, and methane hydrates are problematic (United States. National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). However, regardless of all of the concerns, Transocean's *Deepwater Horizon* began drilling for oil in the Gulf of Mexico.

In the days leading up to the explosion at the Macando well in the Gulf of Mexico, many workers felt as if the rig was being pushed too hard and that there was an imminent possibility for disaster. Transocean's tool pusher Jason Anderson had "told his father that BP was pushing the rig operators to speed up the drilling" as well as "gave his

wife, Shelley, instructions about things to do if anything were to 'happen to him,'" demonstrating his concern and discomfort with his work on the *Deepwater Horizon* (Safina 2011, 14). Although OPA made great strides in dealing with oil spills, there was a continued lack of protection from the oil spills initial occurrence. The Mineral Management Service (MMS) did a poor job of establishing regulations and there was difficulty balancing the economic forces that drove the drilling with the protection the environment. Environmental regulations were relatively weak, the juxtaposition between energy independence and environmental protection served to be problematic, and leasing was complicated because the Gulf of Mexico was exempt from various laws that limited leases. All were factors that had influences on the belittling of the risks involved with drilling in the Gulf of Mexico. "The rigs expose their crews to the risks of injury or death if not properly operated and maintained—risks compounded for operations conducted in progressively deeper waters, ever father from shore" (United States. National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011, 68). And while OPA was enacted in 1990, it did not address any of the regulatory problems and only added responsibilities to the already weak MMS. Overall, it was an environment that was ill disposed to controllable extraction of oil in which "environmental safeguards eroded" (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). There was no NEPA review and the oil spill response plans that were required by OPA were far from adequate. All of these negatives served as signs for the eventual disaster that ensued with the Macondo well, where "the only question had become not whether an accident would happen, but when" (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011, 85).

The Spill

On April 20, 2010 the Macondo well blew out due to "a number of separate risk factors, oversights, and outright mistakes combined to overwhelm the safeguards meant to prevent such an event from happening" (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011, 90). The well had been in a high-risk position and the uncontrolled discharge of hydrocarbons directly resulted in the blow out. Additionally, the well had been originally used as an exploratory well and then was turned into a production well, a practice that was somewhat out of the ordinary (Safina 2011). The Macondo well had been experiencing problems a few weeks prior to when the blow out on April 9th a fracture occurred, altering the mud circulation that was necessary for the proper functioning of the well. The process of remediating the problem was extremely extensive, particularly the cementing process. Cementing is relatively uncertain by nature especially in a deepwater setting because it is very difficult to determine the success of the job at such a great depth (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). On the day of the spill, the cement repair had been completed and deemed to be successful. The crew had began conducting positive and negative pressure tests to fully assess the functionality of the well. While conducting the negative pressure test, levels seemed to be a tad off and there began to be signs of a possible "kick," an action that results from inconsistent pressure levels.

At sometime between 9:40 and 9:43, the kick had occurred and the crewmembers sprang into action, yet their efforts were too late. The first explosion occurred at 9:49, claiming victims on the drill floor because the blowout preventer was unable to contain

the well (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). Because of the damage from the first explosion, the rig was unable to disconnect, resulting many other problems that only caused the situation to worsen. BP ignored the risks that corresponded with deepwater drilling, but regardless of such risks, the blowout that occurred on April 20th was preventable (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). The inherent risks were not probably addressed through efficient regulatory oversight and thus, "it is now clear that both industry and government need to reassess and change business practices to minimize the risks of such drilling" (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011, 127). The spill then went on for eighty-six days because of its deepwater location. It was extremely difficult to find a way to successfully cap the well and many looked on as the oil continued to spew out of the well, destroying the surrounding environment and threatening the entirety of the Gulf of Mexico.

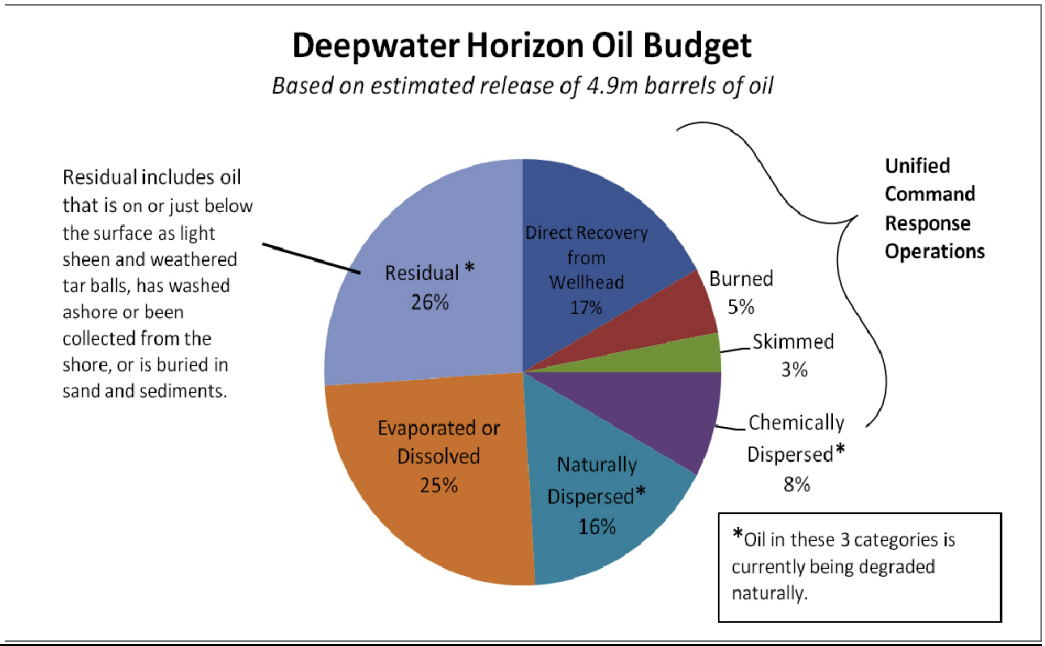
The Response and Aftermath Effects: Eighty-Six Days of Spillage

Because the oil had continued to spill out for almost three months, the response was continuous and the effects of the spill proceeded to worsen as the amounts of oil being released into the Gulf increased. The early response mostly focused on search and rescue and the establishment of command posts, but the news only became aggravated as time elapsed. BP's response plan left a lot to be desired, and although they had the funds to supply the recovery, an adequate plan is still an essential aspect of the overall remediation of the area. OPA required funding for spill response, but it was not required through the act for those responsible to research spill response techniques. In fact, even

though there were advances in the technology required for skimming and booms, the materials used in both the *Exxon Valdez* oil spill and the *Deepwater Horizon* oil spill were extremely similar (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). Additionally, the effects of the *Deepwater Horizon* spill were very similar to those from the *Exxon Valdez*. Environmentally, the fisheries and the health of the Gulf and the species inhabiting it were the primary concerns. Economically, OPA required BP to fund the clean up, which cost millions of dollars in addition to the detrimental effects that the spill had on the economy of the surrounding area that relied on the Gulf for their business. Socially, the people of the coastal states were devastated. For example, Dean Blanchard had made his entire living off of the sea, running Louisiana's largest shrimp business called Seafood Inc. and as a result of the spill, Blanchard lost $15 million in 50 days (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). Blanchard is just one example of the thousands of people adversely affected by the spill whether it was economically or physically, through the negative health effects brought on by the presence of oil on the coast. Additionally, when the disaster is manmade, society takes a longer time to recover due to the fact that the damages that were inflicted upon them were the result of human action and therefore they need full compensation for their losses (United States. Congress. Senate Committee on the Judiciary 2011). Overall, the *Deepwater Horizon* spill negatively impacted every aspect of society and took the lives of eleven crewmembers, a risk that should have been taken into account.

The measures that were taken throughout the eighty-six days varied; however, the critical point was that there needed to be a more definite and acceptable recovery plan

from BP to ensure a better clean up. Even though OPA required BP to take financial responsibility for the spill, there was still discretion on which party was making the decisions on the actions that needed to be taken to stop the oil from spilling and clean up existing oil. The Mineral Management Service was essential in dealing with the deepwater well, yet fixing the continual leakage of oil from the well required help from additional parties. Additionally, as the oil had started to spread to the coast, citizens wanted to get involved in an effort to save their environment and way of life. Decisions were also made about dispersant usage, which like with the *Exxon Valdez*, proved to be complicated in terms of protecting the health of the water while decontaminating it. Various approaches were taken in an attempt to stop the spill including the failed efforts of a containment dome and the top kill and junk shot as well as conflicts over the boom and berms (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011). In mid-July, the well was finally capped as a result of a collective effort from various agencies and companies and extensive research to ensure success. "For the first time in 87 days, no oil flowed into the Gulf of Mexico," and now efforts could be entirely focused on cleaning up and restoring the environment in the Gulf (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011, 165).



(Lubchenc 2010).

Overall, 4.9 billion barrels of oil, 19 times as much as *Exxon Valdez*, were released in the Gulf of Mexico total, as the well was officially determined dead on September 19th, 152 days following the blowout (United States National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling 2011) and (Repanich 2010). The above pie graph created by NOAA illustrates the breakdown of what happened to the 4.9 million barrels of oil in an attempt to demonstrate the success achieved by the overall clean up; however, one fourth of the oil is still remains to be residual, showing that there is significant room for improvement.

<u>On the Ground Perspective: Interview with U.S. Coast Guard Rear Admiral Mary Landry</u>

Mary Landry was the Rear Admiral for the Coast Guard and also served as Commander of the Eighth Coast Guard District and Commander of Task Force 189.8, all stationed in New Orleans during the *Deepwater Horizon* oil spill on April 20, 2010. The Rear Admiral was in charge of 26 states and a great deal of the coastline and played a

vital role throughout the oil spill. Through conducting the Human Research Study approved interview with Mary Landry, I hoped to gain a first-hand account of the spill from an individual who had a deeper knowledge of the spill and had been onsite while the entire event was occurring. I then aimed to apply her perspective to a greater analysis of the spill in order to gain a well-rounded assessment because Mary viewed Coast Guard's approach to the spill as a success, a position that adds a complexity to the case study. When I began to interview Mary, she disregarded the questions that I prepared and just began speaking at a rapid pace, demonstrating her knowledge and excitement concerning the spill.

At first, she discussed the past and the events that led up to the eventual *Deepwater Horizon* oil spill. Mary started off with the March 1967 Torrey Canyon spill off the coast of England, stating that there was no national contingency plan in place, showing that there was no law in place to protect the environment and prepare for possible disasters. She then moved onto the *Exxon Valdez* oil spill, where a contingency plan was in place, yet there was no one to properly administer it and use it, so disaster ensued. However, as a direct result of the *Exxon Valdez* oil spill, the Oil Pollution Act (OPA) of 1990 was passed. The Act would forever alter the way in which drilling for oil and spills were dealt with. A national contingency plan was now required when any work was being done with oil, which would be handled by the Coast Guard in coastal and offshore areas and the EPA for inland spills. In addition, a national incident management system (NIMS) was put in place, which gave a structure for the state, local, and responsible parties to work together so that what occurred with the *Exxon Valdez* would not transpire again. Another crucial aspect of OPA was the Worst Case Doctrine, where it

was required of the responsible party to prepare for the worst type of discharge of oil in the case of a disaster. Finally, there needed to be an FOC (Full Operational Capability) on the scene that had final say for the spill and made significant decisions.

Over the twenty year period between the *Exxon Valdez* oil spill and the *Deepwater Horizon* oil spill, a great deal changed throughout the country. A series of events took place in the country that altered the way in which various agencies interacted with each other. Mary Landry called it "an evolution of crisis response." First, after OPA was put in place, smaller oil spills were under control and had better response times. Because of the requirements put in place, there was annual stimulation of the fund and a great deal of preparedness by the companies involved in drilling for oil. There was a lesser impact on the environment and lesser amounts of oil being spilt. Although spills continued to happen, there was a better response to the spills because the laws required it and the companies needed to exercise the contingency plans that were mandatory. Oil spill response was rigorous, which resulted further protection for the environment, even though spills continued to happen. Then, the terrorist attacks on the World Trade Center and the Pentagon occurred on September 11th, 2001 and NIMS, developed as a result of the *Exxon Valdez* oil spill and was part of OPA, was applied to all hazards. Because of the terrorist attacks, the Department of Homeland Security was created as well as a National Response Plan. Agencies worked together to address domestic problems, yet the national contingency plan was never integrated. The National Response Plan was not good for Katrina and resulted in the need for the National Response Framework, so that the two together could plan for all disaster (pandemic, health and human services, natural disasters).

With all of the other issues occurring throughout the country, oil companies and those involved in the drilling were resting on their laurels and were complacent with the progress they had made since the *Exxon Valdez*. No one had looked at the potential for a spill in the Gulf and the high level of technology left the Coast Guard with seemingly little to worry about. The United States was the best at the time, with fewer spills and spill response companies being better on the private sector. Minimal response was always ready, yet no one thought it could happen. Resources from the federal and state budgets were applied what were considered to be the biggest risks, which at the time were Katrina and other terrorist attacks. And yet, the spill still occurred resulting in the need for Mary Landry to go into action.

In being the District Manager, Mary was responsible for 4,000 people. Although sadly 11 people died, Mary was responsible for saving another 126 from the rig. After the blow out occurred, all of the parties involved were already meeting together. The state, federal, and private entities all were better at working together after 9/11, which was a key part of the evolution of crisis response in the country and what was lacking significantly during the *Exxon Valdez* spill. On the day of the spill, there was the potential for the entire vessel to set aflame and it was unsure if the safety device for the blow out preventer had worked. It was clear that there was a leak, but it was unclear where the leak was coming from. Fortunately, only very shortly after any word had come that something was wrong on the rig, the EPA, BP, and the Coast Guard, along with other agencies were already all together in New Orleans discussing collectively how to best manage the problem at hand, taking into account the Doctrine of Worst Case Discharge. They saw a small amount of oil, yet leaching through the Gulf of Mexico was natural. In addition, the

oil that was being extracted was a light crude and the surrounding environment, warmer water, had adapted to the natural seeps. The Gulf had the ability to recover more than the Prince William Sound because although the volume of oil was more than that of the *Exxon Valdez* spill, the water and climate were more resilient.

Mary Landry had to take charge of the situation since she was responsible for any offshore issues. She stood at the command post and had to respond to an oil spill worse than any other before. The rig was 5,000 feet under the sea and although the technology was very advanced, dealing with the leak was extremely difficult. Right after news of the blow out had spread, BP called every boom manufacturer and dispersant distributor in the world, since the Gulf had already been approved for dispersants. The response had a massive buildup from all of the various levels and the jurisdiction was split between the Coast Guard, who managed the vessel, and the Minerals Management Service, who dealt with the rig. Mary personally had various responsibilities that she needed to deal with right away. First, search and rescue was the number one priority. Saving the 126 people on the rig was a success, using life rafts and helicopters to rescue the people 26 miles offshore at the rig. Additionally, there was the marine causality investigation, which was dealt with by the marine report board and was deemed a civil case, although Mary had the administrative function to find out why it happened the way it did. Mary serves as an investigator, a rig inspector, and a pollution manager.

Secondly, the worst-case doctrine, which was born out of the *Exxon Valdez* disaster, led to the response being started from day 1. The way in which the spill was responded to attracted the participation of many different countries. In addressing the spill, a national approach was taken. 40,000 people worked in the response and over 20

billion dollars were spent as a result of OPA. Another aspect of OPA involvement was the nickel per barrel tax, which went into the trust fund in the case that if the responsible party was unknown, there were still funds to pay for the clean up of an oil spill in a timely manner. The tax, which was required by law, was imposed until the fund reached 1 billion dollars. After Hurricane Katrina, the fund was increased to eight cents a barrel, in order to achieve an ultimate goal of 2 billion dollars. This occurred because it was seen through all of the oil spills that resulted from Katrina how widespread such spills could be. Additionally, the majority of oil companies would have remediation companies on retainer to handle response to oil spills, so not only did they quickly take responsibility, but also had a company able to step in to ensure quick clean up. These events all occurred within the first days of the spill. Cabinet level secretaries came together and held the responsible party, BP, accountable. BP had the financial resources to pay for the response and BP took responsibility for their spill and gave the necessary funds, 20 billion dollars in all, which were separate from the trust fund. The money resulted in more of an environmental response than had ever been seen in this country. From the doctrine being born out of OPA as well as the jurisdictions set in stone, the response to the spill occurred in time for the Gulf to survive.

Mary Landry then began to discuss what could have been improved in the initial reaction to the spill as well as the clean up. Community involvement was difficult because although the community wanted to assist, many of the citizens did not have the proper training to participate in the clean up. There was a lack of exercises in teaching individuals how to clean up the oil, but because time was of the essence, there was no time to train the individuals that wanted to get involved. Overall, there were not enough

people in various different fields to make the response as effective as it could have been: there were learning curves within the response, they did not have enough people for day jobs, and NOAA did not have enough people. In addition, there was some confusion on the dispersants and the levels of initial versus long-term toxicity, but they used the best educated guesses as possible that were available at the time. BP pulled people from everywhere in the world in order to provide their best response possible. The ultimate job of the Coast Guard was to make sure that BP did the job right. They had on scene coordinators that ensured the companies that were doing the spill response for BP were doing an adequate job, especially because BP was funding the clean up. Additional money was processed through the trust fund. Within 30 days, the Coast Guard had put up 100 million dollars and BP had funded 900 million, but for one single event, the trust was limited to no more than 123 million dollars. Mary Landry then had to place an invoice to BP, pushing the limits of the laws and policies, but from an extraordinary effort behind the scenes, she was extremely successful in secure additional clean up funds.

The way in which the United States handled the BP *Deepwater Horizon* oil spill challenged every other country to do what the United States did in terms of oil spill response. Europe initially thought that OPA was fair too strict and required too much of oil companies and felt that it put the United States on an uneven playing field. International maritime regulations became difficult because the United States held its companies to higher, more rigorous standards that were extremely costly for the oil industries because of the need to pay more for response plans. Yet after oil spills occurred in Spain, Europe has begun to see the advantages of stricter, more expensive regulations in order to better protect the environment and actually desired such legislation. In the end,

the combination of NIMS doctrine, the Worst Case Doctrine, and OPA led to a well-organized effort for spill response. An ecosystem and an entire way of life could have been lost. There was a lot at stake, and individuals such as Mary Landry made sure to clarify that while certain things could have been done better, in retrospect the ecosystem had been saved and the Coast Guard had done its job. Mary, in closing, discussed the difficulties with applying risk standards and stated that risk will always coexist with offshore drilling. Success, then, comes from designing and implementing the proper systems to deal with the risks. She suggests pushing technology as a means to be a leader in the field, but cautions the complicated balance between adequate technology and safe guards, raising the ever present question of how can we continue to advance and develop with maintaining the health of the environment for future generations?

Mary ended the conversation by addressing the more current issues of hydraulic fracturing and the Keystone Pipeline, demonstrating that the Coast Guard is also involved in these aspects concerning environmental protection. Work is going on globally and nationally in order to attempt to enhance protection of the environment in various drilling locations, but differences between various nations approaches occasionally become a problem. Cuba is about to drill for oil, but if there were to be an emergency that the United States needed to respond to, they would not be able to help due to the political relationship between the two countries yet the U.S. would still be impacted, showing a conflict. Overall, the demand for energy exists and will continue to exist and even increase as the population continues to grow. We need a mix of energy sources, Mary says, a combination of oil, gas, wind, nuclear, and solar, in order to accomplish our energy goals in the context of the health of the environment. It is necessary to then apply

rigor in reviewing processes. Mary feels an obligation to make sure that there is some compliance with certain standards and some oversight in the various ways that companies extract resources for energy uses. These companies are not perfect and with the continued push for more technology, risks increase, causing the need to assess such risks. The difficulty then comes in "finding the sweet spot" between governing and holding back in areas that are too high a risk while remaining competitive and keeping the health of the environment in mind. The Coast Guard was involved in the Keystone pipeline as well as with wind farms and nuclear energy, demonstrating the competing interests that Mary has to deal with. She says it is a constant body of work balancing the interests in the current day and looking ahead to the future, and the work will only continue as time goes on.

Lessons Learned: Examining Congressional Reports and Applying the Precautionary Principle

It is extremely interesting to compare Mary Landry's account of the *Deepwater Horizon* oil spill to the Congressional Reports and Hearings concerning the spill. The comparison demonstrates the disconnection between authority members and the way in which the legislation is applied to the case at hand. For the *Deepwater Horizon* oil spill, some environmental policies were put in place in attempt to protect the Gulf, but at other times, the Gulf was excluded and the policies were not actually applied. This notion comes from the obsession with oil, particularly in the domestic form, and the economic gains that come with the industry. Because the regulations were put in place, the question then becomes why were the regulations not followed to the degree that would have properly assessed risk? Is the risk just too difficult to assess in the first place? And if

assessing the risk is too difficult, why are the entities involved extracting oil when the risks are so high?

In some ways, the environmental policies implemented through OPA had a positive impact on the *Deepwater Horizon* oil spill due to the fact that it forced BP to pay for the spill and allowed there to be adequate funds for clean up. For *Exxon Valdez*, 8,000 of the fisherman that had been promised compensation died before they could receive any of the money that they deserved, which conversely illustrates the success of OPA in forcing BP to take responsibility and pay $20 billion immediately (United States Congress Senate Committee on the Judiciary 2011). However, although the BP contingency plan was in place, it was not sufficient enough to deal with a spill of such magnitude. If the precautionary principle had been applied to the scenario, deepwater drilling may not have even been an option. It is understandable that the need for domestic oil has an immense impact on the decision to drill in such deepwater; however, the risks increase tenfold when drilling in such a precarious location. Accidents happen. Yet when the accident is avoidable by not partaking in the action in the first place, the risks are no longer an issue because they do not exist. All of the statistics and various jurisdictions can be examined a thousand times over, but what it comes down to is the notion that deepwater drilling for oil has proven to be too risky. Although the *Deepwater Horizon* oil spill was one event, the possibility for disaster is clearly imminent. Various measures had been put in place in order to deal with a "worst-case scenario" and according to Mary Landry; the efforts of those involved in cleaning up the spill were successful. However, the problem lies in the fact that the spill was able to happen in the first place and that precautions that could have been taken were not. In the Senator from West Virginia John

D. Rockefeller IV's opening statement at the hearing on Response Efforts to the Gulf Coast Oil Spill, he stated:

> Unfortunately, it seems to me that drilling has always come first, and that safety and disaster planning only came second […] The Administration's proposal to increase energy exploration in-on the Outer Continental Shelf will likely lead to more offshore drilling units in the future, and that does concern me. And if they happen once every 10 years – it takes 10, 15, 20 years to recover from the last one, so – you know, saying it doesn't happen very often doesn't carry a lot of water with me – if it happens at all, that's what matters (United States Congress Senate Committee on Commerce, Science, and Transportation 2011, 1-2).

Oil spills matter and it is clear that our practices need to be cleaned up if they are going to continue at their current level of production. The *Deepwater Horizon* spill proves that it will be extremely difficult to prevent disasters through policies due to the complexity of risk. The United States can either stop attempting to drill for oil, which is not realistic due to the fact that or country heavily relies on it for the majority of our everyday actions, or to implement stricter restrictions prior to and throughout the extraction periods in order to ensure the safety of the environment and those involved in working with the wells. Until our nation reduces its reliance on oil, precautions must be taken in the extraction of natural resources to secure the health of their surrounding environments for future generations.

Making the Shift to Hydraulic Fracturing

Although hydraulic fracturing has become a staple in some states for energy production from natural gas, New York State has not fully determined the parameters for the Marcellus Shale. As demonstrated through examples of oil extraction, the extraction of natural resources can have detrimental effects on the environment and thus the surrounding economy and society if risks are not taken into account. However, the fear of hydraulic fracturing is groundwater contamination, which could directly put the health of

the individuals in the nearby areas at risk. New York State has the opportunity to prevent these risks by choosing not to use hydraulic fracturing as a widespread practice; however, this is unlikely due to the pressure for jobs as well as additional forms of energy resources. Thus, when examining hydraulic fracturing, the precautionary principle must be applied and extreme measures taken prior to beginning widespread extraction of natural gas if the environment has a chance of surviving.

Chapter 4: Case Study of Hydraulic Fracturing in New York State

Introduction

As the world is approaching peak oil and global warming is becoming increasingly more threatening, the United States has begun to extensively explore additional forms of energy. Due to the vast amount domestically available and the fact that its emissions are lower than coal, natural gas has become the newest natural resource of choice for the United States. With the various shale reserves extending over more than 20 states, including the Marcellus, Barnett, and Haynesville reserves, the opportunity for extracting natural gas domestically and utilizing another fossil fuel for energy usages is certainly apparent (Natural Gas Supply Association 2011). However, the problem not only lies in the fact that natural gas is still a nonrenewable resource but also in the manner in which the natural gas is extricated. In order to extract the resource from the tightly packed shale, techniques such as horizontal drilling and hydraulic fracturing are used. These practices not only require additional non-renewable resources but also produce a great deal of wastewater.

The issue of hydraulic fracturing is particularly prominent in New York State, the location of the massive shale reserve, the Marcellus. This case study examines the advantages and disadvantages of hydraulic fracturing in an attempt to come to a conclusion on the question of its widespread practice in New York State by applying lessons learned from the oil spills. Ongoing studies are being conducted in attempt to fully assess the risk to drinking water; yet economic pressures as well as the need to shift away from dirtier sources of energy may result in premature production. As seen through the oil spills that have plagued the United States since the beginning of drilling, with the

extraction of natural resources comes the possibility for disaster. Oil spills such as the *Exxon Valdez* and *Deepwater Horizon* have proven the extensive environmental, economic, and social impacts of disasters that ensue as a result of a combination of the inability to adequately assess risk and the lack of addressing the possibility of disaster in policies and regulations. With continued population growth, our country is shifting to more precarious locations and forms of energy extraction in attempt to establish and maintain our future energy sources. Until renewable energy technology becomes more advanced and efficient, small steps such as using cleaner natural gas may have to be utilized in order to relatively maintain the health of the environment.

In a perfect world, the precautionary principle would be applied to the extreme and hydraulic fracturing would simply not occur in New York State because some of the risks that scientists are studying have already become realized in other locations throughout the United States. Although New York has a chance to become a leader in refuting hydraulic fracturing and focusing on renewables, widespread hydraulic fracturing will most likely take place in New York State because of the economic advantages that are coupled with its implementation. Therefore, the extensive policies and regulations must be enacted in order to even have a chance of protecting the environment from the possibilities of groundwater contamination and inherent risks to human health. Additionally, hydraulic fracturing must occur in moderation and under control with comprehensive continued testing as the drilling commences. Studies also must be fully completed of each of the areas in question for extensive hydraulic fracturing prior to beginning to drill. If such regulatory precautions are not taken, New York State is in essence signing the death notice of its aquifers and watersheds as well as

for the many citizens that would be adversely impacted by the contamination of drinking water. The damage could be irreversible and therefore it is of the upmost importance that precautionary measures and the best worst case scenario approach are applied in order to protect the environment for current and future generations.

What is Hydraulic Fracturing?

Very simply, the purpose of hydraulic fracturing is to extract natural gas from shale through pumping of highly pressurized liquids that are used to fracture the rock and release the composites of natural gas underneath the shale. Various substrates, such as sand, are used in order to "keep the fractures open, but the natural formation pressure will return most of the fluids to the surface, were they will be either recycled or treated and disposed" (Swartz 2011, 32). The fluids used in hydraulic fracturing are made up of:

> About 90% water, 9.5% proppant particles, and 0.5% chemical entities (the latter percentage is variable but is less than 1%). The additives have a number of purposes, including reducing friction (as the fluid is injected), biocide (to prevent bacterial growth), scale inhibition (to prevent mineral precipitation), corrosion inhibition, clay stabilization (to prevent swelling of expandable clay minerals), gelling agent (to support proppants), surfactant (to promote fracturing), and cleaners. Estimates of the actual chemicals utilized range as high as 2500 service company products containing 750 chemical compounds (Groat and Grimshaw 2012, 20).

Then, the wastewater that is created is held on site at the drilling pads. For some time, the chemicals that were present in the water were unknown. Initially, the practice of hydraulic fracturing began in the United States in 1947 in Grant County, Kansas and since the practice has had increasing applications for various forms of resource extraction (Environmental Protection Agency 2004). Until relatively recently, hydraulic fracturing was not a viable option for New York's portion of the Marcellus shale. However, according to the NYS Department of Environmental Conservation (DEC), the fracturing

technology has advanced to the point that New York's fragment of the 489 trillion cubic feet of natural gas can now be significantly extricated using this approach (New York State Department of Environmental Conservation 2012).

As stated on the DEC's website, geologists have known for some time about the natural gas resources available in the Marcellus, but due to the difficult nature of obtaining the resource, statewide extraction has not occurred. Now, however, scientists believe that advances in technology for gas wells coupled with the demands for natural gas in New York and the surrounding areas and the construction of the Millennium Pipeline have proven to be adequate reasons to begin widespread hydraulic fracturing and horizontal drilling (New York State Department of Environmental Conservation 2012). In order to access the natural gas, drilling is required in some locations as deep as 7,000 feet. Like with deepwater drilling for oil in the ocean, increasing the depth of drilling practices greatly increases the risks, demonstrating one of the possible dangers in New York State's hydraulic fracturing plans. Although improvements have been made to the technology and while there is an apparent increased demand for natural gas, it does not necessarily mean that hydraulic fracturing to collect natural gas is the right choice for New York's energy future. For example, the town of Dryden in Tompkins County, upstate New York has successfully prohibiting natural gas and oil companies from drilling within their town. (Bertrand 2012). A drilling company, Anschutz Exploration, sued based on the fact that they believed that only state laws could control the companies that came into various townships to drill; however, the Syracuse Branch of the State Supreme Court ruled in favor of the local zoning law (Bertrand 2012). Such a ruling significantly alters the way in which hydraulic fracturing can be addressed legislatively.

If towns can now individually prevent drilling companies from extracting natural gas from their land, there may be some conflict, yet also there is the possibility that the towns collectively can refuse hydraulic fracturing even if it is approved statewide.

In the current day, the comprehensive effects of the chemicals, which are an integral part of fracturing, are still being studied for their impacts on groundwater. A great deal of research has been conducted by various entities across the country, but the absolute risks and consequences of hydraulic fracturing itself are still extremely questionable. The United States Environmental Protection Agency has repeatedly studied hydraulic fracturing and is currently conducting yet another study that attempts to quantify the potential impacts of hydraulic fracturing on drinking water. The study will be completed in 2014 with the goal of having an extensive analysis of the true impacts of hydraulic fracturing on groundwater (Environmental Protection Agency 2012). The question then becomes what actions does the state take until the study is complete? Is the government willing to begin widespread practice of hydraulic fracturing prior to the release of the study? And if so, what are the consequences of beginning highly intensive drilling and how can we best prepare for possible disasters through regulations and environmental policies?

An Engineer's Viewpoint: Talk with Professor Ghaly

Professor Ghaly is an engineering professor at Union College and is a very knowledgeable source concerning the pressing issue of hydraulic fracturing in New York State. In speaking with Professor Ghaly, I knew that he was supportive of hydraulic fracturing because he viewed it purely on a scientific basis. By hearing his perspective on the topic, I wished to understand the advantages of hydraulic fracturing and the reasoning

behind his support of its practice. Our talk began with Professor Ghaly stating that nothing is ever totally good or totally bad, but we must ask the question of how much risk we are willing to accept when performing an action. Although he said there is no analogy directly between oil spills and hydraulic fracturing, both have to do with the extraction of a natural resource for energy production usage. Professor Ghaly suggested a very straightforward approach to hydraulic fracturing that would merely require taking samples out of the ground to measure chemical levels and determine if something is going wrong underneath the surface. Such practices, however, will need to come from policy provisions. The measurements needed demand additional workers to take the samples from all the different drills at all of the different well sites as well as the scientists to analyze the levels of chemicals consistently throughout time. Ghaly believes that measurements could continue until the level of pollution increases beyond the level of risk; however, the difficulty then lies in determining what are the appropriate levels of pollution and risk. He recommends that those decisions would have come from the collective wisdom of the community that would dictate the legislature, who has the power to grant permits.

And yet, with democracy comes ignorance about various issues, demonstrating the need for widespread education prior to decision-making. The legislature makes the decisions based on facts from the experts, but issues such as hydraulic fracturing do not have absolute yes or no answers. Various side effects that occur from hydraulic fracturing add to the complexity of the decision-making process. In addition, investors too have an impact because they are the groups allocating the funds for such practices and they also may have only a certain level of tolerance for the consideration of risk. Overall, the

decisions concerning risk are dependent on a set of parameters that are measureable and indicative of something that people will put up with. In the case of hydraulic fracturing, Ghaly believes that this set of parameters would come from the sampling of the soils. If the results from the tests are within the tolerance range and are at an adequate level of acceptable risk, Ghaly believes hydraulic fracturing should occur. However, the issue then becomes defining the tolerable limit and levels of risk that the state and various communities within it are willing to deal with as well as maintaining the testing and monitoring of the hydraulic fracturing drilling sites throughout the state.

The Advantages and the Risks: The Imbalance of the Two

Like with the majority of commodities, there are advantages and disadvantages to all actions required to secure them. The same concept applies to hydraulic fracturing in New York State. Possible advantages include economic stimulus for New York, an increase in jobs on hydraulic fracturing sites, and a source of cleaner energy that is domestically extracted. In New York State alone it is estimated that the development of natural gas could result in "more than $1.6 billion in annual economic impact, including more than $600 million in tax revenue and the creation of a thousand jobs" (Natural Gas Supply Association 2011). Drilling companies are also seemingly willing to pay for the hydraulic fracturing process, therefore making it easier for the government to approve because of the private sector nature of the industry. During a time of economic recession, implementing hydraulic fracturing in order to achieve economic gains in revenue and increasing jobs seems relatively favorable. Additionally, although natural gas is a nonrenewable resource, the emissions released are far less than those of coal and oil. By implementing natural gas as a more prominent energy source in New York State, little by

little the production of energy is becoming cleaner. Because the technology for renewable energies is not developed enough to be implemented as a major energy source, a shift to relatively cleaner energy may be New York State's best choice in combating climate change and global warming.

However, when economic advantages are the driving reasons behind decisions, the majority of the time the health of the environment falls to the wayside. When there is an opportunity for revenue, risk assessments become devalued and while they may be required, regulations are not always obeyed. At many times throughout the history of the United States, economic advantages have belittled the importance of protecting the environment as demonstrating in such events as the construction of the Trans-Alaskan Pipeline and the decision to implement deepwater drilling in the Gulf of Mexico. No matter how considerable the advantages of a given action are there are some unfavorable disadvantages and inherent risks that cannot be ignored when making the decision concerning hydraulic fracturing in New York State.

Although the advantages from hydraulic fracturing seem favorable, the risks are much more extensive and have the chance to bring about more economic losses than gains if a disastrous event were to occur requiring substantial clean up. Primarily, the chemicals actually used in hydraulic fracturing were unidentified for a considerable period of the history of hydraulic fracturing. Only since the beginning of February, drilling companies in the state of Texas are now required to report the chemicals as well as the amounts of water used in hydraulic fracturing for the public knowledge on a website called fracfocus.org (Galbraith 2012). The practice of hydraulic fracturing has been occurring in Texas for quite some time; however, the regulations and data collection

has been lacking even since drilling became widespread. Research scientist for the Bureau of Economic Geology at the University of Texas at Austin Dr. Jean-Philippe Nicot questions where the water used for hydraulic fracturing is coming from whether it be from aquifers or recycled water previously used for fracturing (Galbraith 2012). This brings about two of the most important risks that correspond with hydraulic fracturing: the vast amount of water needed in the practice of hydraulic fracturing and the resultant groundwater contamination. In addition to these two risks, other factors such as the continued usage of fossil fuels as part of the hydraulic fracturing process, natural gas still is not renewable and has emissions, and the complicated notion of all the parties involved in drilling and the governments' role all represent disadvantages that would result from utilizing this widespread practice.

Primarily, the amount of water needed for hydraulic fracturing is enormous. Millions of gallons of water must be used at the well production sites, and many times, the water being taken from the source is through groundwater wells from shallow aquifers or municipalities (Swartz 2011). Additionally, if the water is not taken from on site, it requires transportation, which uses more natural resources through the moving of water from various locations. The amount of water required vast now, but if that amount of water is contaminated and then returned to the system, it will need a substantial amount of time for the water table to recover from the contamination. Damage inflicted may then be irreversible, especially in relatively shallow aquifers.

If the practice of hydraulic fracturing is going to be widespread, it could eventually led to widespread water contamination, a problem that does not have a simple solution. With oil spills, the majority of the risks resulted in indirect impacts on society,

such as destruction of economic means through fisheries. In terms of hydraulic fracturing, if the risks are realized, they will directly impact human health. Safe drinking water is an entity that is essential to the population of our country. It is very easy to turn on the faucet and have clean water readily available to drink and use. However, if the very realistic possibility of groundwater contamination from both chemicals used in the process and wastewater being returned to the water system without proper treatment occurs, human health becomes an issue. In a report conducted by the Energy Institute at the University of Texas Austin references a previous report, which "indicates that from 2005 to 2009, some 95 products containing 13 different carcinogens were utilized in hydraulic fracturing. Four compounds – 2-BE (a surfactant), naphthalene, benzene, and acrylamide (or polyacrylamide) – were singled out in this report for special emphasis" (Groat and Grimshaw 2012, 20-21). These four compounds that were studied further in terms of groundwater contamination were found to be not incredibly harmful in small doses with the allowance of time for them to disperse at great depth. However, these chemicals are still being released into the ground and if hydraulic fracturing would become a more widespread practice, issues such as accumulation may result. The study continued to examine the migration of fluids to aquifers and determined that at areas with relatively shallow wells, the fluid does not migrate, yet in New York State the drilling would be much deeper, demonstrating a disconnect in research (Groat and Grimshaw 2012). Overall, the report studies hydraulic fracturing without any possible significant problems and determines that "the greatest potential for impacts from a shale gas well appears to be from failure of the well integrity, with leakage into an aquifer of fluids that flow upward in the annulus between the casing and the borehole" (Groat and Grimshaw

2012, 24). It is obvious that the technology behind hydraulic fracturing has advanced over time; however, because it occurs so close to drinking water, the risks are extremely higher because of the location of the wells and the chemicals that have the potential to be released into the aquifers if certain disasters would occur. Drilling for oil in deepwater locations has demonstrated what occurs in the event of a disaster in a precarious location. Hydraulic fracturing by nature is in an even more precarious location and the risks are much higher due to the chemicals involved and the general techniques of hydraulic fracturing, especially without proper monitoring.

Additionally, there are already examples of problems with hydraulic fracturing that demonstrate the realization of such risks. In states such as Pennsylvania, hydraulic fracturing has already had detrimental impacts on the environment. For example, in May 2011, a new study was released by Robert Jackson of Duke University revealing the occurrence of groundwater contamination in Pennsylvania as a result of hydraulic fracturing for natural gas in the Marcellus shale. Methane was found in 51 out of the 60 wells sampled and had been connected to the hydraulic fracturing because the methane was older when the levels of radioactive carbon were measured. It was determined that the methane had come from fossil natural gas that was released through the hydraulic fracturing (Biello 2011). Furthermore, the study found that within one kilometer of a natural gas well, concentrations of methane were 17 times higher and the danger of methane can clearly be seen through Jackson's statement, "'I saw a homeowner light his water on fire,' Jackson notes. 'The biggest risk is flammability and explosion'" (Biello 2011). Not only do the levels of methane impact drinking water, but also the contamination brings about the risks of property damage and death through possible

explosions of homes. Flaming water is unnatural and should serve as a red flag demonstrating the harm that is possible from the leakage of methane that coincides with hydraulic fracturing. Additionally, the leakage of methane from hydraulic fracturing contributes to greenhouse gas emissions at a higher concentration than the emissions from burning coal, further showing the possible harmful impacts from methane. As shown through the study conducted on the Marcellus shale in Pennsylvania, with hydraulic fracturing comes the possibility for eminent disaster. Some of the risks have already been realized with the same shale reserve that would be utilized in New York. What more do we need in order to prove that hydraulic fracturing in the Marcellus is not a good idea for New York State?

Lessons from Oil Spills: The Precautionary Principle and the Need for Regulations

As stated previously, in a perfect world, hydraulic fracturing would not be widespread in New York State's reserves of the Marcellus shale. The government has a chance to completely alter the country's view on hydraulic fracturing because New York is a leader amongst the United States. It is a good sign that New York is questioning hydraulic fracturing, which demonstrates the possibility for abstaining from the practice. New York has been one of the first states that has stopped and examined hydraulic fracturing extensively prior to beginning widespread practice. The hope is that New York State would come to the conclusion that hydraulic fracturing would bring more harm than good to New York due to the immense risks that accompany its practice. In addition, New York has the chance to apply the precautionary principle at the best point in time: before the practice becomes widespread and the citizens of the state suffer the consequences of the imminent disaster that would ensue. By basic definition, the

precautionary principle is “the precept that an action should not be taken if the consequences are uncertain and potentially dangerous” (Dictionary.com 2012). As studies have shown, hydraulic fracturing is potentially dangerous in numerous aspects of life. In addition, with studies continually ongoing, some of the consequences have not yet been realized, and therefore, the correct decision concerning hydraulic fracturing would be to simply not do it. New York State has the chance to say no to a practice that has been proven to be problematic. Unlike with the extraction of oil, which has proven to result in disasters when it is pushed too hard especially in precarious locations, hydraulic fracturing is not yet widespread in New York and the state can stop itself before it shoots itself in the foot like what has occurred throughout the country time and time again concerning oil.

Additionally, at this point in time the New York State Department of Environmental Conservation (DEC) does not have the adequate resources needed in order to properly monitor widespread hydraulic fracturing. In an article in the Times Union newspaper by Ronald Fraser entitled “A hydraulic fracturing crisis awaits,” it is made clear that the DEC does not have the human resources needed in order to adequately assess the conditions of the groundwater if widespread fracturing were to occur. The article states that, “The DEC has a nine-person staff to oversee more than 13,000 active vertical oil and gas wells in New York. That’s one inspector for every 1,400 wells” (Fraser 2012, A9). Gresham’s law is also referenced in the article, which declares that “when an organization (DEC) is charged with both short-term, highly programmed, revenue producing tasks and long term, unprogrammed, and costly tasks, the short term task will take precedent” (Fraser 2012, A9). This applies to hydraulic fracturing because

the permits will be easily issued whereas securing and training the manpower necessary to sufficiently monitor all of the wells throughout the state is a difficult if not impossible task.

The final lesson that has become apparent from oil spills is the great impact that disasters can have on the surrounding societies. As shown through *Exxon Valdez* and *Deepwater Horizon*, the oil spilt had severe negative impacts on the economy, society, and environment in both the Prince William Sound and the Gulf of Mexico. Furthermore, if disaster would ensue as a result of fracturing, not only would the same negative impacts materialize, but because any sort of disaster would directly impact the drinking water, human health would be adversely affected directly. This concern is portrayed through the ongoing outlash and protests from citizens of the New York as well as throughout the country. Individuals have made the realization that if leaks would occur, not only could their drinking water become polluted but also the methane released threatens their lives. Because the results of disaster could mean life or death, the issue becomes much more serious for the general population. Additionally, if rampant hydraulic fracturing is allowed, the government is in essence asking people to risk their lives for a resource that is not even renewable. Although natural gas is cleaner than coal and oil, there are still emissions as a result of its usage for energy purposes when the state's focus should be moving towards renewable energy sources rather than beginning widespread production of a nonrenewable, emission releasing resource that the extraction of which is extremely risky.

Even with all of the known possible risks clearly outlined as well as the risks that have still yet to be uncovered, there is a strong possibility that New York State will be

driven by its economic goals and approve of widespread hydraulic fracturing. During a time of such economic recession and when unemployment is a pressing issue, historically the economy drives decisions, rather than does the importance of protecting the environment. This notion derives from the fact that the current economy cannot adequately place a monetary value on protecting the environment. Due to the fact that leaving the reserves in the Marcellus undisturbed would not bring any revenue to the state, it is not the preferred action. Drilling and extracting the resource that could bring $1.6 billion annual economic income to New York State becomes the selling point for legislators and the need to protect the environment gets pushed to the wayside. However, if the government approves widespread hydraulic fracturing, the emphasis then shifts to focusing on the risks that although not significant enough to stop hydraulic fracturing from occurring, still very readily exist. Therefore, the fate of the environment is left to the policymakers who need to ensure that the risks evident in all of the studies are addressed aggressively through precautionary policies in order to protect New York State's water supply and overall environment.

Conclusion: Policy Suggestions

In conclusion, if hydraulic fracturing is inevitably going to happen, the ideal way to attempt to protect the environment is through extremely strict regulatory policies. Primarily, legislation needs to be enacted limiting the amounts of hydraulic fracturing wells that can be implemented throughout the state. Just because the resources are available, it does not mean that they must be exhausted as quickly as possible. More importantly, thorough environmental impact analyses must be required prior to any means of constructing a well pad or even testing areas for natural gas reserves. In

addition to such initial tests, sampling must be continual during the process in order to ensure that groundwater contamination or leaking of methane is not occurring. The companies drilling for the natural gas resources should be obligated to fund the both the sampling of the surrounding geology and the testing of the samples. In essence, this will force them to realize the hidden costs of their actions, which are a result of altering the natural environment for their own profit, and require economic investments in order to fund these actions. The DEC also must hire more employees to monitor and regulate the wells because the current ratio of wells to workers is highly inefficient. In addition, the DEC should give out far less permits than intended to further limit immediate intensive drilling. There also must be numerous regulations concerning wastewater and the focus on reusing water already utilized for hydraulic fracturing again in the same practice in order to minimize the amount of water coming out of aquifers and becoming contaminated. Drilling should not take place even relatively close to any of the major watersheds because if disaster were to occur, the possible damage could be catastrophic. Finally, companies must educate the townships that they are drilling of concerning the risks so that the individual townships have a say in their fate, as shown through Tompkins County.

As helpful as all of these policy suggestions may be, the fact of the matter is hydraulic fracturing is an extremely risky practice. Environmental policies have been in place for decades in order to protect the environment in areas that resource extraction is occurring. However, oil spills have occurred even with such policies in place because the risks are too great to quantify and include in overarching environmental policies. Yes, it is possible to plan for the "worst possible scenario," but such an approach is difficult to

predict. In certain aspects, the *Deepwater Horizon* spill was more successful than the *Exxon Valdez* due to the Oil Pollution Act; however, both of the spills still occurred because of the need for domestic oil and the inability to realize the risks in its extraction. It is possible that in order to implement policies that truly protect the environment in terms of hydraulic fracturing that there may have to be the equivalent of an *Exxon Valdez* event to pass legislation such as OPA to more successfully address the economic aspect of disaster like for *Deepwater Horizon*. Overall, the best environmental policy would be to ban hydraulic fracturing in New York State because the risks to the health of the environment are far greater than those of oil extraction. New York has an opportunity to realize the risks prior to beginning widespread practice of hydraulic fracturing and set the tone for the rest of the country, focusing on renewable energy instead.

Chapter 5: Conclusion

Until the United States has an overarching change in mindset concerning the way in which the country consumes natural resources and the degree to which we consume them, environmental risks from resource extraction will be extremely prominent within our society. Risks correspond with action and assessing such risks is nearly impossible. The easiest way to avoid such risks is to simply not partake in the action. Environmental policies are a vital part of legislation, however if they are not detailed or strict enough, they are useless. We are beginning to learn, but at the point that our environment is at, we can no longer be satisfied with mediocre protection. The environment must become a priority and the economy must work with protecting the environment rather than against it. Money should be allocated towards renewable energy and then the market for that type and thrive both economically and environmentally. There needs to be a balance in order to be successful and knowledge plays a critical role as well as the education of future generations. I was taught at a young age that Exxon was unacceptable and we would not get our gas from there because they did a substandard job of cleaning up an oil spill in Alaska. Today, I am doing my senior thesis on the subject matter and still remember the views instilled in me as a young child, demonstrating the importance of America's youth in the future of energy and resource extraction and protecting the environment. We are protecting the environment for the future generations that will continue to protect it; they need something to even have a chance to protect. Our country needs a mindset switch away from our addiction of natural resources and New York State has a chance of paving the way for a change by refusing to partake in widespread hydraulic fracturing as a result of the risks, known and unknown. In saying no to hydraulic fracturing, New York is

taking a step in the right direction and may give our country a fighting chance in the continual battle for energy.

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