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***Lesson not learned: Deepwater Horizon research and media coverage
exposes gaps in knowledge and risky protocol within the oil industry***

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Interdisciplinary Studies

Concentration: Marine Science, Biology and Journalism

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Lesson not learned: Deepwater Horizon research and media coverage exposes gaps in knowledge and risky protocol within the oil industry

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Abstract

An insatiable thirst for oil has led poorly coordinated, risk-prone megasystems deeper into the ocean in search of new oil reserves. Profit-driven agendas at the corporate level have a top-down effect within these megasystems. Cost-cutting and risk-downplaying leaves the field employees unprepared to handle emergencies. A series of costly mistakes led to the 2010 BP Deepwater Horizon oil spill, which caused extensive damage to an already fragile ecosystem in the Gulf of Mexico. The wealth and political influence of the oil industry overpowers lax regulatory agencies and legislation – even though media and research has exposed frustrating parallels between the Deepwater Horizon spill and previous spills in terms of causation and impaired response capabilities. The need to improve environmental review and legislation is apparent. Effective emergency response requires better coordination of collaborative assessment and restoration efforts, and honest, objective communication between all parties involved. Restoration should take the entire ecosystem and its surrounding communities into consideration. Accurate monetary valuations of nature are impossible, and the best method of preservation is prevention.

Introduction

Energy demands have created a worldwide dependency on oil. Over three billion gallons are used daily worldwide, 700 million of which are used by the United States (Congressional Digest 2010a). Widespread use and continuous transportation of oil make it nearly inevitable that some spillage will occur. Spills in rivers, bays and ocean basins are typically caused by accidents involving tankers, barges, pipelines, refineries and storage facilities, usually during transportation (Congressional Digest 2010a). High likelihood of spills has led to a demand for prevention and management strategies, which are prepared using extensive research on the causes of spills, and the resources and personnel necessary to clean them.

Oil spills can be caused by mistakes or carelessness, faulty or damaged equipment, natural disasters, or deliberate acts by terrorists, countries at war, vandals or illegal dumpers (Congressional Digest 2010a). In any case, spills of any size typically initiate a response from local, State and Federal government agencies, and numerous volunteer organizations. In the United States, the U.S. Coast Guard or the Environmental

Protection Agency (EPA) usually take charge of response, and organizations such as National Oceanic and Atmospheric Administration (NOAA) and the Fish and Wildlife Service are contacted for help and information (Congressional Digest 2010a). Severe penalties against companies at fault and safety regulations on vessel design have been implemented as prevention strategies (Congressional Digest 2010a).

Oil floats on salt water and freshwater; rarely, very heavy oil sinks in freshwater. A thin layer of oil, referred to as an oil slick, is formed as the floating oil spreads rapidly across water surfaces. As oil spreads further by wind and water currents, the oil thins to a sheen, which often looks like a rainbow (Congressional Digest 2010a). Surface oil on water, marshes and beaches is visible, which helps facilitate removal. Detection of oil in deeper waters or in sediments requires highly specialized instruments, due to physical and chemical changes of the oil that take place after it sinks (Unified Area Command 2010). Oil can become sticky and coalesce with particles that make it heavy enough to sink, most often in nearshore areas where loose sand is abundant. When not combined with heavy particles, dispersed subsurface oil droplets typically degrade and diffuse to concentrations that are too low for removal (Restore the Gulf 2010a 2010).

Location and timing have a huge impact on immediate effects of an oil spill on local flora and fauna. Seasonal and daily variations in distribution and behavior determine whether an organism is present at the time of a spill. A species' vulnerability to spilled oil also determines the degree of impact of a spill (Restore the Gulf 2010a 2010). Contact with spilled oil can be especially harmful to marine birds and mammals, fish, and shellfish, especially organisms in early developmental phases. Oil reduces the insulating property of fur on mammals, and the water-repelling ability of bird feathers (Congressional Digest 2010a). Without insulating mechanisms, exposure to cold can lead to hypothermia and/or death, and ingestion of the oil (e.g., from birds preening to clean their feathers) can cause illness or death. Marine mammals that surface to breathe can experience eye or skin irritation from the oil, and/or breathe in harmful fumes. Fur-bearing marine mammals and feathered sea birds are more vulnerable to the impacts of oil than mammals that have blubber for insulation. Oil sinking in the water column can hurt or kill fish and plankton, especially drifters and weak swimmers (Restore the Gulf 2010a 2010). Wind and water currents push oil onshore, leaving gobs of oil along the

beach, and smothering burrowed organisms (NOAA 2006). The toxicity and concentration of the spill determines the extent of harm that organisms experience, but even non-lethal exposure to oil can hinder reproduction, alter development, impair feeding mechanisms, and decrease immune responses of marine life (Congressional Digest 2010b).

The best clean-up method to use after an oil spill depends on weather conditions, amount of oil spilled, the distance from the shore, proximity and size of local human populations, and habitat types of native animals. Methods include booms, floating barriers to stop oil leaks by collecting oil, and “skimmer” boats that skim spilled oil from the surface. Extra-large sponges known as sorbents absorb oil directly, and chemical dispersants or biological agents can be used to break down oil into its chemical constituents. Freshly spilled oil floating on the water surface can be burned (in-situ burning) and oil on beaches can be washed off with low- or high-pressure hoses, or vacuumed by vacuum trucks (Congressional Digest 2010a).

NOAA’s Office of Response and Restoration is the primary government agency overseeing restoration efforts. The agency acts to protect coastal and marine resources by moderating threats, reducing harm, and restoring ecological function of environments damaged by oil spills and other disasters. NOAA incorporates real-time data and regular briefings from satellites, aircrafts, ships, and buoys as well as physical samples in emergency response and long-term restoration plans (NOAA 2010). In-depth studies and analyses of effects on organisms at small and large scales are used comprehensively. Data include information on salinity, temperature, and pressure in affected water columns, as well as sediment samples and fluorometer readings.

The Natural Resource Damage Assessment (NRDA) follows the initial EPA and Coast Guard cleanup, and involves a three-step evaluation to determine impacts of hazardous-substance release such as oil spills. A Preliminary Assessment uses time-sensitive data, scientific literature and mathematical models to determine environmental injury, and its severity. Injury Assessment and Restoration Planning quantifies environmental damage and identifies possible restoration projects using economic and scientific studies. After evaluation, the Restoration Phase implements these projects and monitors their progress and effectiveness (NOAA 2010).

The Deepwater BP Oil Spill – caused by an explosion and subsequent fire of a deepwater drilling platform – leaked roughly 700,000 gallons of oil into the Gulf of Mexico, and killed 11 men (Congressional Digest 2010a). In the years prior to the Deepwater disaster, legislation regarding oil spills has been demanded and implemented to further develop prevention and management strategies. These acts focus on industry liability, and require safeguard and response plans.

After the BP Deepwater Horizon spill, NOAA invited a public response for restoration ideas and projects. Additionally, after analysis and quality check, pre-assessment scientific data from the NRDA was posted publicly. Pre-assessment data are rarely released, but high public interest in this spill, and the need to consider all potential restoration methods, encouraged the public release. Restoration planning should be a comprehensive collaboration of government agencies, volunteer organizations, and the general public (NOAA 2010).

The practices and regulation of oil-drilling companies are often subjects of concern for researchers, environmental enthusiasts, the media, and general public. The general and scientific public has questioned gaps in knowledge of the hazards of exposure to crude oil. Conflicting research on oil drilling practices and spill effects is often released or reported in the media, and at times misrepresented. Perhaps most importantly, risky, cost-cutting and image building practices are widespread throughout the oil industry. The consistency and completeness of information provided by the government, drilling companies, scientific research, and media coverage of oil spills, all of which influence legislation, has yet to be determined.

Investigation

To examine the consistency of data released regarding the Deepwater Horizon spill, I compared information collected from scientific papers, government information databases, press releases, and news articles regarding oil spill assessment and restoration. These sources focus primarily on the Deepwater Horizon incident, and also include studies of previous spills and media. The complexity of interactions within an ecosystem and consequent impacts of spilled oil, combined with strong economic, political and social influences make restoration a long and controversial process. Government

agencies, oil companies, scientific research, and media coverage are all interconnected, but have conflicting interests in matters of energy demand. First, a comprehensive overview of the effects, responses, and preconditions of the Deepwater spill is given, followed by a discussion of gaps in knowledge, damage report inconsistencies and conflicts of interest between the oil industry, government, media and researchers.

Damages to an already fragile ecosystem

The Gulf of Mexico lies in a transition zone between temperate and tropical waters, an ecosystem that supports exceptionally high marine biodiversity (Campagna 2011). An ecosystem is a complex system formed by organisms and their environment, including interactions between the organisms, and biotic and abiotic factors. Ecosystems provide value far beyond their individual resources. Ecosystems include structural components, such as marsh flora and the composition of soil layers, as well as dynamic processes, such as nutrient cycling, water filtration, and life cycles of organisms (Kornfeld 2011). None of these components function independently, and interference at one level can have rippling effects that are magnified throughout the ecosystem.

Unfortunately, the Deepwater Horizon spill had damaging effects for species already considered vulnerable. In the Gulf of Mexico, the U.S. Endangered Species Act, Marine Mammal Protection Act, and Migratory Bird Treaty Act protect a limited number of marine species; however, many species are considered threatened by other organizations, but remain unprotected by federal law (Campagna 2011). The International Union for Conservation of Nature (IUCN) lists forty threatened but unprotected species that occur in the Gulf on their Red List of Threatened Species. The Red List is a highly respected international system that uses a rigorous scientific process to assess relative, global extinction risk at the species level (Campagna 2011). Marine species in particular may be underrepresented by the U.S. ESA; therefore, environmental impact assessments regarding offshore drilling in the Gulf of Mexico should include available data on globally threatened species (Campagna 2011).

Information from the IUCN Red List helps coordinate conservation priorities for migratory and transboundary species (Campagna 2011). Around 75-90% of organisms in the northern Gulf of Mexico spend part or all of their lives in estuarine waters

surrounding Louisiana's vast wetlands. Oysters and bay anchovies are permanent residents of these estuaries, whereas other species move out to sea to spawn and complete their life cycles (Mascarelli 2010). Bluefin tuna in the Gulf have a peak spawning period from mid-April to June, during the timeframe of the 2010 BP oil spill (Campagna 2011).

Seagrasses provide structural habitat, food and nursery grounds for recreationally and commercially important fish, invertebrates, mammals, reptiles, and waterfowl. Some seagrasses, as indicated by their names (e.g., turtle grass and manatee grass) are primary food sources for already threatened species. Damages from oil exposure place stress on species that are directly dependent on these plants the higher trophic levels that herbivores support (Campagna 2011). The Kemp's Ridley sea turtle is the rarest sea turtle in the world, and nests exclusively in the Gulf of Mexico. This species is listed as critically endangered on the IUCN Red List and is protected by the ESA. The Deepwater Horizon spill coincided with this species' key reproductive period. The species was on its way to recovery after a population collapse several decades ago, but the vast majority of sea turtles found dead since the spill were Kemp's Ridleys (Campagna 2011). Sea turtles do not breed annually and do not reach maturity until after 12 to 20 years of age, so the effects of the spill on future generations of sea turtles will not be apparent for years (Safina 2011).

The Florida manatee, a subspecies of the endangered West Indian manatee, is found in the Gulf and around the Florida coastline. This species suffered a 10% population loss during the winter of 2009-2010 due to record-breaking low temperatures. The West Indian manatee already faces population pressures from habitat loss, increased boating activity, and fishing gear entanglement. Surface oil from the spill may cause skin and eye irritation to manatees as they emerge to breathe. The marine mammal could also ingest oil-covered seagrasses, or experience toxic effects from chemical oil dispersants (Campagna 2011).

Dispersed oil in the water column may harm organisms at the lowest trophic levels, which may result in greater damages to the long-term health of an ecosystem. The BP Deepwater Horizon spill occurred during maximum larval production of fish, shellfish and small life-forms that maintain the productiveness of the Gulf (Plater 2011). The billions of larva and plankton that drifted in the contaminated water column may

have died from oil exposure or poisoned other organisms that ingested them (Plater 2011).

Researchers feared Louisiana wetlands would be damaged. The extent of damage is determined by how deep hydrocarbons from the oil penetrated into sediments. If chemicals prove toxic to wetland root systems, erosion and subsidence would accelerate, damaging important offshore nursery grounds (Mascarelli 2010). Long-term effects of the oil spill on organisms and habitats in the Gulf and on the coast remain to be seen, and depend on the concentration of oil, how far it has travelled, and exposure time – most of which are unknown (Mascarelli 2010).

Health hazards: gaps in research

Although further research is still necessary to determine long-term environmental damages, researchers know surprisingly little about the hazards of human exposure to crude oil. Even though at least 10 percent of all oil tanker spills between 1970 and 2009 have affected coastal populations, there has been little research on the long-term health effects from oil spills (Sandler et al. 2011). Scientists have a better understanding of the vulnerability of sea bird and marshlands to oil than that of humans (Woodward 2010).

Crude oil is a combination of various chemical compounds, composed mainly of polycyclic aromatic hydrocarbons (PAHs) (Meo 2009). Health hazards from exposure to crude oil spillage include symptoms such as shortness of breath, cough, runny nose, asthmatic attacks, redness of eyes, nausea, vomiting, abdominal pain, headaches and dizziness (Meo 2009). Respiratory problems, skin irritation, and heat stress were common in workers involved in the cleanup of the spill. The National Institute for Occupational Safety and Health reported that oil is an irritant of skin and lungs, but is “unlikely” to damage health in the long term (Woodward 2010). However, impaired lung function caused by air pollution due to crude oil spills is a function of the duration of exposure to the contaminants (Meo 2009).

In order carry out an effective, comparative health study, it is critical to identify workers who may have been exposed to oil, collect exposure and medical histories as early as possible, and conduct detailed exposure assessments. These processes are often overlooked during the urgency of immediate response efforts, which is why studies of exposure assessment in the Deepwater Horizon spill are largely retrospective. Gathering

the exposure and medical histories of workers as early as possible, preferably before any work-related symptoms appear, can identify an appropriately unexposed comparison group. A broad range of health issues should be considered. Health outcomes by exposure duration among workers can be used to identify immediate health service needs and the relationship between oil exposure and work practices. This information, as well as information on the use and effectiveness of protective equipment and worker safety training, can be used to modify future spill cleanup techniques to minimize exposure (Savitz and Engel 2010).

The Deepwater Horizon spill had negative psychological consequences for the people directly and indirectly affected by it. Psychological impacts of the spill resulted from uncertainty over ecological effects and consequent future viability of fishing and tourism (Safina 2011). Louisiana state counseling teams reported that grounded fishermen, affected industry employees and business owners, as well as residents close to the crisis exhibited signs of acute anxiety, depression, excessive drinking, and some suicidal ideation (Woodward 2010). A study was conducted to determine the level of distress and mechanisms of adjustment for communities indirectly impacted by or directly exposed to the oil spill. No significant differences were found between groups in terms of distress, adjustment, or environmental worry, but residents of both communities displayed clinically significant depression and anxiety. Residents who suffered spill-related income loss showed more depression and less resilience, and were more likely to use behavioral disengagement as a coping mechanism (Grattan 2011).

Seafood contamination was a major concern after the BP oil spill. Fishing bans were initiated by NOAA in 36% of federal waters in the Gulf (nearly 87,000 square miles) at the height of the spill (Issues in Science & Technology 2010). Concentrations of chemicals related to the spill were tested in seafood and compared to data from previous oil spills. Risk assessment of health impacts from PAH exposure and metal contamination were used to evaluate seafood safety before reopening fisheries. Chemical test results indicated low PAH levels in contrast to previous oil spills, and low levels of concern were determined, even under conservative risk parameters (Gohlke 2011). Fisheries began to reopen as early as late summer in 2010, but consumer doubt regarding effects of oil on fish and shellfish remained, despite the government's claims of safety

(Uhlmann 2011). Long-term spill effects of the spill on spawning grounds and reproductive capacities are uncertain (Uhlmann 2011). Florida State University researchers testified that the spill could reduce population sizes of edible marine species, and could decrease ecosystem productivity by up to 10 to 15% in the Gulf; tuna, shrimp, fiddler crabs, and clams are likely to be the most affected (Issues in Science & Technology 2010).

The Macondo well and blowout

The Macondo well was leased by multinational energy company British Petroleum (BP) Exploration and Production, Inc. in 2008. The plot of seafloor in the Gulf of Mexico where the well was located is roughly 70km from the southern shore of Louisiana. The drilling company Transocean was hired in 2009, but a hurricane delayed drilling and damaged the rig. Deepwater Horizon rig replaced the original rig, and drilling the well began in February 2010 (Safina 2011, Uhlmann 2011). The drilling platform was bigger than a football field, and the drill itself was nearly 122m long (Safina 2011). Drilling rigs are meant to discover, not extract. Various problems set the project behind schedule and over budget, but the rig was prepared to close in April 2010 after a commercially valuable oil reservoir was discovered (Safina 2011, Uhlmann 2011).

Oil found below deepwater is under tremendous pressure, and pressure control consequently tops the priority list of concerns in drilling procedures. Drilling mud, which is a special, heavy fluid, is injected through the drillpipe to prevent pressurized oil and gas from surging through the well. Drilling mud is replaced by a brine solution to maintain well control once the well is completed (Latham 2011). However, pressurized drilling fluid escaped through the porosity of the Macondo well's loose walls. A special viscous fluid was used as a sealing mixture, but engineers mixed more than needed, creating an expensive and tedious waste-disposal problem. Drilling rules allowed the viscous fluid to be mixed with other drilling fluids and sent down the well, instead of sending the hazardous waste to land for disposal. Unfortunately, the viscous fluid clogged a key pressure gauge, and the gauge showed a zero-pressure reading.

A pressure gauge on a different line showed building pressure, indicating a cement plug failed to seal pressurized hydrocarbons in the well. Rig crew members

convinced themselves the gauge showing zero-pressure was correct, and the other reading was an anomaly (Safina 2010). Workers were unaware that gas was escaping from the well, which led to an explosion and two-day fire; and the rig eventually sank into the nearly mile-deep water. By the time a problem was realized, confusion and issues over authority delayed assessment of severity, and caused hesitation in initiating attempts to disconnect the rig from the mile-long pipe (Safina 2011, Uhlmann 2011). In the event that drilling mud or cement fails to control well pressure, the most critical piece of emergency response technology is the blowout preventer. However, the reliance of the oil-drilling industry on blowout preventers has been proven dangerous, and this costly mistake directly contributed to the magnitude of the Deepwater Horizon spill (Latham 2011).

Response Failures

In the aftermath of the explosion, many of BP's attempts to seal the leak failed; meanwhile, cleanup crews attempted to collect or disperse the oil using mechanical surface-cleaning methods before it reached the Gulf Coast. An oil slick nearly 29,000 square miles formed in the Gulf (Uhlmann 2011). BP had a federally approved spill response plan for the Gulf of Mexico that included major sections merely cut-and-pasted from Arctic spill response plans. The approval process overlooked the fact that the plan explained what it would do for walrus and sea lions, creatures that do not inhabit the Gulf of Mexico. In a region filled with oil rigs and hardware, a device to shut off a mile-deep leaking pipe was nowhere to be found. Dispersant chemicals and response paraphernalia adequate to contain small spills were the only response equipment available (Safina 2010).

In order to limit damage from oil spills and facilitate containment and cleanup efforts, timely information on spill location, size and extent must be obtained. Direction and speed of oil movement, and wind, current, and wave information are critical to predict oil drift and dispersion. Fast turn-around time and frequent imaging of the site are necessary to monitor spill dynamics (Klemas 2010). The inability to accurately estimate the amount of oil gushing from the broken pipe at a depth of one mile was a critical spill response fault in this incident. Estimates of spillage obtained by BP, the Coast Guard and

research organizations ranged from 200,000 to several million gallons per day. By the middle of June, thousands of vessels and tens of thousands of personnel were involved in cleanup efforts (Klemas 2010).

Oil spill preconditions

The BP oil spill in the Gulf of Mexico is often listed as the worst environmental disaster in U.S. history; however, the incident was not without precedent (Uhlmann 2011). The Deepwater Horizon spill was not the first time a blowout preventer failed to avoid a catastrophic flow of oil after pressure-control was lost (Latham 2011). Hard systemic lessons learned from previous oil spills had been largely forgotten or diluted in subsequent years, and there are frustrating parallels between the Deepwater Horizon spill and previous spills in terms of causation and impaired response capability (Plater 2011).

Preconditions for catastrophes lie latent within the processes of planning, permitting, constructing and operating oil-drilling systems, and in designing inadequate precautionary safeguards (Plater 2011). The 1990 Alaska Commission noted that the Exxon-Valdez drilling system was developed using shortcuts and with a primary focus on production rather than safety. Regulatory agencies often accepted industry data and assurances uncritically, and a lack of system safeguards was overlooked as permits were issued without required documentation (Plater 2011).

These regulatory problems were compounded by a series of internal shortcuts and mistakes that ultimately led to the Deepwater Horizon blowout. At the scene of the disaster, the mistakes began with the bond cement test that BP cancelled that might have revealed problems with the cement seal. The drilling mud, which helps the cement cure, was not circulated adequately; and the drilling mud was even diluted with seawater, which accounted for the porosity through which the gas escaped (Uhlmann 2011). The pressure tests conducted hours before the blowout should have revealed the instability of the cement seal; but rig workers failed to correctly interpret pressure-gauge disparities and overlooked warning signs at a critical time. They were able to convince themselves the clogged zero-pressure reading was the correct one, even though the possibility of building pressure should require a response of the utmost precaution (Safina 2010). Hesitation over authority prevented emergency-response action from being taken,

possibly because individuals within an organization at times sacrifice sound judgment to avoid questioning the majority (Flournoy 2011).

The system of oil production and transport is a complex, multi-corporation, multi-agency megasystem, exponentially multiplying risks and the potential for catastrophe (Plater 2011). The Minerals Management Service (MMS) is the Interior Department agency responsible for overseeing drilling safety. The effectiveness and reliability of blowout preventers has been a concern of MMS for over a decade, and studies even showed 117 failures at 83 deepwater wells (Latham 2011). The need to improve and enhance environmental protection of deepwater drilling was also addressed by MMS years before the Deepwater Horizon spill occurred. It took more than 1400 incidents, forty-one fatalities, and ten instances of lost pressure-control, in addition to the Deepwater Horizon disaster, for a rule that furthered deepwater drilling and environmental safety regulations to be published (Latham 2011).

Industry shortcomings

The Gulf oil spill exposed significant regulatory shortcomings within the MMS. (Uhlmann 2011). In the years leading up to the Deepwater Horizon incident, the organization lacked funding, personnel, and the technical expertise necessary to develop adequate safety regulations. MMS lacked staff to perform meaningful inspections, which involved only limited review of drilling activities. Regulations are based heavily on data provided by oil companies, and inspections were infrequent, rarely unannounced, and consisted almost entirely of verifying paperwork (Flournoy 2011, Uhlmann 2011). These outdated authorizing statutes fail to protect and take adequate account of human health, safety and the environment.

The Deepwater Horizon Environmental Impact Statement prepared by the MMS did not address a blowout scenario or worst-case analysis – even though the MMS had previously questioned the reliability of blowout preventers. Several entities reviewed the EIS, but none raised an alarm about the possibility of an uncontrolled blowout. The agency's procedures for environmental review fail to provide an effective framework for analyzing oil exploration and drilling risks, and modest penalty provisions fail to deter risky conduct or emphasize the seriousness of violations and threats to human health and

the environment (Flournoy 2011, Uhlmann 2011). Although the MMS was given charge of regulating an extremely sophisticated industry, in which technology increased the complexity of monitoring necessary for effective regulation, its budget remained relatively flat (Flournoy 2011).

The general success of previous problem-solving techniques contributes to their legitimacy – which provides reinforcement for veteran employees, and newer employees are taught how to perceive problems the organization frequently encounters (Kurtz 2010). Hindsight bias often inclines those seeking to learn from past mistakes to be overly confident that they can avoid the same error, and during emergency preparations, safety lessons from past drilling incidents were offhandedly accepted as already learned (Flournoy 2011). Warning signs were missed, and by the time anyone realized a blowout was occurring, it was too late (Uhlmann 2011). The Deepwater Horizon blowout made it apparent that disasters caused by humans are not merely a result of technical problems, but an internal set of decision-making norms that hinder effective reflection, adaptive learning, and innovation (Flournoy 2011, Kurtz 2010).

Cost-cutting and risk downplaying

Current domestic oil recovery and output fails to meet an ever-increasing demand, and petroleum engineers continue to delve progressively deeper in search of new supplies of recoverable oil. Tapping deepwater-oil deposits involves increasingly sophisticated technology to locate potential oil reserves thousands of feet under the ocean's surface, and equally advanced technology to then extract the oil from thousands of feet beneath the ocean floor (Latham 2011). In just the past decade, the number of wells has jumped from only two dozen to nearly 300 (Safina 2011). Inherent with increasing size, complexity, and technical sophistication of the elements of a megasystem is increased risk of a mega-catastrophe – and greater need for extreme vigilance in design, coordination, and operation (Plater 2011). In spite of this, the bigger these megasystems become, the more difficult it is for corporate managers and government agencies to keep track of and manage the cumulative mass of critical points of risk. Likewise, the growth of megasystems is matched by increasing daily internal economic and political pressures to maximize short-term benefits, and consequently, a tendency downplay risks (Plater

2011, Safina 2011).

Despite high-risk locations, huge technological challenges and high-risk potentials, internal management strategies are often driven by short-term economic gains and managed in business terms, rather than in the interest of safety. Cost-cutting practices and under-vigilant regulatory agencies are driven by profits, politics and an ever-increasing demand for oil supplies. Shareholder and managerial expectations of high revenues take priority over public concern for human and environmental safety, but industry executives are skilled at creating a safety-first image both internally and externally (Plater 2011).

BP's corporate leadership flaunted an environmentally-friendly image. The corporate banner British Petroleum was replaced by BP, a logo representative of a vision looking "beyond petroleum." A focus on alternative energy, dedication to environmental protection, and safety-first practices were all stated components of the new BP. The image assured stakeholders that the company was a different from other energy corporations, and the company strove to convey an image of integrity. Authority figures claimed they viewed every employee concern as an opportunity for action and continuous improvement. This declaration, and the conveyed image of integrity, conflicted with testimonies from U.S. Senators, citizen oversight groups, BP field employees and independent analysts. These reports painted a picture of a profit-first culture, and leadership that regularly ignored safety concerns and engaged in excessive operational risk taking (Kurtz 2010).

The deterioration of integrity was a top-down process, enforced by authority figures within the company. Symbolic stories, icons, and image-building – not substantive actions – were used by BP's leadership to maintain an external image for stakeholders, and internal misconduct. Stories of management threats, coercion and job-loss deterred "whistleblowers" within the company, and veteran field staff and new employees learned to overlook environmental compliance and safety infractions. At higher levels in the organization, managers who exceeded production and profit targets were rewarded with bonuses averaging 120 to 150 percent of their base salaries (Kurtz 2010).

Damage assessment inconsistencies

In the aftermath of the oil spill, reports regarding long-term ecological effects varied widely. The extent of environmental harm may not be known for many years, because such a large amount of oil has never before been spilled from an offshore well (Uhlmann 2011). Legal liability is relative to how much of the spilled oil enters the environment. This gives oil companies a strong incentive to minimize or hide the amount of oil spilled (Safina 2011).

After the spill, two storylines unfolded. The first story, as told by media and researchers in an attempt to downplay the damage, played along the lines of oil-consuming microbes clearing any oil not siphoned from the well, burned or skimmed at surface, or chemically dispersed. Other research and news articles, determined to expose the oil industry, told of marine life being smothered and poisoned by largely unseen oil, and one study even reported a vast plume of oil on the floor of the Gulf (Nash 2011, Uhlmann 2011). Interlaced factual, emotional and political aspects of the incident shaped the damage reports (Safina 2011).

Oil production and transportation are governed by public and private societal governing structures, comprised of two theoretically counter-balancing divisions (Plater 2011). Administration driven by industry, market, and profit has a primary focus of generating jobs, technology, wealth and political power. In contrast, state and federal regulatory agencies must monitor the industry and protect the public from industry's market failure. The industry and agency players form a combined culture of complacency, collusion, and neglect (Plater 2011). The resulting oil megasystems are poorly coordinated and risk-prone, incapable of ensuring human or ecological safety. Internal corporate culture is likely controlled by the dominant partner's corporate agenda and policy. To make matters worse, industries have the right to hold company information confidential, even when the data are of critical public importance (Plater 2011).

Withholding information protects the image of the oil industry. For example, the chemical components of dispersal agents were kept secret, and they served BP's interests in hampering understanding of the amount of oil leaking (Safina 2011). Chemical dispersants are often criticized as a spill-response method. The Alaska Commission warned against dispersant use twenty years ago, in favor of surface collection

technologies such as booms and skimmer craft, which are more effective and less destructive to human and environmental health. However, these technologies are more expensive to maintain and operate, making them an unlikely choice in a profit-driven industry. Dispersants also detract from spill visibility, dispersing oil into billions of small, suspended particles well beneath the surface, and reducing the number of images of fouled beaches and dying wildlife (Plater 2011). Unfortunately, lack of visibility does not mean lack of harm. Dispersing oil downward in the water column increases risk to drifting organisms, and dispersants have been implicated as a cause of physical problems in humans and non-human animals (Plater 2010).

Two studies of environmental and human health hazards implemented since the Deepwater Horizon spill are of particular interest. The first, a \$500 million Gulf of Mexico Research Initiative, was implemented by BP to study the environmental and public health effects of the spill. The fund will be managed by a board of scientists appointed by BP and the Gulf of Mexico Alliance, a partnership of the Gulf states (Issues in Science & Technology 2010). It will be interesting to compare differences in results published by the Gulf Long-term Follow-up Study (GuLF STUDY), which was announced by the National Institute of Environmental Health Sciences (NIEHS) in January 2011. NIEHS is one of the National Institutes of Health (NIH), which is part of the Department of Health and Human Services. The GuLF STUDY will include data from over 50,000 participants, and aims to assess potential short- and long-term health effects associated with Gulf of Mexico Oil Spill clean-up. NIEHS also intends to create a resource for collaborative research on specific scientific hypotheses or subgroups. BP is not involved in the design, implementation or data analysis of this study. The NIEHS is careful to point out the study will provide unbiased and authoritative advice to decision makers and the public, and privacy protection for the participants.

Political and economic influence

The cost-cutting and risk-downplaying actions that lead to the Deepwater Horizon oil spill were consequences of the country's insatiable thirst for oil. Agencies are often driven by political pressure over public interest. Intense political pressure can even cause an agency's personnel who are dedicated to pursuing public interests to

misinterpret those concerns (Kornfeld 2011). BP may have been particularly prone to cutting corners in the Gulf of Mexico, but the comfortable relationships with the MMS and its lax oversight are shared by many drilling companies (Plater 2011).

The wealth of large oil companies is almost impossible to conceive. The top five oil companies (BP, Chevron, ExxonMobil, Conoco Phillips and Shell) made a combined profit of \$100 billion in 2008 (Flournoy 2011). The industry can use this wealth as a powerful influence in legislation. In 2010, campaign contributions from the oil and gas industries were reported by the Center for Responsive Politics as exceeding \$23 million, and the oil industry spent over \$175 million on lobbying efforts in 2009 (Flournoy 2011).

Oil and gas industries oppose efforts to reform and strengthen statutes and regulating agencies, making it unlikely that Congress or agencies will do more than respond to direct and concrete causes of disasters (Flournoy 2011). Under the current energy policy, hefty subsidies are offered as an incentive for highly profitable oil and gas industries to continue finding and providing oil and more gas. Additionally, a 2005 Congressional Budget Office Report showed that capital investment tax rates for oil extractions are among the lowest rates for any industry (nine percent), and tax deductions and credits for the oil extraction industry amount to roughly \$4 billion per year (Flournoy 2011). Louisiana state politicians were elected by oil money, and have defended the industry from regulation (including wetland protection), reduced royalties, and given tax breaks to that industry (Kornfeld 2011).

BP has implemented expensive response projects that politicians wanted, but that experts criticized as ineffective, ecologically damaging, and a waste of money (Safina 2011). Scientists, lawyers and the general public have a responsibility to keep the long-term effects of this tragedy in the public eye before politicians drop the issue in their haste to move on to what they deem to be more expedient political concerns (Kornfeld 2011).

Publicity and liability: a conflict of interest

Controversy, litigation and economic consequences follow environmental disasters; and data from research on the health effects of the disaster are used as ammunition in the political and social battles that follow (Savitz and Engel 2010). Soon after the Deepwater

Horizon spill, tension developed between the desire to fully investigate the health consequences of the spill and the desire to provide reassurance that will reinvigorate the region's tourism and seafood enterprises (Savitz and Engel 2010).

Some residents, business owners, fishers, environmentalists and the media fueled panicky predictions of permanent ruin. Federal agencies lost public trust when some officials made hasty assurances not long after the spill that the oil was "gone" (Safina 2011). Regardless of the nature of reports, the general public has never before been exposed to the amount of media coverage of an environmental tragedy, via a multitude of mediums and over an extended period of time. News stories, photographs and videos of oil-covered wildlife, gushing oil and cleanup crews were published in newspapers, on television, and over the Internet (Uhlmann 2011).

The group of academic scientists that reported the deep-water oil plume arrived in the Gulf less than two weeks after the well blew out to inquire what was happening to unseen oil and natural gas leaking into mile-deep waters. Research was funded by NOAA, which asked for a detailed inventory of all water samples collected, in case of the need for evidence in legal proceedings. NOAA worked closely with BP in response efforts, but must also lead the environmental assessment that ultimately determines the liability of BP for the spill (Schrope 2010).

EPA regulation of BP's response effort required some urgency in answering scientific questions regarding hazards of dispersant use, but merging the specifics of scientific and legal processes can become complicated. Damage-assessment research as a whole was a new experience for many researchers; some claimed, "It's a huge lab experiment, but there are no controls." The concept is frightening to scientists who usually have a control to measure against (Mascarelli 2010). Also, the NRDA process for gathering evidence in spill-liability cases requires restrictions on how samples and data are handled, a process foreign to many scientists (Schrope 2010).

There were researchers who felt that NOAA's protocol appeared to be an attempt to minimize liability on the part of the oil company, and reluctance to admit new assessment directions that would make the NRDA process even more complex. Research of new issues complicated NOAA's relationship with BP, because assessment studies created the potential for liability on BP's part. Researchers pointed out the lack of overall

coordination of the many types of research being undertaken, which can lead to overlooking an issue, or downplaying the risks of another due to complications (Schrope 2010).

Media exposure of mistakes made by the multi-billion-dollar corporation was unfavorable for BP. The intense media focus generated a lot of public anger and resentment by Americans struggling after a recession (Uhlmann 2011). The Deepwater Horizon Unified Command said local, state, and federal officials worked together to streamline responses of a complex problem to both reporters and the public (Zak 2010).

Initially, it appeared that BP and the government were attempting to restrict media and public knowledge of the extent of spill damages. Authorities received criticism for a series of minor run-ins that gave the impression that BP was calling the shots in media coverage. Reporters and photographers claimed that police and federal agencies restricted access to public property. One photographer had to wait through 30 minutes of phone calls to higher authorities after being stopped by police 100 yards from the surf, only to gain 15 minutes of limited access to photograph an affected beach. In the weeks following the spill, BP, the Federal Aviation Administration and the Coast Guard restricted access to oil-affected to planes carrying media.

A lieutenant commander for the Coast Guard stated that neither BP nor the U.S. Coast Guard had any rules in place that would prohibit media access to impacted areas. Many journalists reported incidents that conflict this statement, but federal authorities said they did their best to make it clear that they want to provide access to the story while maintaining the proper safety parameters for both cleanup workers and the environment itself (Zak 2010). The Gulf Coast Task Force backs this statement, and said media embarks aboard response assets are highly encouraged, to the extent they can be safely accommodated. Media access requires proper credentialing, coordination through the Unified Area Command Joint Information Center, and following necessary ground rules (Restore the Gulf 2010b). The consistency of the compliance of federal agencies, BP and the media was important to their liability following the spill, in order to avoid misleading conduct and violating First Amendment rights (Zak 2010).

Organizational bias in the media

The sponsors who promote their agendas to media representatives create news jointly with the journalists who decide which stories will be covered, and which sources will be interviewed (Widener and Gunter 2007). The complex features of disasters lend themselves to multiple interpretations. Depending on their vested interests, claims makers may seek to expand or contract the dangers posed by hazardous technologies and the damage done by specific disasters (Widener and Gunter 2007). After a disaster, researchers often address the “acceptable risks” and systemic features make accidents virtually inevitable, as evidenced by research following the Deepwater Horizon spill. In contrast, media frames focus more narrowly on the ramifications of a disaster, and go to the heart of culpability and compensation issues (Widener and Gunter 2007).

The story and facts presented in the media are largely determined by the sources interviewed, which are most commonly political figures, government representatives, and members of legitimated institutions. Reporters often rely on a “short-list of trusted source contacts,” who are “articulate and reliable” (Widener and Gunter 2007). Presenting multiple sides of a controversial issue allows the media to project an image of objectivity, even though all views are not rewarded equal coverage. The media seek credible sources, but simultaneously present some sources as more credible than others (Widener and Gunter 2007).

A comparative study between spill coverage in a mainstream newspaper and an alternative newspaper in Alaska following the Exxon-Valdez oil spill illustrated the sharply contrasting pictures the media can paint. The mainstream paper primarily covered only measureable entities such as financial compensation and wildlife. The paper also offered a wider range of perspectives, including the differing assessments of whether a particular species had or had not recovered. In contrast, the alternative paper sought to connect damage with broader themes of respect, duties, and the betrayal of trust from the oil industry and the state government to the people of Alaska. When they wrote of wildlife losses, they spoke of despair and sadness, not numbers (Widener and Gunter 2007). The media is a powerful tool in shaping the public’s perception of the magnitude of a disaster.

Scientists and the media

Initially, containment and impact studies focused on surface oil. Media exposure of research on a deep oil plume was met by questioning BP executives and spokespersons, who argued simply that oil floats (Schrope 2010). NOAA also had a cool response to data on the deep-water plumes, calling the research and media reports “misleading, premature, and in some cases, inaccurate” (Schrope 2010).

Unfortunately, most researchers are unprepared for media attention, especially at this magnitude. Scientists who acted as the “research face” for the media were overwhelmed by interviews for days, weeks, or months. Little media experience, fueled by journalists on the hunt for heart-wrenching stories, often led to interview misinterpretation. Researchers did what they could to keep records straight and were careful to note that more analysis was necessary before confirmation, but they were unsure of how else they could have better controlled the picture that the media painted for the public (Schrope 2010).

The media is not solely to blame for dramatization of Deepwater Horizon damage reports; some scientists made overstated claims predicting unlikely scenarios, such as a thick oil getting entrained in the Loop Current and Gulf Stream and blanketing the east coast (Safina 2011). However, even the majority of scientists who reported honestly and may have been misconstrued do not regret spreading news, because experimental opportunities might have been missed if the press had not exposed the data (Schrope 2010).

The importance of carefully chosen words quickly became clear to scientists put on the spotlight about their data. The scientists were surprised by a statement made by NOAA, which said the scientists wished to clarify they had not reached definitive conclusions, their findings did not show oxygen levels low enough to be of concern, and that connections to subsea-dispersant use was speculative. While scientists fully agreed with the statements attributed to them, they had not seen the text before NOAA released it. Researchers understood NOAA’s need to perform damage control and avoid panic, but believed better communication between government agencies and scientists would produce more accurate media reports (Schrope 2010).

In the face of conflicting interests, scientific results will inevitably be seen as supportive of one view and counter to another (Savitz and Engel 2010). Researchers

should be aware of this, and ensure that scientific evidence is generated and presented in an objective, transparent manner. Funding and oversight of the research should be carefully configured, and include the external scientific community and worker advisory boards to ensure quality, credibility and acceptability of the findings (Savitz and Engel 2010). Forums and newsletters allow the general public and affected communities to help to direct scientific research, and serve as a point for media contact.

Conclusions

It appears that the Deepwater Horizon oil spill unfolded in three parts. First, the factors that led to the blowout. Second, the varied responses while oil continued to leak from the well. Third, the post-leak period; when assessment, study, and comparison merged the technological, political, emotional and scientific components that comprised the event (Sarafina 2011). Risk of disaster and conflict of interest are inherent aspects of a technologically advanced industry that is driven by politics and economics, and governed by wealthy, powerful corporations. Cost- and corner-cutting practices undermine the importance of safety. A heavy emphasis on image building and profit-boosting from the highest levels of authority, reinforced by employee punishment and reward, stifled any potential whistleblowing at lower levels (Kurtz 2010). Weak governmental regulatory provisions were overpowered by the political and economic influence of the oil industry. The advancement and proliferation of contemporary media outlets, and their ability to influence public perception, both contributed to and exposed internal issues that are innate in the oil-drilling industry.

These issues demonstrate the need to re-evaluate the planning, regulation, and emergency response plans of the oil-drilling industry. Disasters arise from an interaction between technological and organizational system failings, and cannot be understood in purely technical terms (Flournoy 2011). The natural environment and the organisms that utilize an ecosystem – including coastal communities, businesses, and their consumers – are all irreversibly linked. The loss of one can dramatically affect the sustainability of the others; and the recovery of one can influence the restoration of another (Widener and Gunter 2007). Environmental catastrophes such as oil spills threaten the integrity of local ecosystems, produce concerns about long-term health impacts, involve drawn-out court

cases, create excessive bureaucratic red tape, and erode communal ties (Widener and Gunter 2007). Restoration plans should consider local ecosystems, local people, and their history (Kornfeld 2011). Community participation and the exchange of honest, objective local knowledge are critical to injury, recovery and transformation assessments. Within the oil-drilling industry, a process of continual inquiry and adaptive learning should be developed, paired with a culture of effective communication and emphasized safety (Flournoy 2011).

On a global scale, environmental issues in oil-drilling and other utilitarian practices were there before the Deepwater Horizon incident, and remain after. Widespread predictions notwithstanding, long-term effects will not be known until the long term (Safina 2011). The complexity of an ecosystem is simultaneously a weakness and a strength; organisms are biologically inclined to adapt, and many scientists agree that ecosystems have a remarkable capacity to heal (Mascarelli 2010). Calculating the cost of restoration is more efficient than the difficult process of the valuation of nature (Nash 2011). Most important is determining the appropriate level of restoration, which differs depending on whose interest is in mind. There is complexity and imprecision of economic models of ecosystem values and services, and their role in conservation policy decisions (Nash 2011).

The Deepwater Horizon oil spill shed light on the need to repair the overall Gulf ecosystem, which has lost land area roughly the size of Delaware during the past 50 years (Issues in Science and Technology 2010). Oil spills seem smaller and fleeting in comparison to deforestation, accelerating species loss, freshwater depletion, fisheries collapses, human population expansion, polar melting, coral bleaching, and changes to the planet's heat balance and the seas' chemistry (Safina 2011). One of the most important lessons from the events that caused the blowout is that human judgment is too frail and self-filtered to prevent all future accidents associated with deep drilling. Deep water accidents are difficult to contain, increasing the stakes to effect natural assets that support regional economics, and much stronger government oversight could help (Safina 2011). Because of the inherent risk in deep drilling, internal changes are especially needed within oil companies. Oil companies as a whole must not mislead the public

about protocol before or after a disaster, but accept the responsibility of their mistakes, and take the necessary action to repair the damage.

Each environmental disaster is unique, but they all require identifying health consequences, strategies to mitigate them, and lessons for how to do better in future emergencies (Savitz and Engel 2010). First, it is crucial to anticipate the next possible disaster, not merely seek to avoid repeating the most recent one. Second, it is necessary to identify not just specific types of disasters that may occur in the future, but the blueprint or architecture for this and other similar disasters—the economic, political, and regulatory context that facilitated the cascading errors that produced the disaster (Flournoy 2011). The general public and media must lobby for the acknowledgment and implementation of systematic lessons that have been overlooked in the past (Plater 2011). Spotting relevant patterns will help to avoid another set of painful and costly mistakes (Flournoy 2011).

Literature Cited

- Campagna C, Short, FT, Polidoro, BA, et al. 2011. Gulf of Mexico oil blowout increases risks to globally threatened species. *BioScience* 61(5): 393-397.
- Congressional Digest. 2010a. Background on Oil Spills: Causes and Response. June 2010: 165-166.
- _____. 2010b. Oil Spills in U.S. Coastal Waters: Background, Governance, and Issues for Congress. Impact of Oil Spills: Environmental and Economic Costs. June 2010: 167-192.
- Flournoy AC. 2011. Three meta-lessons government and industry should learn from the BP Deepwater Horizon Disaster and why they will not. *Boston College Environmental Affairs Law Review* 38(2): 281-303.
- Garza MD, Prada A, Varela M, Rodríguez MXV. 2009. Indirect assessment of economic damages from the Prestige oil spill: consequences for liability and risk prevention. *Disasters* 33(1): 95-109.
- Gohlke JM, Doke D, Tipre M, Leader M, Fitzgerald T. 2011. A review of seafood safety after the Deepwater Horizon blowout. *Environmental Health Perspectives* 119(8): 1062-1069.
- Grattan LM, Roberts S, Mahan Jr. WT, et al. 2011. The early psychological impacts of the Deepwater Horizon oil spill on Florida and Alabama communities. *Environmental Health Perspectives* 119(6): 838-843.
- Issues in Science & Technology. 2010. Oil spill investigations continue. Winter 27(2): 24-25.
- Klemas V. 2010. Tracking oil slicks and predicting their trajectories using remote sensors and models: case studies of the Sea Princess and Deepwater Horizon oil spills. *Journal of Coastal Research* 26(5): 789-797.
- Kornfeld IE. 2011. Of dead pelicans, turtles and marshes: natural resource damages in the wake of the BP Deepwater Horizon spill. *Boston College Environmental Affairs Law Review* 38(2): 317-342.
- Latham MA. 2011. Five thousand feet below: the failure to adequately regulate deepwater oil production technology. *Boston College Environmental Affairs Law Review* 38(2): 343-367.
- Mascarelli A. 2010. Deepwater Horizon: After the oil. *Nature* 467(7311): 22-24.
- Meo SA, Al-Drees AM, Rasheed S, et al. 2009. Effect of duration of exposure to polluted

air environment on lung function in subjects exposed to crude oil spill into sea water. *International Journal of Occupational Medicine & Environmental Health* 22(1): 35-41.

Nash S. 2011. Oil and water, economics and ecology in the Gulf of Mexico. *BioScience* 61(4): 259-263.

[NOAA] National Oceanic and Atmospheric Administration. 2006. Assessing Environmental Harm: Oil Spills along the Shore, Emergency Response Division, Office of Response and Restoration. (*response.restoration.noaa.gov*)

_____. 2010. Natural Resource Damage Assessment (NRDA), Emergency Gulf Spill Restoration.

Plater ZJB. 2011. The Exxon Valdez resurfaces in the Gulf of Mexico and the hazards of "Megasytem Centripetal Di-Polarity". *Boston College Environmental Affairs Law Review* 38(2): 391-416.

Restore the Gulf. 2010a. Subsurface Oil Monitoring. (*restorethegulf.gov/release/2010/10/02/subsurface-oil-monitoring-overview*)

_____. 2010b. Media Access: For Members of the Press Corps. (*restorethegulf.gov/task-force/joint-info-center/media-access*)

Safina C. 2011. The 2010 Gulf of Mexico oil well blowout: A little hindsight. *PLoS Biology* 9(4): 1-5.

Sandler DP, Kwok RK, Engel LS, et al. 2011. Gulf Long-Term Follow-Up Study. *GuLF STUDY* 3: 9-89.

Schrope M. 2010. Deepwater Horizon: A scientist at the centre of the spill. *Nature* 466(7307): 690-684.

Uhlmann DM. 2011. After the Spill is Gone: the Gulf of Mexico, Environmental Crime, and the Criminal Law. *Michigan Law Review* 109 (8): 1413-1461.

Unified Area Command. 2010. Deepwater Horizon MC 252 Response. Strategic Plan for Sub-sea and Sub-surface Oil and Dispersant Detection, Sampling and Monitoring.

Widener P, Gunter VJ. 2007. Oil Spill Recovery in the Media: Missing an Alaska Native Perspective. *Society and Natural Resources* 20: 767-783.

Zak D. 2010. As oil spread, did BP battle to contain the media? *Washington Post*.

Woodward C. 2010. Gulf oil spill exposes gaps in public health knowledge. *Canadian Medical Association Journal* 182(12): 1290-1292.