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The DeepWater Horizon Catastrophe: Explanation on the Causes and Management of a Regional Disaster and How Such an Event Can Influence Further North American Offshore Oil Development

Mémoire de fin d'étude présenté par
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Résumé

Le 20 avril 2010, une explosion et un incendie dévastèrent la plateforme de forage 'Deepawater Horizon' située dans le Golfe du Mexique à 50 miles au sud-est de Venice, près de la Louisiane. L'explosion tua onze travailleurs et en blessa 16 autres. Il s'ensuivit une marée noire provenant du puits Macondo que cette plateforme n'avait pas eu le temps de sceller. Pendant 87 jours, 780 000 m³ de pétrole ont jaillit de cet orifice pour se déverser sans interruption dans le Golfe du Mexique.

Cet évènement dramatique représente un tournant dans la politique américaine en matière de forage offshore. La catastrophe est, par son ampleur et sa durée, la plus grande catastrophe pétrolière que les Etats-Unis aient connue jusqu'à présent. Les activités offshore revêtent un aspect cruciale dans le politique énergétique américaine car elle contribue significativement à la production nationale. Le cadre juridique a fortement évolué depuis les années 70. Néanmoins, il ne fut pas assez robuste pour éviter une catastrophe d'une ampleur telle que celle du Golfe du Mexique. Les causes de ce désastre ne sont pas seulement imputable a BP et ses contractants, il s'agit d'un ensemble d'erreurs et de lacunes également imputables à l'industrie pétrolière dans son ensemble et à un État américain trop laxiste en matière de sécurité. Les méthodes utilisées, tant pendant la durée de la crise (le déversement du pétrole) qu'après le scellage du puits afin de réduire l'impact du pétrole sur le Golfe du Mexique, sont sans précédents. Cela va de moyens purement techniques comme la collecte du pétrole et le nettoyage des oiseaux jusqu'au déversement de grandes quantités de dispersant à la surface et à 5000 pieds, au point de jaillissement du pétrole.

Les décisions prises le furent dans l'urgence et reflètent un manque de préparation criant face à ce genre d'accidents pourtant prévisibles. Les conséquences de la marée noire sont multiples et concernent évidement les écosystèmes locaux (voire éloignés), l'économie régionale supportée par les industries pétrolières (déstabilisées par le moratoire et les nouvelles normes), de la pêche (impactée par la fermeture des zones de pêches et les craintes subséquentes liés à la contamination possible des produit issus du golfe) et du tourisme. L'aspect sanitaire est l'un des autres problèmes qui surgit avec la marée noire et l'usage de dispersant. Les habitants de la région ainsi que les volontaires ayant participé aux actions de nettoyage ont été exposé à des substances dangereuses dont l'impact réel n'a pas encore été identifié avec précision. La marée noire ayant suivi l'explosion a ébranlé l'économie d'une région toute entière mais a également déstabilisé la nation américaine fortement dépendante du golfe en matière énergétique.

Des modifications majeures, tant au niveau légal que technique, ont fort heureusement été instaurées suite à la catastrophe. Néanmoins, les projets de forage offshore continuent de se multiplier, et ce avec le support du gouvernement américain, qui en retire un profit non négligeable.

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List of Acronyms and Abbreviations

AK:	Alaska
API:	American Petroleum Institute
BOEM:	Bureau of Ocean Energy Management
BOP :	Blowout-preventer
BSEE:	Bureau of Safety and Environmental Enforcement
Ca:	California
CAA :	Clean Air Act
CEO :	Chief Executive Officer
CG :	Coast Guard
Co:	Company
Corp:	Corporation
COS:	Center for Offshore Safety
CS :	Continental Shelf
CWA :	Clean Water Act
DOI :	Department of Interior
DWH:	Deep Water Horizon
EIS :	Environmental Impact Statement
EPA :	Environmental Protection Agency
ESA :	Endangered Species Act
FWS:	Fish and Wildlife Service
GoM :	Gulf of Mexico
ICP:	Incident Command Post
La :	Louisiana
MARPOL:	International Convention for the Prevention of Pollution from Ships
MBTA:	Migratory Bird Treaty Act
MMPA:	Marine Mammal Protection Act
MMS :	Minerals Management Service
MODU:	Mobile Offshore Drilling Unit
MSFCMA:	The Magnuson-Stevens Fishery Conservation and Management Act
MWCC:	Marine Well Containment Corporation
NCP :	National Contingency Plan
NEPA:	National Environmental Policy Act
NIC:	National Incident Commander
NMFS:	National Marine fisheries Service
NOAA:	National Oceanic and Atmospheric Administration
NIOSH:	National Institute for Occupational Safety and Health
NRC:	National Research Council
OCS :	Outer-Continental Shelf
OCSLA:	Outer continental Shelf Lands Act
ONRR:	Office of Natural Resources Revenue
OPA :	Oil Pollution Act
OSHA:	Occupational Safety and Health Administration
plc:	public limited company
ROV:	Remote Operated System
SA :	Stafford Act
SEMS:	Safety Environmental Management System
SONS :	Spill of National Significance
Tx :	Texas
UAC :	Unit Area Command
UN :	United Nations
US :	United States (of America)
VoO:	Vessels of Opportunity
WCD:	Worst Case Discharge

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Introduction

The 20th century has unquestionably been an oil century. Oil is synonymous with industrialization, comfort's improvement, -and of the generalization of transportation. Oil is furthermore crucial for nations given its strategic importance and the richness it can arouse (Copinschi, 2010: 5). Indeed, within a century, oil has become the most important strategic natural resource of our civilization, providing us with the necessary energy. The choice of using oil is driven by different intrinsic characteristic of this resource: its concentration of energy (before gas and coal) and its liquidity, making of this resource an easy product to deal with. (Wingert, 2005: 22-23)

Offshore oil production is crucial to meet American domestic consumption and is therefore encouraged by the government. Because of the price our society is inclined to pay for the black gold, oil companies always take more risks and go in difficult zones to exploit oil (and gas). Our addiction to oil provokes indirectly oil spills, resulting in major damages for exposed people and ecosystems.

This work will attempt to present a state of art of the incident of the BP Macondo well blowout in the Gulf of Mexico (GoM) in April 2010, which caused an unprecedented economic, human and environmental disaster in the USA. We shall focus on its causes, its management, impacts and what has been learned from it. First of all, before getting to the heart of the matter, a first chapter (1. Oil and Offshore Drilling in the USA) will aim at giving the reader the necessary tools to understand this thesis by offering a general overview of oil, the importance of offshore activities in the US and their evolution across time as well as the legal framework within which offshore exploitation operates. From the second chapter onward, we shall focus on the catastrophe of the BP oil rig in the GoM. Indeed, the second chapter (2. The DeepWater Horizon Catastrophe) will concentrate on the origins of the blowout by identifying its legal and political causes but also by underlining the internal failures (negligence, mechanical failures) of BP and the oil industry that led to the concrete explosion. The management of this social; economic and environmental crisis will also be broached in this chapter. A third chapter (3. Consequences of the Oil Rig Explosion in the GoM) will concentrate on the various impacts generated by the spill and the pressure the event exerted on the GoM's human populations (economy and health) and ecosystems. Finally in the fourth and last chapter (4. After the DeepWater Horizon Blowout), we shall attempt to detect and identify any significant changes directly resulting from the destructive event as far as prospects, practices, legislation and safety are concerned. In this last chapter the future prospects of the oil industry and the orientation of the American energy policy regarding offshore activities will also be discussed. Before beginning we wish to remind the reader that the catastrophe only occurred two years ago, in April 2010, this means that the scope of the economic and environmental damages and the costs that it represents are not yet clearly identified, since the longer-term effects will only unveil over years and decades.

1 Oil and Offshore Drilling in the USA

In this first part we shall provide the reader with a synthesized definition of oil (1.1), and shall also try to sketch a more balanced image of the relative importance of man-made oil spills impacting the marine environment (1.2). Further sections will be devoted to the evolution of offshore activities, as well as to the importance of offshore drilling in the Gulf of Mexico (GoM) for the North American oil industry (1.3). Finally, a last section will deal with the legal framework of offshore oil exploitation in the US, and the liability regime relevant in the case of oil spills (1.4). This first chapter appears to be crucial in order to seize the proper context in which the DWH oil spill occurred. Moreover, it will also gives the reader the opportunity to understand the extent to which American legislation was able or not to cope with this predicament.

1.1 Oil

Oil (and natural gas) results from the degradation of organic material of diverse origin: plankton, vegetation, animals...When these organic substances fall on the bottom of the sea, they progressively disappear, eaten by bacterias, except if specific conditions are met. Indeed, in waters (lake, sea, ocean, marshes...) with a low-level of oxygen, this organic material is protected and forms blackish sludge that can progressively accumulate over a very long period of time (thousand or millions of years) to reach several dozens or hundreds meters deep. Buried under sediments the sludge undergoes a transformation caused by the action of anaerobic microorganisms. This process produces macromolecular structures consisting of carbonaceous products, called kerogen. The new sediments piling up on the ground compact the layers buried deeper and provoke the expulsion of water from the kerogen. The weight of the sediments is so important that subsidence of the earth's crust can occur. Consequently this mass moves downward into the depth where temperatures and pressures are higher. This phenomenon provokes the elimination of nitrogen and oxygen from the kerogen, and creates shorter molecular chains, transforming the kerogen into hydrocarbons, the blending of these hydrocarbons is what we call oil. Molecules are smaller when temperature is higher and the period of formation longer. Very deep in the ground where the temperatures reach between 120°C and 140°C, we find the shortest chains of hydrocarbon molecules, known as methane, this is the extreme stage where oil completely disappears to transform into natural gas. Depending on the depth, the oil will be different and the gas' proportion will vary. (Boy de la Tour, 2004: 36-38)

The rocks in which oil is found (reservoir rock) are generally not the place where it was formed. Indeed, oil forms itself in porous rocks (Boy de la Tour, 2004: 37-38) and then under the influence of pressure, due to the depth, is excreted from the source rocks and migrates to the surface. If during its journey, oil encounters an impermeable geological layer (clay or salt), it accumulates to form an oil-field situated in what is called a reservoir rock. But if no impermeable layer (cap rock) is on the way to stop the migration, the petrol reaches the surface where lighter molecules evaporate. The remaining elements are heavier and transform in bitumen such as the Athabasca tar sands in Canada or the Orinoco heavy oil belt in Venezuela. (Copinschi, 2010: 76) Roughly 90% of oil formed in the soil slowly leaks to the surface. According to some estimations, seeping oil would represent 60% of hydrocarbons “pollution” found in the oceans surrounding North America. (Burroughs, 2011: 43)

1.2 Origins of Oil Pollution in the Marine Environment

In this section we shall identify the various origins of oil pollution in the marine environment, with a evident focus on the marine blowouts (1.2.3). This interest for other types of marine pollution, such as spills from tankers (1.2.1), and operational discharges (1.2.2), is relevant because we think that a global overview of the relative importance of different types of oil pollutions, is necessary to understand the reach of a catastrophe like the BP[1] blowout in the GoM. Furthermore, it seems relevant to mention in this work that not all oil spills are caused by human actions, indeed natural oil seepage is also very present and can even produce effects that we would not expect (1.2.4).

1.2.1 Spills from Tanker Incidents

Oil tanker accidents have long been in the limelight as regards oil spills. The number of this type of accidents and the quantities of oil released have significantly decreased since the 1970's, notably because certain measures have been adopted. The average yearly amount of oil that spilled reached 314 000 tons in the 1970's and 21 000 tons in the 2000's. The year 2009 was even characterized by figures as low as 100 tons. This positive development is mainly due to the double hull of modern tankers, lowering spill risks after minor impacts, and to the compartmentalization of these vessels so that in case of leakage, only a part of the cargo flows into the sea. Furthermore sea lanes with unidirectional traffic have been established, and the GPS (Global Positioning System) has been generalized, reducing drastically the risk of collisions. (Jernelöv, 2010: 354)

1.2.2 Operational Discharges[2]

As was underlined by Alain Préat (Alain Préat, personal interview, March 23, 2012), Professor of geology at the Free University of Brussels, tankers along with various other types of ships, such as con-

1 BP p.l.c (public limited company) (formerly called British Petroleum and later BPAmoco) is a British multinational oil and gas company, founded in 1909. This is the third-largest energy company in the world. (Techno Science. s. d.)

2 As opposed to accidental discharges. Accidental discharges are oil spills resulting from (1) tankers breaking open at sea following collisions or distress, (2) blowouts of offshore oil wells, or (3) broken pipelines (Global Marine Oil Pollution. s. d.).

tainer ships and fishing vessels, are responsible for another type of pollution, much more important than most people think. Indeed, vessels also cause pollution by discharging illegally oil into the marine environment. This phenomenon, called “operational discharge”, includes degassing[3] and deballasting[4] out at sea (and not in treatment plants) (Jernelöv, 2010: 354). The majority of deliberate discharges is caused by hydrocarbon residues unfit for propulsion, and concerns all types of vessels (Black Tides. s. d.). Between 1988 and 1997, the operational releases amounted to over 200 000 tons per year but have since been reduced to about 100 000 tons per year and this especially in territorial and near-shore waters of developed countries. Nevertheless the activity is expected to continue and will be difficult to reduce more. (Jernelöv, 2010: 354)

1.2.3 Marine Blowouts

To find a clear trend is much more difficult in the case of marine blowouts. One can usually consider that blowouts on land and in shallow waters can be controlled quickly. In deeper waters, blowouts are much less frequent but when they occurred they cause major pollutions and are hard to cap. The process of sealing a well can easily take months and the amount of oil gushing into the water can reach astronomical quantities. (Jernelöv, 2010: 354) The Santa Barbara (Ca) Spill of 1969 is known as the first major oil spill disaster in the US. It was caused by a blowout into a submarine oil reservoir. It took technicians eleven days to contain the spill, approximately 3 million gallons[5] of oil were released. The media coverage of the event stoked the public resentment against oil companies and played an important role in initiating the American environmental movement culminating in the first Earth Day celebration and the adoption of laws (see further 1.4.) to strengthen environmental protection. (Shigenaka, 2011: 989-990) This Californian blowout remained the largest offshore drilling accident in American waters until the Macondo blowout (National Commission, 2011: 28-29).

1.2.4 Oil Seepage: a Natural Pollution?

Besides human oil spills, there also exist natural oil spills, known as “natural seepage” of oil into the ocean. Seepage occurs at thousands different places and is thus what we could call a diffuse pollution (unlike the punctual pollution of oil slicks and blowouts) (Jernelöv, 2010: 363). Oil in its raw form, is a natural substance present in many parts of the world above ground or on the water. The National Re-

3 Degassing involves freeing fuel tanks and crude oil tanks of the gases which remain after the tanks have been emptied (Black Tides. s. d.).

4 Deballasting consists in emptying out the contents of a ballast tank (a reservoir that can be filled, or partially filled, with water to improve the stability of a vessel). Empty fuel tanks (crude oil tanks on an oil tanker), constitute natural ballasts. Ballasting (filling of ballast tanks) with water rinses out the oil and to get rid of their contain in the open sea. (“Black Tides. s. d.)

5 3 million gallons represent 11356.24 $m^{3.}$ Conversions can be made on the website of Unit Juggler <http://www.unitjuggler.com>. Moreover, the reader can find a table of conversion, giving an idea of the proportions in the annexes.

search Council (NRC)[6] estimates that 45% of the oil entering the world's oceans is of "natural" origins, deriving from natural seepage. (Shigenaka, 2011: 989) In 2003, it was estimated that the annual amount of oil resulting from natural seepage was equal to 600 000 tons. Quite surprisingly the natural seepage in some parts of the GoM seems to represent 70 000 tons annually. (Jernelöv, 2010: 363) A certain level of exposure to oil can be tolerated by the marine environment. Unexpectedly, the proximity to natural oil and gas seeps seems to increase productivity and stimulate fecundity, especially for species like copepods, crustaceans generally considered to be sensitive to hydrocarbons exposure (Shigenaka, 2011: 989-990). However, quantities released by a well blowout such as the Macondo well are definitely disastrous for local ecosystems, unable to tolerate such an exposition.

1.3 Oil Exploration and Drilling in North America[7]

Possibilities of offshore drilling have rapidly been attractive for the oil industry. This fact is mainly due to the importance of oil for the American nation, and the increasing domestic demand that has pushed toward more exploitation. Indeed, following World War 2, American domestic consumption of petroleum has increased drastically, due to the popularization of automobiles. US oil production peaked the in 1970's. This phenomenon along with the 1973 OPEC embargo have triggered the quest to develop new offshore reserves. This exploration was strengthened by "Project Independence," launched by the Nixon Administration in 1973[8] (National Commission, 2011: 31), and the creation of the Department of Energy by President Jimmy Carter in 1977[9] (National Commission, 2011:59), announcing a dramatic increase in the pace of leasing in the Gulf and a resumption of sales off the Atlantic, Pacific, and Alaskan coasts. (National Commission, 2011: 31) Consequently, the oil present under marine waters has led to intense prospecting. The Energy policy in the USA has been deeply influenced by the possibility of finding oil along the coasts. The offshore production planned by the US government did not compensate for the decline. As a consequence, the US began to import increasingly more oil from overseas, still increasing its dependence on foreign oil production countries. (Burroughs, 2011: 45) In such a context every single well present on the American territory, onshore or offshore is essential (Sèbille-lopez, 2006: 99).

Oil and gas extracted from offshore fields contribute significantly to the American domestic energy supply, as will be exemplified further. As a result, since the 1940's, the American coastal policy and the national energy policy have been intermingled (see 1.4.) (Burroughs, 2011: 43). The sector has de-

6 The NRC is an organism whose goals are to improve government decision making and public policy, increase public understanding, and promote the acquisition and dissemination of knowledge in various fields such as science, engineering, technology, and health (National Academy of Science. s. d.).
7 For an overview of the major landmarks of the oil and gas offshore history, please see annex 2.
8 It refers to energy independence. President Richard Nixon proposed a considerable expansion of offshore oil and gas development (National Commission, 2011:59).
9 President Jimmy Carter also secured the passage of the National Energy Act of 1978, designed to promote development of domestic energy supplies (National Commission, 2011:59).

veloped different technical devices in order to drill in areas that were before inaccessible (1.3.1) The oil industry and Federal government have especially targeted the GoM, known for its important oil resources (1.3.2). (Patzek and Tainter, s.d.: 9)

1.3.1 Offshore Drilling: Overview

As early as the 1920's, the oil industry has been interested by the oilfields potentially present under water. According to estimates, more than 70 million km² sedimentary basins would be located under water among which 30 million km² under less than 500 m deep[10]. The real exploitation began in the 1960's and 1970's in two operational zones: the GoM and the North Sea which have ever since been major exploitation provinces. Thanks to recent technologies two new regions have acquired a major importance: the Gulf of Guinea and Brazilian offshore. Additionally these recent scientific progresses have also led to new discoveries in the GoM. (Boy de la Tour, 2004: 55-57)

As far as exploration is concerned, offshore prospecting bases itself on geophysics[11] whose techniques are twice or thrice less expensive than on the continent. Regarding exploration, there is almost no difference between a terrestrial and offshore drilling. However, the material necessary for offshore activities is quite different. At sea, the drilling facilities must be maintained above water by a metallic rig especially dedicated to this use and capable of moving quickly from one drilling place to the other. (Boy de la Tour, 2004: 57-58)

In this thesis, the topic being the BP DWH drilling rig blowout in the GoM, we shall briefly detail the evolution of drilling platforms, whereas production platforms will only be mentioned. There are many different types of facilities from which offshore drilling operations take place. Jackups (see figure 1) are the most popular type of mobile offshore drilling unit (MODU) for offshore exploration and development purposes. Jackup rigs rest on the sea floor rather than float. A jackup rig is self-elevating, the legs are stationed on ocean floor and the drilling equipment is jacked up above the water's surface. Jackups can drill in waters up to about 350 feet deep[12]. When drilling is performed in waters that are deeper, 'deep-water MODU' become a more logical choice for exploration and development operations. Deep-water MODU include semi-submersibles (see figure 2) and drill-ships (see figure 3) that are capable of operating in water depths up to 10 000 feet[13]. In shallower waters the deep-water MODU are anchored to the seabed, however in deeper water (>5000 feet[14]), the semi-submersibles or drill-ships are maintained at the required drilling location by using dynamic positioning. (Rigzone. s.

10 30 million km² also corresponds to the totality of sedimentary basins located on the continents (Boy de la Tour, 2004: 55-57).
11 Geophysical methods can be used at sea or on earth and provide the geologist with interesting data concerning the geological organization of the underground, and the possible localization of hydrocarbon fields (Boy de la Tour, 2004: 42-44).
12 350 feet represent 106.68 meters.
13 10,000 feet represent 3048 meters.
14 5,000 represent 1524 meters.

d.)

Figure 1 : Jackup
Source: (Mudblogger (Admin.). 2008.)

Figure 2: Semi-submersible
Source: (Fish Safe. 2009.)

Figure 3: Drill-ship
Source: ("Drillship". 2012.)

Just like on earth, offshore drilling implies several development wells in order to drain properly the oilfield. Drilling a well is very expensive, consequently, to reduce the costs, the oil industry uses increasingly directional drilling carried out from several rigs (as few as possible to cut the costs). The production rigs that are settled on the well after drilling must be capable of treating extracted oil and to storage it before the evacuation. (Boy de la Tour, 2004: 58-59) As for drilling, there exist different types of production platforms[15] but we will not describe them.

1.3.2 The Gulf of Mexico

American oil reserves are unevenly located on the territory, indeed 82 % of these reserves are located in fours states: 22% in Texas, 22% in Louisiana, 20% in Alaska and 18% in California. The remaining 18% are to be found in about twenty other states. The American offshore reserves are mainly concentrated off California and in the GoM (see figure 4) where the states of Texas and Louisiana largely dominate. The GoM represent 25% of the American oil production and 45% of its refining capacity. (Sèbille-lopez, 2006: 97-98)

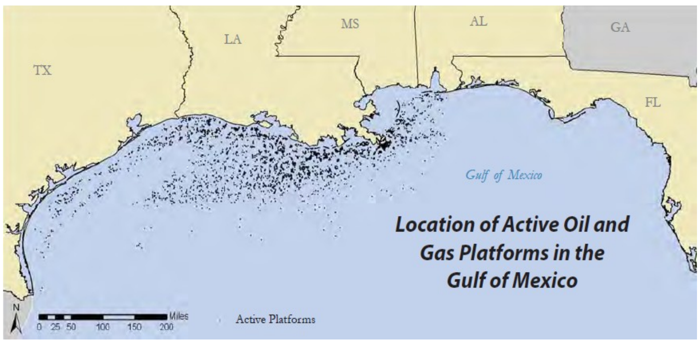


Figure 4: Oil and Gas Platforms in the GoM
Source:(NOAA. (Lead Author), 2012)

15 For more information on this topic, please read (Boy de la Tour, 2004: 58-59) and 'Production Platforms' on <http://www.oilandgasuk.co.uk/publications/Production/Production_Platforms.cfm>.

On top of that, the gulf region is also crucial as far as oil and gas import and export with other countries are concerned. The coastal region is furthermore essential regarding the transport of crude oil toward the North American continent thanks to important pipelines, such as the famous "Colonial pipeline" delivering hydrocarbons from Houston to New York (most US eastern coast states). In spite of their huge oil production potential, the US are increasingly dependent on oil importation. This unfavorable situation is mainly due to their over-consumption. (Sèbille-lopez, 2006:97-98)

The developments of the GoM have been essentially platform-based unlike the increasing number of floaters being used in the North Sea. This is probably due to the fact that oil fields in the GOM, even in deep water, are relatively close to the shore. Short pipelines of the shallower-water facilities can be easily tied and used to reach the extensions from deeper-water developments. From a geographical perspective, the US GoM is informally divided into two areas: "shallow water" and "deep water" (> 300 m)[16]. Additionally, there are two geological features characterizing the GoM region. The first is known as the Flexure Trend or Flex Trend[17] that generally runs through the intermediate depth zones. A second geological peculiarity is the presence of giant salt formations. About half of the Gulf continental shelf is thought to be underlain with these thick horizontal sheets of salt. (International Energy Agency. 1996: 84-85)

This geological area is governed by a series of rules concerning offshore drilling. In the following section, we shall discuss the legislative framework in which offshore drilling and its development articulate as well as the emergence of an environmental insight.

1.4 Legal Framework for Offshore Drilling in the US[18]

In order to understand American legislation regarding offshore activities, it is crucial to gain insight into the basic concepts of Continental Shelf (CS) and Outer Continental Shelf (OCS) (1.4.1). Next, we shall underline the regulatory evolution of offshore activities (1.4.2) and the liability regime developed in the US in order to respond to potential accidents(1.4.3). In a final part (1.4.4), we shall describe the various intersections between the offshore drilling regulation and other coastal legislative pieces. Because of the potential damage done by oil spills, a significant body of law has emerged in order to prevent large oil spills, to restore impacted zones, and to financially punish the spillers (Birkland and DeYoung, 2011: 473).

16 According to federal agencies, the dividing line is over 200 meters whereas industry often uses 304, 8 meters (1000 ft) as the turning point (International Energy Agency. 1996: 85).

17 The Flex Trend is an area in the Gulf reaching just beyond the edge of the continental shelf, this is a place where there is a flex in the seafloor (National Commission, 2011: 31).

18 For an overview of the different pieces of legislation related to oil and offshore drilling, please see annex 3.

1.4.1 The US Outer Continental Shelf (OCS)

The American offshore oil policy and strategy has been strongly conditioned by the legal notions of CS (Continental Shelf) and OCS. The CS (see figure 5) is an extension of the continental landmass (in the US, the width of the CS varies from 20km to 400 km) under the ocean (OCS Energy. s.d.), situated between the continent and the deep ocean (Patzek and Tainter, s.d.: 9). The CS waters are rarely deeper than 200 m (OCS Energy. s.d). As far as the OCS is concerned, it is a particularity of the US political geography. This is the part of the US CS, not falling under the jurisdictions of the individual American states ("Outer Continental Shelf". s. d.). According to the definition of the American Federal government, the US OCS consists of "the submerged lands, subsoil, and seabed, lying between the seaward extent of the States' jurisdiction and the seaward extent of Federal jurisdiction" (Patzek and Tainter, s.d.: 9). The US OCS is divided into four leasing regions: (1) the GoM OCS Region, (2) the Atlantic OCS Region, (3) the Pacific OCS Region, and (4) the Alaska OCS Region (MMS, 2009: i). Usually the OCS begins approximately 3 – 9 nautical miles[19] from shore (depending on the state) and extends 200 nautical miles[20] outward (OCS Energy. s.d.).

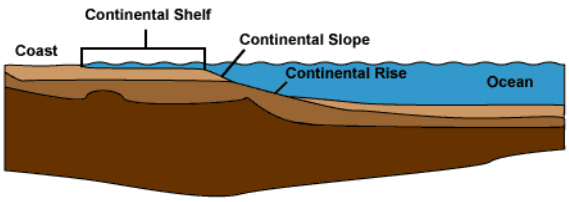


Figure 5: The Continental Shelf, including the State CS and the Federal OCS
Source: (OCS Energy. s.d)

In 1953, the Congress designated the Secretary of the Interior to administer mineral exploration and development of the entire OCS through the Outer continental Shelf Lands Act (OCSLA 1953) (Patzek and Tainter, s.d.: 9). The legal framework for OCS development not only defines jurisdiction, governs leasing procedures, and assesses responsibility for spill and cleanup, but also establishes the relationship that oil developments will have with other coastal activities (see 1.4.4). The resources hidden in marine waters surrounding the country have often led to tensions between the states and the federal jurisdictions. Indeed, the resources were not limited to the state waters and this implied conflicts. Originally, California and Louisiana claimed the revenues generated by drilling oil under marine waters adjacent to their states. The Submerged Land Act of 1953 settled the problem; and defined the boundary between the two areas. (Burroughs, 2011: 56 -57)

The OCSLA 1953, revised in 1978, defines how federal OCS oil may be exploited by private corporations. The crucial element in the procedure is the leasing of 4.8 km by 4.8 km tracts of seafloor to a

19 3 and 9 nautical miles represent 5.556 kilometers and 16.668 kilometers.
20 200 nautical miles represent 370.4 kilometers.

private corporation. This tract is governed by a variety of rules. The company pays a small fee in order to hold the land and as soon as oil is produced the corporation also pays a royalty to the government that often amounts to 16.66 % of the value of the oil produced. Initially, the revenues generated by OCS leasing (fees and royalties) filled almost exclusively the federal treasury, in spite of the fact that coastal states were the ones to invest in onshore infrastructures supporting offshore activities (more about that further) (Burroughs, 2011: 56 -57).

1.4.2 Offshore Legislation: Evolution

No legal regime existed before the 1970's to force oil spillers to be liable for and support cleanup costs and damages resulting from oil spills (Birkland and DeYoung, 2011: 480). A large number of oil spills in the 1960's, including the Santa Barbara (Ca) well blowout of 1969 (see 1.2.3), led to the apparition of a series of environmental laws and acts. The National Environmental Policy Act (NEPA) enacted by Congress in December 1969 and signed by President Nixon in January 1970, represents the first major environmental law in the US and is also known as the "Magna Carta" of environmental laws. NEPA rely on agencies, such as the Environmental Protection Agency (EPA), to implement its policies. These agencies are charged with assessing the environmental effects thanks to environmental impacts statement (EISs) of proposed actions before their potential implementation. (Council on Environmental Quality Executive Office of the President. 2007: 7*)* Besides environmental considerations, the NEPA also takes into account the socio-economic effects of the potential impacts (National Commission, 2011: 80).

Two year later, under the enactment of section 311 of the Federal Water Pollution Control Act Amendments of 1972[21] (Clean Water Act or CWA), liabilities were established for owners of oil facilities and for ship owners, at $8 million for fixed facilities and $100 per gross ton or $14 million for ships. Amended in 1978 the owner's' liability raised to $150 per gross ton for ships and $125 per ton for barges. The same act section also mandated a National oil spill Contingency Plan (NCP) and included the creation of a revolving fund to cover costs of potential future cleaning up after oil spills. (Birkland and DeYoung, 2011: 480) Furthermore, the Department of Interior (DOI) established the "Environmental Studies Program" in 1973, aiming at providing information regarding the geological, physical, biological, and chemical characteristics of offshore oil and gas leasing areas, but its focus slowly shifted to the assessment of resource management decisions (National Commission, 2011: 59).

As previously mentioned (see section 1.4.1, OCSLA 1953), the Congress passed the OCSLA Amendments in 1978 (revision of OCSLA 1953). This act created another oil spill fund providing for $200

21 Under the federal CWA, there exist requirements regarding any discharge of pollutants into navigable waters resulting from offshore activities (National Commission, 2011: 80).

million for cleanup and $25 millions liability limit for damages, the novelty is the unlimited liability for cleanup from spills resulting from offshore oil production. (Birkland and DeYoung, 2011: 480) On top of that, the 1978 revision incorporates several environmental considerations, including a schedule for the anticipated lease sales and the possibility for states to identify tracts or sales that would likely cause environmental damage, if developed by the oil industry. Furthermore the revision of OCSLA officialized the "Environmental Studies Program" of 1973, enforced the ability of states to determine if the development of a tract would harmonize with their local plans, and established the means to favor safer working conditions. (Burroughs, 2011: 58 -60)

In spite of these various environmental laws, the conflicting goals of environmental protection, energy independence, and revenue generation were not reconciled. Oil drilling was banned in some offshore regions due to environmental concerns, whereas elsewhere, such as in the GoM, some environmental protections and safety oversight were sometimes diminished (formally or unofficially) in order to support a dramatic expansion of offshore oil and gas production. (National Commission, 2011: 55)

From that time onwards (1978), there have been a number of significant changes or additions (positive or negative) to OCS law, such as the OCS Deep Water Royalty Relief Act of 1995. This act, by reducing the amount of royalty due to the government, was an attempt to encourage oil firms to invest financially more in costly deep-water (> 200 meters) oil development. The financial involvement and support of coastal federal states in the GoM for offshore oil production, as well as the costs they bear in case of environmental damages were recognized in the the Gulf of Mexico Energy Security Act of 2006. The act stipulates that coastal sates should receive some of the revenue generated by the OCS oil exploitation. Accordingly, 37,5% of offshore oil revenues must be apportioned to adjacent coastal states. Another piece of legislation awarded the states a share of 27% of the royalties due to the Federal Treasury and generated in waters 4,8 km seaward of the state-federal line. Until recently most OCS laws were implemented trough the DOI (Burroughs, 2011: 58 -60), but the catastrophe of the DWH, as we shall see further (chapter 4), has implied some changes in the legal and federal oversight organization of offshore drilling.

1.4.3 Liability Regime

The oil pollution liability regime has been developed on the basis of a series of various conventions, codes and resolutions that have been enacted by the United Nations (UN) International Maritime Organization (IMO). The 1973/78 International Convention for the Prevention of Pollution from Ships (Marpol) is the central treaty in this field. Marpol appeared as one of the measure that followed the

Torrey Canyon oil disaster in 1967[22]. Nevertheless, the 1989 Exxon Valdez oil spill[23] in Alaska required in the US further regulations which took the form of the Oil Pollution Act of 1990 (OPA) and imposed stronger studies of care on ship-owners and also included a right of action against operators. However, the current terms of application of claims for compensation within contracting states continues to be set by the International Convention on Civil Liability for Oil Pollution 1992 (CLC), and the International Convention on the establishment of an International Fund for compensation for Oil Pollution Damage 1992 (FUND), in force as of 1996. (Noussia, s.d.:138 -140)

The OPA is the most important law concerning pollution in the American legislation. The Act imposes a series of oil-spill planning, preparedness, and response requirements on fixed and floating facilities engaged in oil and gas exploration, development, and production on the OCS (National Commission, 2011: 80). OPA empowers natural resource trustees in governmental entities which have as objective to represent the public and ensure that the responsible parties take measures in order to restore the system damaged by the oil spill. To some extent, the responsible parties are liable for cleanup costs and damages consequent to the spill. The measures include removal costs and compensation for damages to or loss of resources, destruction of private property, loss of earning capacity, (R. Burroughs, 2011: 60), subsistence use, federal, state and local tax revenues, lost profits and the cost of providing additional public services (Noussia, s.d.: 146). The liability regime applicable in the case of the DWH blowout (2.4) as well as the financial compensations that can be expected from BP (4.3) will be discussed further in this work.

1.4.4 Interactions with Other Uses of Coastal Land and Waters

The body of law related to offshore oil development also encompasses specific provisions about possible interactions with other uses of the American coastal regions. As stated above, Environmental impact statements (EISs) are required by the NEPA (1969) in order to clearly identify the potential consequences of offshore oil activities. Carrying out an EIS gives the DOI (Department of Interior) the opportunity to compare different alternatives to leasing and to evaluate their respective effects on the surrounding environment. Indeed, offshore oil development impacts navigation, environmental quality, and natural organisms. (Burroughs, 2010: 60-61) An eloquent example of the interactions of offshore activities with other pieces of legislation appears in the relation between offshore exploitation and navigation. Through the River and Harbor Act, the Corps of Engineers influences the location of offshore platforms and activities because it has the responsibility to limit obstructions to navigation. Additionally, the US Coast Guard (CG) determines the various luminous signals used on platforms. (Bur-

22 The Torrey Canyon was a supertanker that wrecked while it was trying to take a short cut between Cornwall and Scilly. It resulted in the spilling of 36 million gallons of crude oil in the sea. (B.B.C. 2010.)

23 In 1989, the tanker Exxon Valdez ran aground in Prince William Sound (AK) and spilled approximately 10.9 million gallons of its 53 million gallon (about 163 million liters) cargo of Prudhoe Bay crude oil. It impacted over 1,100 miles of non-continuous coastline. It is the largest oil spill to date in U.S. waters. (Cleveland, Cutler J. 2010)

roughs, 2010: 60-61)

As far as environmental quality is concerned, the issue is addressed in the Clean Air Act (CAA) of 1990. This act regulates OCS air emissions and empowers the US EPA to impose to offshore facilities located within 40 km of the seaward boundary of a state, rules applicable onshore. On top of that, another act, the CWA (Clean Water Act) has a role in regulating the discharge generated by the separation of saltwater and oil/gas produced from wells in offshore areas. Three other significant laws focus on the biological variety of coastal areas and influence offshore oil activities. Firstly, the Endangered Species Act (ESA) requires from federal agencies that they consult the National Marine fisheries Service (NMFS) and/ or the US Fish and Wildlife Service (FWS) before undertaking any action. This provision is based on the assumption that oil development could harm a listed species. Moreover, the NMFS and FWS can issue a biological opinion about the reasonable and prudent characters of the activities pursued before development may go forward. Secondly, in case of potential negative impact on a mammal, the Marine Mammal Protection Act (MMPA) applies. (Burroughs, 2010: 60-61) The MMPA restricts activities injuring or harassing marine mammals. Besides, the National Marine Sanctuaries Act calls on consultations in order protect the marine sanctuary resources from potential negative impacts related to oil and gas leasing activities. (National Commission, 2011: 80) Thirdly, the (Magnuson-Stevens) Fishery Conservation and Management Act[24] (MSFCMA) requires agencies to analyze the potentially adverse impacts of oil and gas activities on fish habitat and populations, and provide conservation measures to mitigate those impacts (National Commission, 2011: 80). In spite of these various regulations environmental considerations are not always taken into account. Indeed, the OCSLA is above any other rules. The Act expressly singles out the GoM for less rigorous environmental oversight under NEPA. (National Commission, 2011:80-81)

After this general overview[25] (chapter 1) of the American offshore drilling industry and legislation, we shall presently deal with the core of this work, namely the analysis of the DWH catastrophe.

24 The MSFCMA is the primary law governing marine fisheries management in US federal waters (NOAA., s.d.).
25 The important acts can be found in annex 3.

2 The Deep Water Horizon Catastrophe

On April 20, 2010, an explosion and a fire devastated the DeepWater Horizon (DWH) drilling rig which was located in the GoM, 50 miles[26] (on the OCS) southeast of the town of Venice, near the Louisiana (Narayan, 2010: 58). This explosion killed 11 platform workers (Kleinnijenhuis, Schultz et alii, 2011: 97), and injured 16 others (National Commission, 2011: 17).

Figure 6: The 2010 Oil Spill in the GoM
Source: (Mitsch, 2010: 1608)

The explosion occurred while the DWH rig was drilling a well, called Macondo, owned by the BP oil company[27], under 5000 feet[28] water, and then over 13.000 feet[29] under the seafloor in order to reach the hydrocarbon reservoir below (National Commission, 2011: vi). A short while after the explosion, the rig sank to reach the bottom of the Gulf. Unfortunately, this happened just before the well on which the BP company was working could be sealed with a containment cap. As a result, crude oil began to leak from the blown-out well at an incredible rate. Approximately 60.000 barrels[30] are estimated to have entered the GoM each day. (Narayan, 2010: 58) During the gushing and after the sealing, the spill evolved as an ever-changing footprint, expanding to an area of over several hundred kilometers square (Mitsch, 2010: 1607). In total an estimated 780 000 m³ of oil has flown into the gulf during 87 days before the well was sealed (Tao et alii, 2011: 6).

This particular event exceeds from far the other oil disasters with which the US have had to cope in

26 50 miles represent 80.7 kilometers.

27 BP (plc UK) is a powerful oil company, and is one of the six largest Oil companies in the world (non-state owned companies) with Exxon Mobil (USA) Royal Dutch Shell (UK/Netherlands), Chevron Corp. (USA) ConocoPhillips (USA), and Total S.A (France). These companies are also known as supermajors or IOC (International Oil Companies). BP was founded in 1908 and has built its business thanks to Middle-East crude oil. After several misadventures, the company emerged in the 1990's with a greatly expanded portfolio of Gulf leases and assets and became the Gulf 's largest oil producer. (National Commission, 2011: 45)

28 5000 feet represent 1524 meters.

29 13 000 feet represent 3962.4 meters.

30 60.000 barrels represent 9 539 238 liters.

the past, such as the the Santa Barbara (Ca) Spill of 1969 (first major oil spill in the US, releasing 3 million gallons[31]) (Shigenaka, 2011: 989-990), the 1979 oil spill of Ixtoc well[32] (in Mexican waters, 3 million barrels[33]), and the 1989 Exxon Valdez oil spill (250 000 barrels[34]) (Narayan, 2010: 58). It became rapidly clear that the impact of the DWH blowout on the coastal inhabitants and ecosystems would be enormous and that the the economic sector would suffer losses reaching ten thousand of dollars (National Commission, 2011: vi).

We shall know attempt to understand what exactly happened. A first section (2.1) will focus on the acquisition of the well and its exploitation before the blowout (National Commission, 2011:89-90). Moreover, the company, industry and management failures, as well the legislative shortcomings resulting from a lack of active environmental and safety regulations will be discussed. If the drilling actors are undoubtedly responsible for the Macondo blowout, the government has also its share into it, through unsatisfactory legislation and risky non-regulation (2.3). Another section will be devoted to the identification of the liable parties (by using the theory presented in the first chapter, section 1.4) that will have to pay in order to compensate and restore what has been damaged (2.4). Furthermore, the crisis itself and how it was managed, as well as the problems encountered while mitigation efforts were deployed, will also be the focus of this second chapter (2.5).

2.1 The Macondo Well : Acquisition and Exploitation

The Macondo well was purchased by BP in March 2008, the company paid a little over $34 million to the Minerals Management Service (MMS) for an exclusive lease in order to drill in Mississippi Canyon Block 252, a lease area of 9 miles² [35] plot in the GoM (National Commission, 2011:89). Following the logic of the American oil industry, BP was not alone to manage and exploit the well. Indeed, the British giant worked on Macondo in close collaboration with Anadarko Petroleum and MOEX USA. BP and its partners had foreseen $96.2 million and 51 days of work for the completion of the well. However, the well had been challenging and the work had dawdled. As of April 20, the drilling of the well was nearly six weeks behind schedule and more than $58 million over budget. (National Commission, 2011:2)

Originally, the Macondo well had to be drilled by another giant rig, the Marianas. The drilling process

31 3 million gallons represent 11 356.23 m^3.
32 The Ixtoc blowout is a blowout that occurred in the Mexican GoM, three decades ago (Jernelöv, 2010,353-354). The pressure in the well was far too high and the crew on the drilling rigs has neglected warning signals and proceeded as usual. In the case of the Ixtoc blowout, the solution was found after 9 months by the drilling of relief wells. The area affected by the Ixtoc slick was far less vulnerable than the wetlands of Louisiana. (Jernelöv, 2010, 363-365)
33 3 million barrels represent 476 961.9 m³
34 250 000 barrels represent 39 746.825 m³
35 9 miles² represent 14.49 kilometers square.

had reached more than 9,000 feet[36] below the ocean surface (4,000 feet[37] under the seafloor) when Hurricane Ida struck the GoM and damaged the rig. The rig needed to be repaired, consequently, another rig was called to complete the drilling and sealing. The platform that took over was the DWH. Both Marianas and DWH were semisubmersible rigs possessed by Transocean[38]. The DWH ($350 million) was considered as the best rig of the Transocean's fleet. Since 2001 the platform was working in the GoM and had been under contract to London-based BP. (National Commission, 2011:2)

DWH arrived at the Macondo lease site on January 31, the crew was composed of about 126 people, including Transocean employees, BP men, cafeteria and laundry workers and workers contracted for specialized jobs[39] (National Commission, 2011: 3). After its arrival, the first task of the rig was to lower its giant blowout-preventer (BOP)[40] (see figure 7 and 8) onto the wellhead put in place by the Marianas. Once the BOP is put in place, every material needed in the well, such as drilling pipe, bits, casing, and mud, passes through the BOP. The DWH's BOP was composed of various features designed to seal the well if necessary. (National Commission, 2011: 92-93)

Figure 7: A BOP (Blowout-Preventer or Christmas Tree)
Source: (Cavnar, 2010)

Figure 9: A ROV (Remote Operated Vehicle) System
Source: ("Sub-Atlantic - Electric ROV Systems and ROV System Components", s.d.)

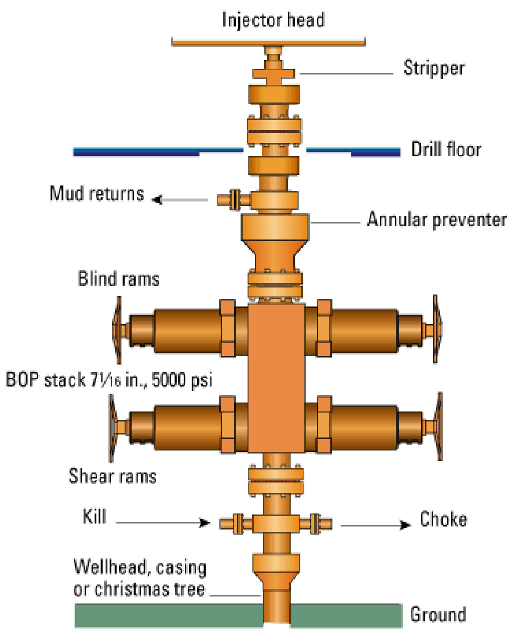


Figure 8: The BOP's Constitutive Devices
Source:
(M. Steve, 2010.)

36 9 000 feet represent 2743.2 meters.
37 4000 feet represent 1219.2 meters.
38 The company was founded in Louisiana in 1919 and is currently the world's largest contractor of offshore drilling rigs (National Commission, 2011:2).
39 ie. Halliburton cementers, mud loggers from Sperry Sun (a Halliburton subsidiary), mud engineers from M-I SWACO, a subsidiary of Schlumberger (international oilfield service provider), remote operated vehicle (ROV) technicians from Oceaneering, or tank cleaners and technicians from the OCS Group. (National Commission, 2011:3)
40 The Blowout preventer (BOP) is a stack of enormous valves that rig crews use both as a drilling tool and as an emergency safety device (National Commission, 2011: 92)

2.2 Immediate Reason of the Explosion

The blowout of the Macondo well took place on April 20, 2010 during one of the most sensible step related to drilling activity. Indeed, the drilling of the well had been completed and the platform was preparing to move. During the drilling process, well-safety is assured thanks to a heavy fluid, called mud (nearly twice the weight of sea water) injected continuously (Hopkins, 2011: 1422). The objective of a drilling platform is to drill a path to the hydrocarbon reservoir by simultaneously controlling the enormous pressures (very high in deepwaters), and avoiding any fracture in the geologic formation containing the reservoir. Consequently, the counter-pressure generated by the drillers inside the well-bore must be adapted to the reservoir pressure (pore pressure) that pushes hydrocarbons into the well. To obtain equilibrium, drillers use drill pipe, casing, mud, and cement in a series of calibrated steps. The drilling mud simultaneously lubricates and cools the drill bit during the drilling process but is also the key element for controlling the hydrocarbon pressure in the well. If the mud is too light, it can generate a kick, when fluids such as oil and gas enter the well. These fluids can potentially trigger a blowout if the problem is not controlled in a timely fashion. In contrast, if the mud weights too strongly on the formation, it can fracture the surrounding rock, potentially leading to a leakage of the mud into the formation. (National Commission, 2011: 90) Before leaving the location, the column of mud raising from the sea bottom must be replaced by sea water. Safety is ensured if the casing that has been inserted into the well to shut it, is completely sealed in order to prevent any influx of oil or gas into the bottom of the well. Once the casing is inserted, the effectiveness of the seal must be tested. This is realized by reducing temporarily the pressure inside the well. Observers are supposed to check the process and verify whether there are signs revealing that fluids flow out of the top of the well or that the pressure increases. If one of these two signals is noticed, it means that the well is flowing, implying that if the mud is completely removed the well risks to blow. (Hopkins, 2011: 1422)[41]

In the case of the DWH, the rig staff misinterpreted the results of the testing, what provoked the terrible disaster. Indeed modifying the pressure in the column is a crucial step in the sealing of a well. When mud is replaced by water the weight of the fluid exerted in the well becomes lighter. The volume of fluid going into the well should be compensated by what is coming out. If more is coming out than is going in, the well is flowing and needs to be shut immediately so that the situation can be analyzed and rectified. The catastrophe occurred because the staff members proved to be incompetent or inattentive[42] to the alarming signals. (Hopkins, 2011: 1422)

41 Usually, after sealing a well, the drilling rig must secure the well through a process called “temporary abandonment. This operation is followed by the removal of the riser (piping that connects the drilling rig at the surface with the BOP at the wellhead on the seafloor.) and BOP. Afterward the job of “completing” the well is given to a smaller (and less costly) rig, which installs hydrocarbon-collection and -production equipment in order to make way for the production rig. (National Commission, 2011: 103)

42 Accidents caused by human failure seem to represent the majority. Indeed, 80% of high-consequences accidents fall in the category of human-factor uncertainties (hubris, arrogance, greed, ignorance and laziness). 60% of them are due to trouble in operations and maintenance. (Bea, 2010)

Furthermore as we shall see in the following section, the quality of the products and mechanical elements used during the drilling, including the cement and BOP were dubious. Indeed, the BOP completely failed to function as a result of poor maintenance. Moreover, the quality of the cement that was used in the well to strengthen the borehole and to prepare the well for production was questioned. From the tests, it seems that the cement used was not as strong as needed, and was incapable of preventing the gas from moving up the well. In addition to that, MMS whose laxity and corrupted attitude is explicitly broached in the following section, knew of a study that the BOP was not strong enough to shear and plug the deep-water pipes used at the well's depth. (Birkland and and DeYoung, 2011: 475)

2.3 Causes and Origins

Now we shall focus on the various failures that have led to the explosion. As we shall see, there exist a multitudes of causes explaining the blowout, including legal, human, practical and mechanical shortcomings. Immediate failures (2.3.1), an inefficient internal safety culture, a negligent oil sector management (2.3.2), and regulatory inconsistency (2.3.3) are at the core of the tragedy. Indeed, the Macondo blowout has resulted from as series of individual missteps and oversights by BP, Halliburton, and Transocean, which government regulators failed to anticipate and prevent from occurring because of a lack of authority, necessary resources, and technical expertise. (National Commission, 2011: 115)

Before going further it is worth mentioning that a specific commission called “the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling” has been created by President Obama on May 21, 2010. The Commission's objectives were to analyze the causes and impacts of the disaster but also to formulate recommendations for the US government to prevent and mitigate the impact of any future spills resulting from offshore drilling (Encyclopedia of Earth, 2011).The final report of this commission has been crucial in our understanding of the DWH event (and for the redaction of this paper).

2.3.1 Acts of Negligence and Missteps

Negligence was at the core of the failures that occurred on the rig. Three elements ensure a better control of pressure and could have prevented the blowout and the following explosion and spill from happening: the cement at the bottom of the well, the mud in the well and in the riser, and the BOP. But these safety devices were compromised (National Commission, 2011: 114-115). In the days following the blowout, BP has been accused by a US congressional committee of ignoring warnings, violating its own safety guidelines and choosing risky procedures with as first objective to cut cost and save time. Negligence mainly concerned technical and mechanical elements that have certainly prevented the safety automatic mechanism from being successful. According to this committee, BP made five fatal decisions, illustrating the oil company's desire to put profit before safety. (Pilkington, 2010) Here are the accusations:

(1) BP used a cheap design for the well, preferring a single casing rather than the more sophisticated design recommended by its own analysis;
(2) the company only used six centralizers despite being advised to use 21 by its contractor Halliburton;
(3) the acoustic tests designed to measure the efficacy of the cementing in the well to blog off gas flow was not carried out on a decision of BP, the process would have cost $128,000 and lasted an extra 12 hours;
(4) the proper working of the new well system implying the circulation of drilling mud from its bottom to the surface was not controlled; and
(5) the firm made the choice not to install a primordial piece of equipment: a “lockdown sleeve”. It has as function to lock the wellhead and the casing at the level of the sea floor. The absence of this device could explain the blowout. (Pilkington, 2010)

These five accusations clearly illustrate the carelessness and complacency that BP has shown in the hours preceding the fatal blowout (Pilkington, 2010). Despite the obvious responsibility of the oil corporation, BP will nevertheless managed to save partly its image and to manipulate the public opinion thanks to a well-thought communication strategy (see 2.5.7). The missteps mentioned here above reflect the failures inherent to oil industry management in the US and extend beyond BP, to its contractors also serving many other corporations of the oil sector (2.3.2). Nevertheless this systemic negligence also results from the government's incapacity to provide effective regulatory oversight of offshore drilling (2.3.3). (National Commission, 2011:122) These two elements are going to be discussed in the two following sections.

2.3.2 Industry Management and Self-policing Failures

Exploration and production of offshore oil and gas are risky. But these risks can be reduced, with proper incentives and disciplined systems, sustained by committed leadership and effective training (National Commission, 2011: 218). In this section, we shall first shed light on the shortcomings of the oil and gas industry by identifying management failures (2.3.2.1). Then, we shall scrutinize BP's safety culture in order to understand the inherent attitude of the corporation toward its offshore activities (2.3.2.2).

2.3.2.1 The Offshore Oil and Gas Industry

Offshore activities especially oil and gas exploration and exploitation are risky enterprises. Drilling a well and the risks that it represents are not negligible. Furthermore, drilling platforms constitute dangerous environments with their heavy equipment, hazardous substances (chemicals and flammable oil and gas), and distant location from shore, in contexts where weather and water conditions are unpredictable. In the US, safety standards of the oil and gas industry were until recently mainly developed by the American Petroleum Institute (API). This organism relies on a serious and longstanding technical expertise and produces standards, recommended practices, specifications, codes, and so on, that had most of the time been adopted by the US DOI. But it is obvious that API's reliability to set standards for drilling safety is compromised by its role as the industry's principal lobbyist. Indeed, API regularly disapproved of and resisted agency rule-makings, favoring only decisions promoting an autonomous industry free from governmental oversight. In some ways, API's shortfalls have undermined the entire federal regulatory system. (National Commission, 2011:.224-225)

Quite surprisingly, risks and safety appear to be approached differently according to the part of the globe where companies operate. Indeed, from 2004 to 2009, fatalities in the offshore oil and gas industry were significantly higher (more than four times) per person-hours worked in US waters than in European waters, even though companies operating in these waters are frequently the same. This striking discrepancy strengthens the point of view suggesting that the problem is not so much dependent on the business itself, but is rather determined by specific cultures and regulatory systems under which the numerous members of the industry operate. (National Commission, 2011:224-225)

The most significant problem at Macondo is to find in industry management. Indeed, most shortcomings can be identified as typical management (in the decision-making process) and communication (between BP and contractors) failures. These two elements along with effective training of key engineering and rig personnel would have prevented the incident. (National Commission, 2011:122-126) Here is a list of the main mistakes made before the blowout and resulting from failures in industry management:

(1) "BP's management process did not adequately identify or address risks created by late changes to well design and procedures"**.** Every change to well design is subject to a management of change (MOC) process, except when they occur in the weeks and days before implementation. (National Commission, 2011:122-123)

(2) "Halliburton and BP's management processes did not ensure that cement was adequately tested." Halliburton was not in control of the situation regarding laboratory testing and could not make sure that the test results were rigorously analyzed or communicated (National Commission, 2011:123).

(3) BP, Transocean, and Halliburton failed to communicate adequately**.** Information was compartmentalized. BP did not share important information with its contractors, or sometimes internally. Consequently, people involved were driven to make critical decisions without a full understanding of the context. (National Commission, 2011:123-124)

(4) "Decision-making processes at Macondo did not adequately ensure that personnel fully considered the risks created by time- and money-saving decisions". Most decisions made by BP and its contractors resulting in higher risks were motivated by consideration of time and money (National Commission, 2011:125-126).

Another major failure of the oil industry management and culture is illustrated by the inefficient VIP's visit (an advocated practice of the oil industry) seven hours before the blowout. Indeed in the hours preceding the disaster, the platform was visited by a group of four company VIPs (from BP and Transocean) whose role was to supervise and evaluate safety on the rig. The objective of the visit was management visibility, they were still touring the rig when the explosion took place and were among the survivors. During their visit, indications that the well was not sealed and was at risk of blowing were clear. Nevertheless the signs were missed, or misinterpreted by the staff. What is surprising is that the four VIPs had all experience as drilling engineers but did not notice the sign of the impeding disaster. Ironically the main object of the visit next to management visibility was to emphasize the importance of safety. A strong focus on safety issues would have been expected from the VIP's since four months earlier, Transocean had experienced a near disastrous blowout in the North Sea, off the Scottish coast. After this misadventure, Transocean management wrote a advisory report for every member of the company about the incident reaffirming the importance of staying focused and alert to any significant unusual incident. In this context it would have been appropriate to ascertain that the communication concerning the lessons from the North Sea incident had reached the Macondo well crew. (Hopkins, 2011: 1421-1423)

2.3.2.2 BP's Safety Culture

Safety Culture is "the set of enduring values and attitudes regarding safety issues, shared by every member of every level of an organization. The term refers to the extent to which every individual and every group of the organization is aware of the risks and unknown hazards induced by its activities; is continuously behaving so as to preserve and enhance safety; is willing and able to adapt itself when facing safety issues; is willing to communicate safety issues; and consistently evaluates safety related behavior" (European Aviation Safety Agency, 2011). BP has often insisted on the importance of safety in its worldwide corporation. But safety culture does not seem to be a crucial element for the company in spite appearances. Indeed, BP's safety shortcomings have been chronic. The oil company has provoked several disastrous incidents revealing an approach toward safety management lacking seriousness and focusing on occupational safety (National Commission, 2011: 218) rather than on process safety. Occupational safety or personal safety concerns the protection of the safety, health and welfare of people at work whereas process safety concentrates on major accident hazards associated with releases of energy, chemicals, and other hazardous substances (Energy Institute, 2011). By focusing on personal safety, the company has not succeeded in building up consistent and reliable risk-management processes and has been unable to provide enough commitment to safety (National Commission, 2011:218). BP's lack of safety is illustrated by the following recent accidents in the company's installations:

- the refinery accident in 2000 in BP’s Grangemouth Complex in Scotland, caused by failure in safety management resulting in a succession of mistakes leading to a power distribution failure, (National Commission, 2011:218)
- the rupture of a gas line on BP Forties Alpha platform in the North Sea in 2003, causing the flooding of the platform with methane (fortunately, no explosion occurred thanks to the wind and the absence of spark) (National Commission, 2011:219),
- the explosion of a refinery in Texas in 2005 killed several workers (Dillistone et alii, 2011: 227),
- the Prudhoe Bay (AK) pipeline leak in 2006. BP had been aware of the problem for several years, but had taken no significant measure. (Kirsh, 2010: 296)

After the catastrophe of the Texas refinery, BP changed its approach toward safety and became a recognized corporation as far as safety management is concerned. But the incident of Prudhoe Bay disappointed the public and the stakeholders, understanding that the company did not meet its environmental promises. BP's image was temporally tarnished. (Dillistone et alii, 2011: 227) Recently, BP's safety records in the GoM were considered excellent (National Commission, 2011:222), at least until the night of April 20, 2010. This is probably due, to a progressive slackening of BP's vigilance resulting from its good records and the belief that no accident could occur. This combined with industry management failure and the government laxity (subject of the following section) caused the blowout.

However, in the wake of the explosion, BP ordered an internal investigation. 26 recommendations specific to drilling were issued that BP accepted and is currently implementing across its worldwide drilling operations. (BP. s. d.)

2.3.3 Laxity of the Federal Regulation

According to Robert Bea, engineer at the University of Berkeley (Ca), the crucial responsibility of the disaster is incumbent on the government. The engineer uses the metaphor of the pares and the children to make his point. Indeed, says he, government is the parent and industry the children. (Bea, 2010) Indeed, the legal oversight provided by the American government failed to prevent the mistakes made by the oil industry.

MMS (now reorganized, see further[43]) which until recently was the US authority responsible for collecting the billions[44] of dollars of revenues generated by offshore drilling activities and promoting offshore drilling safety as well as environmental protection (National Commission, 2011: 55), was ineffective in adopting structuring regulations to address the risks of deepwater drilling. Most crucial aspects regarding safety were left to industry to decide without agency review. MMS is not the only federal agency responsible for these failures. The unsatisfactory situation was the result of a combination of factors, among other things, the resistance of the oil industry (including API), members of Congress (especially Conservatives), and several administrations to take strong actions. Consequently, no adequate legal framework was in place to prevent the disaster, deal with the crisis or restore afterward. (National Commission, 2011: 126-127)

After the rig staff of the DWH failed to notice the danger signals, the BOP should have worked and shut the well automatically. Nevertheless the process failed for several reasons, among which the lax inspection and enforcement regime under which offshore wells and drilling were proceeded. Indeed, MMS (agency of the DOI) is under the OPA responsible for oil spill planning and preparedness, and for select response activities regarding oil and gas industry. (National Commission, 2011: 83-84) But the agency, rather than carrying out serious surveys, relied on, and accepted inspection reports written by the oil industry and signed by inspectors (Birkland and DeYoung, 2011: 474).

The weakness of MMS' control is mainly due to its ambivalent role. Indeed, MMS had several missions, such as selling oil leases, collecting revenues, and regulating the safety of offshore exploration and production. The agency gained its revenue from actual quantities of oil and gas transferred to the federal government for resale on the oil and gas markets. Logically, this represented a powerful incentive to promote oil production and to forget safety. In addition, MMS's pro-industry orientation generated some significant instances of corruption. The CWA requires that oil companies have regional and facility spill response plans. However, it was widely known that BP's regional plan was riddled with inconsistencies. (Birkland and DeYoung, 2011: 474), but the response plan was nevertheless approved by MMS without further investigation. (National Commission, 2011: 83-84)

Besides being incompetent and partially corrupted, over time, MMS increasingly showed incompetent to oversee the offshore oil industry. Indeed, because of a lack of resources, the agency was unable to keep pace with industry expansion and increasing reliance on more demanding technologies (National Commission, 2011: 68) The shortage of financial resources also extended to the US Coast Guard, re-

43 Following the incident, some reorganizations have taken place inside the DOI see further, chapter 4.

44 1 billion = 1,000,000,000 in the Anglo-Saxon world but 1 000 000 000 000 in other countries such as Belgium.

sponsible for regulating vessels[45], and other units engaged in OCS activities. (National Commission, 2011:75) This lack of financial resources also contributed to the failure of a whole regulatory system.

2.4 Liability for the Accident

Now with the help of what we have learned earlier (section 1.4: Legal Framework for Offshore Drilling in the US), we shall now discuss the liability in the blowout of the DWH. In order to do so, it seems crucial to identify all the stakeholders directly and indirectly involved in the Macondo well drilling and sealing. The Macondo well tract was acquired in 2008 by BP Plc along with its partners Anadarko Petroleum Corp. and Mitsui Oil Exploration Co. (MOEX). BP, being the majority stakeholder, the company has largely been identified with the spill. The two other corporations, Anadarko Petroleum Corp. and Mitsui Oil Exploration Co. own respectively 25% and 10% stakes and could consequently also be considered responsible and forced to share in the cost of responding to the oil spill. Furthermore, the oil platform was being leased by Transocean Ltd. to BP Plc, and just before the explosion on April 20, 2010, Halliburton Co. had been engaged in cementing operations on the well. Additionally, the platform's BOP (technological device preventing blowouts), manufactured by Cameron International Corp. did not prevent the explosion and fire from occurring. From all this we can conclude that no single actor and factors caused the Macondo well tragedy, but rather a sequence of failures attributable to several actors. (Noussia, s.d.: 141-143)

Each of these actor could be prosecuted for the damage or financial losses even if until now BP has been the one to pay the bill (more about financial compensations in the final chapter). But prosecution is not always obvious because a baseline is necessary. Indeed, claims concerning natural resources damages can be brought by the government if a baseline of pre-spill conditions can be established. This is particularly difficult in areas such as ports and commercial areas that were already partly polluted before the spill. As previously mentioned, the USA has an explicit oil spill liability mechanism to address events like the DWH incident. Under the OPA, a system of 'financial liability' has been created which limits the extent of liability. As far as offshore facility is concerned liability limitation are based on calculations of a worst-case oil spill discharge. As lessee of the drilling area, BP Plc is responsible for removal and government response costs, property and natural resource damages and economic losses resulting from the oil spill. However, even if a corporation is responsible for all removal costs, offshore facility's liability for economic and natural resources damages is limited to $75 million per incident. Expenses exceeding the cap could be paid by the Oil Spill Liability Trust Fund, which is financed through a fee on domestic and imported crude oil. In the case of BP, the liability has not been limited to $ 75 million (removal costs) and is subjected to an exception due to its gross negligence or

45 The definition of vessels applies to most drilling rigs and some production platforms. This imply that CG are partly responsible for regulating their safe operation. (National Commission, 2011:75)

willful misconduct. Regarding the subcontractors: Transocean Ltd., Halliburton Co. or Cameron International Crop, the OPA does not limit their liability. Similarly, OPA does not limit actions for contribution or contractual indemnification. (Noussia, s.d.: 147) Furthermore, the responsible parties will also pay fines if the violation of federal laws (such CWA, CAA, ESA...) is recognized. Under CWA, these penalties could amount to $4.5 billion - $21 billion. The sum owed will moreover depend upon findings of negligence and the calculation of barrels discharged. (National Commission, 2011:211)

Let us now have a closer look at the crisis management in itself.

2.5 Crisis Management

The crisis management that followed the DWH explosion, covers a wide range of issues, and goes from sealing the well (2.5.1) to communication strategies by BP in order to reduce the negative impact of the spill on the corporation's image (2.5.7). Political shortcomings (2.5.2), mitigation efforts (2.5.3), safety, economy (2.5.4), wildlife protection (2.5.5), and the fate of Macondo oil (2.5.6) are also among the elements that will be discussed in the following sections.

2.5.1 Response : Sealing the Well[46]

The response began just after the explosion on April 20, 2010 when the Coast Guards (CG) arrived in the neighborhood of the rig to extinguish the fire and search for survivors, none among the eleven missing people was found. Joseph Paradis who was the Captain of the Marine Safety, became the first Federal On-Scene Coordinator under the National Contingency Plan (NCP). This plan (under NEPA) is a set of federal regulations prescribing the government's response to spills and and other hazardous materials. Accordingly, the CG is the authority responsible for responding when a spill occurs in coastal waters. On April 21, an oily sheen became visible around the area of the explosion and grew progressively. Consequently the number of CG personnel and resources directly involved increased significantly and Rear Admiral Mary Landry took over as Federal On-Scene Coordinator. Despite the various efforts, the rig sank, on April 22, with 700 000 gallons[47] of diesel fuel still on board. Meanwhile, the CG established an Incident Command Post (ICP) in a BP facility in Houma (La), and in Houston (Tx) where BP had also formed a command post in its corporate headquarters. These ICPs, along with others established later, rapidly became the nerve center of the various response operations directed by the Federal On-Scene Coordinator in the framework of the government's Unified Command. Under the NCP, the Unified Command integrates BP, federal and state officials in order to

46 In order to realize this part of the work, we have heavily relied on the report of the National Commission's investigation on the blowout and subsequent spill. Indeed, the commission has provided the most complete document as far as the succession of events is concerned.

47 700 000 gallons represent 3182.26 m³.

provide an efficient response. On April 23, the CG also established a Unified Area Command (UAC) in Robert (La) including representatives of the federal government and of the various coastal states (Louisiana, Alabama, Mississippi) susceptible to be impacted by the spill. Federal agencies such as the National Oceanic and Atmospheric Administration[48] (NOAA) and MMS also took part in response effort by sending emergency responders to the UAC and the ICPs. (National Commission, 2011:130-131)

Even before the rig sank, BP and Transocean directed their attention to the BOP stack of the well. On April 21, BP and Transocean began using a ROV in an attempt to close the BOP and stop the flow of oil and gas. On April 23 and 24, two leaks were discovered on the broken riser. Following this discoveries, BP considered other ways of controlling the well. A primary option was to drill a relief well and enable a drilling rig to pump in cement to stop the flow of oil. But this operation would take more than three months. In spite of this consequent laps of time, the oil company, started drilling a relief well on May 2, and on top of that a back-up well advised by Interior Secretary Salazar on May 17. (National Commission, 2011: 131-132)

In the meantime, responders began to focus exclusively on the large amounts of oil gushing from the well. Under the NCP, CG are supposed to supervise the oil-spill response in coastal waters by using response equipment that must be provided by private oil-spill removal organizations working for the oil company responsible for the catastrophe (here BP). At the peak of the response effort, roughly 45,000 people participated including active-duty members of the Gulf, reservists and responders sent to the Gulf region by federal agencies, such as EPA and NOAA. (National Commission, 2011: 132- 133)

The disaster became a "Spill of National Significance" (SONS) on April 29. This term refers to a spill "that due to its severity, size, location, actual or potential impact on the public health and welfare or the environment, or the necessary response effort, is so complex that it requires extraordinary coordination of federal, state, local, and responsible party resources to contain and clean up the discharge." Following this designation, Admiral Thad Allen[49] was chosen to become National Incident Commander (NIC) and took over the role of the Federal On-Scene Coordinator regarding communication with impacted parties, and coordination between federal, state, local, and international resources at the national level. He consequently became the face of the federal response, whereas the Federal On-Scene Coordinator kept overseeing day-today operations. (National Commission, 2011: 136-137)

48 NOAA is a federal agency within the Department of Commerce, advancing the understanding of and ability to anticipate changes in the Earth's environment, thanks to an improved ability to make scientifically informed decisions, and the conservation and management of ocean, coastal, and Great Lakes' resources (Lubchenco, 2011).

49 Admiral Allen, the outgoing Commandant of the Coast Guard is famous in the GoM thanks to his oversight of the federal response to Hurricanes Katrina and Rita. Indeed, his leadership had widely been considered a success. (National Commission, 2011: 136-137)

In spite of BP's willingness to stop the oil from gushing into the GoM, the oil company had no available, tested technique to operate at such a depth. Indeed, BP had to find other solutions to contain the blowout by adapting shallow-water technology to the deepwater environment, or by creating new technological devices. (National Commission, 2011: 135) In early May, BP's initial efforts to stop the flow of oil ceased to focus on the BOP (first attempt) that until then had seemed to be the best option (National Commission, 2011: 137-138) BP engineers simultaneously worked to contain the flow, drill a relief well and recover oil until they could eventually cap the well (87 days after the blowout). Within days, BP proposed a second solution by considering the use of a large containment dome. It consisted in placing a dome or cofferdam over the largest leak, channeling oil and gas to a ship on the surface thanks to a a pipe. This first alternative failed mainly because of the inaccurate assessments of the quantity of oil flowing from the well. On May 16, BP deployed during 9 days a new collection device: the Riser Insertion Tube Tool (third attempt), composed of a tube fitting into the end of the riser, carrying oil and gas up to a ship. This tool was able to recover about 22,000 barrels[50] of oil. (National Commission, 2011:145-146)

Subsequently, BP tried a new strategy consisting in killing the well completely, thanks to a "top kill" and a "junk shot." (fourth attempt) A top kill implies pumping heavy drilling mud into the top of the well to force the flowing oil back down the well. The top kill is complemented by a junk shot that involves pumping material (ie. tire rubber and golf balls) into the well in order to slow or stop the flow before using the top kill. After the third unsuccessful attempt, this strategy was abandoned. (National Commission, 2011:149-150) BP's next step was an attempt to install a second BOP (a capping stack) on top of the existing one (fifth attempt) (National Commission, 2011:158). In the meantime, in order to collect a portion of the gushing oil, BP cut off the portion of the riser still attached to the BOP and install a "top hat", a collection device connected by a pipe to a ship. By June 8, the latter was collecting approximately 15,000 barrels[51] of oil per day. BP also designed a system to collect oil and gas through the choke line of the BOP which collected about 10,000 barrels[52] of oil per day. (National Commission, 2011:159)

By late June, BP was deploying a "capping stack,"that would enable them to shut in the well. (National Commission, 2011:161-162). Its installation was completed by July 12. On July 15, for the first time in 87 days, no oil flowed into the GoM thanks to the closure of the capping stack. However, keeping the stack shut and eventually stop the flow of oil had to be balanced with the possibility to cause an underground blowout because of the high pressure in the well. After some discussions between BP, the government and other actors, the decision was made to keep it shut. Four days later, on July 19, BP raised the possibility of killing the well before the completion of the relief well, thanks to a strategy

50 22 000 barrels of oil represent 3497.72 m³.
51 15 000 barrels represent 2384.81 m³.
52 10 000 barrels represent 1589.87 m³.

called the static kill and involving to pump heavy drilling mud into the well to push oil and gas back into the reservoir. The process would not be too difficult given the relative immobility of oil and gas thanks to the capping stack. Both the static kill and following cementing of the well were a success. BP finished its first relief well, in mid-September, and intercepted the Macondo well, where it pumped cement in order to permanently seal the reservoir. On September 19, 152 days after the blowout, the Macondo 252 well was effectively dead. (National Commission, 2011: 169)

2.5.2 Political Shortcomings

An intergovernmental conflict became quickly observable during the crisis. This conflict stemmed from state-level misunderstandings. According to the National Oil Spill Commission , the conflict resulted from the fact that the states assumed that response would proceed under a much more familiar model: the Stafford Act (SA). This act is the framework according to which the federal government operates when response and assistance are needed at the state-level and in localities impacted by natural disasters or industrial accidents. However, in the case of oil spill response, most federal authorities proceed under the NCP which implements the CWA (as amended by the OPA 90), and implies a federal response to oil spill quite different from the federal response to natural disasters. Apparently the states were confused by the two different regimes. Nevertheless, the confusion was not quite logical since the federal government had refused to invoke the SA in the Exxon Valdez oi spill in 1989. (Birkland and DeYoung, 2011: 475-476) The choice to act through NCP was furthermore strategical since under this regime people can seek compensation from oil companies and their contractors whereas this does not exist in the case of natural disasters. (Birkland and deYoung, 2011: 476-477) Four majors complaints were made by state and local governments concerning the DWH crisis management in the GoM:

(1) firstly, several governors among whom Governor Jindal (La) complained that the federal coordination was insufficient and that the consultation of state governments was unsatisfactory,

(2) the second criticism targeted the federal government's bureaucracy and red tape slowing down local self-help efforts,

(3) thirdly, there was the general perception that no one was actually in charge of the oil response. The effort was mainly led by the US CG, particularly after the spill was declared to be a SONS. For a SONS, the response actions are supervised by a NIC whereas the technical initiatives are supposed to be undertaken by the spiller and its contractors (as defined in the CWA). BP took responsibility and invested millions of dollars in order to response the most adequately possible. The oil company's efforts were so central to stop the leak that many felt that the federal government had delegated response leadership to BP. This was absolutely not the case since most actions that BP implemented, were undertaken with the approval of the NIC.

(4) A fourth complaint concerned the amount as well as the speed of federal aid to localities impacted by the slick. (Birkland and deYoung, 2011: 476-477)

This lack of understanding between the state and federal levels has certainly not favored the adequacy of the oil response that will be the subject of the following section.

2.5.3 Mitigation and Remediation Measures

The DOI with other State, Tribal and Federal partners act as trustees for 'American' resources. Trustees are responsible for the identification of the natural resources injured and for determining the extent of the injuries, recovering damages and planning and carrying out natural resource restoration activities. These different activities are managed under the Natural Resource Damage Assessment (NRDA) and Restoration Program whose main objective is to restore injured ecosystems. The authority to carry out these activities is provided by three important laws: the “Environmental Response, Compensation, and Liability Act of 1980”, the CWA and the OPA. Other federal agencies are also responsible for the American Nation's natural resources, among which the NOAA, US Forest Service, Department of Defense, and Department of Energy. In the case of oil pollution in marine environment, the source of the discharge is at the very beginning contained by the CG, the EPA, State agencies and the responsible party, here BP. (US Fish and Wildlife service,“The Natural Resource Damage Assessment and Restoration Program” 2010: 1)

Strikingly contrasting with the technology developed in the oil industry for deep-water oil drilling, oil spill recovery techniques have stagnated over the years whereas sea surface conditions inherent to high sea drilling explorations are much rougher. In open waters, it is estimated that only 10% of released oiled can be recovered. Thus, prevention remains the best solution. (Burroughs, 2011: 50) Various conventional methods have been used by BP and the US CG in order to mitigate the impact of the leaking oil, including deploying floating booms, utilizing skimmers (2.5.3.1) bioremediation, burning oil on the water (2.5.3.2), the manual work of cleanup workers (2.5.3.3) and releasing chemical dispersant (2.5.3.4). (see annex 4 for a scheme of the different techniques) (Narayan, 2010: 58). The various processes lying at the heart of the different techniques used to mitigate the impacts of the spill will shortly be explained A final section will consider the relevance of taking action (2.5.3.5).

2.5.3.1 Booms and Skimmers

Booms and skimmers constitute the first techniques used in order to recover or control oil floating on the surface of the sea. Constituted of a floatation element riding on the surface and a weighted skirt extending beneath it, booms (see figure 10) can stop oil moving at the surface when the currents and winds allow it. Booms can be used in several situations, like shorelines protectors or towed by a vessel. Skimmers (see figure 11) are more elaborate oil recovery systems, they are special vessels collecting oil thanks to physical separation from saltwater, either by pumping the oil/water mixture aboard the boat or by moving an oil-absorbing material through the oil and often squeezing the oil/water mixture into a container on the vessel. (Burroughs, 2011: 49-50)

Figure 10: Booms
Source: (US Department of Commerce, s.d.)

Figure 11: Skimmer Ships in the GoM
Source (Ottar Grundvig, James, 2010)

Local communities were particularly attentive to the use of booms in their neighborhood, in spite of their relative effectiveness (see oil budget, section 2.5.6). Residents not being able to see source control efforts on the ocean floor or skimming far out in the Gulf, focused on the visible floating booms protecting their shorelines (National Commission, 2011:151). Initially, responders used the data provided by NOAA scientists on oil trajectory, as well as their knowledge of the region's geography, in order to place booms adequately. But progressively, CG responders distributed many miles of booms according to political rather than operational imperatives, risking by the same occasion that storms would blow them into delicate marsh habitats.[53] (National Commission, 2011:153-154)

2.5.3.2 Burning Oil and Bioremediation

A controversial alternative aiming at recovering oil is to burn it on the surface of the ocean. Nevertheless, less easy than it seems, it requires several conditions: oil must be freshly spilled and in a layer of sufficient thickness. A specific thickness can be obtained by towing fireproof booms in the spill area and igniting the oil captured. (Richard Burroughs, 2011: 50)

Bioremediation has also been attempted in the case of the DWH oil spill. The objective of this process is to use specialized microbes and nutrients in order to create conditions accelerating the degradation and oxidation of oil molecules. (Duhon et alii, 2011: 226-227)

53 The same problem was encountered with the use of berms, an unreliable project that should have supposedly protected the shores and allow to recover oil, but that was never carried over and revealed to be a failure (National Commission, 2011: 154-157).

2.5.3.3 Cleanup Workers

Furthermore in order to mitigate the impact of the oil slick, professionals but also many volunteers have swung into action (see figure 12). While cleaning-up the beaches and saving birds or other animals suffering from the spill, they have been exposed to oil and dispersant. These substance represent a danger for human health. (Weinhold, 2010: A347). More than 40 100 emergency responders have been active in the zone reached by the oil slick (Weinhold, 2010, P. A348- A350). The health question of these clean-up workers will be discussed in the third chapter of this work devoted to the human and social impacts of the spill (3.1).

Figure 12: Clean-up Workers in Houston
Source (Atlas and Hazen, 2011: 3)

2.5.3.4 Use of Dispersant

When oil spills on water under the form of thin layers, the lighter components gradually evaporate, and some soluble ones dissolve. Oil will furthermore be broken up by the wave action, creating oil droplets in the water and water droplets in the oil. Along with this process the oil changes into a brownish emulsion. As long as oil remains on the surface, the UV radiation contribute to break down the oil components. When one choose to use dispersant, it is in order to speed up the emulsification process. (Jernelöv, 2010: 356)

In the GoM, dispersant was wielded during 12 weeks, novel methods and unprecedented volumes were used. The advantage of this technique is that the substance can be used when responders are prevented from skimming and burning because of bad weather. (National Commission, 2011:143) When dispersant was first spread on the oiled water surface (April 22), the interagency “Regional Response Teams” had not yet evaluated and preauthorized their use. However, one could not wait for an thorough analysis because timing matters with dispersant. Indeed, the chemicals are most effective when oil is fresh. As a result, BP and its contractors applied huge quantities of the dispersant Corexit on the surface of the GoM. (National Commission, 2011:143-144)

If dispersing oil may be positive and help protect birds, marshes and beaches, it is quite damaging for fishes, crustaceans, molluscs and all other organisms living and breathing in water (Jernelöv, 2010: 356). Furthermore, Gulf residents became worried of the huge quantity of oil dispersed. Their anxiety was heightened because Nalco, the company that manufactures Corexit, refused to disclose its formula publicly. (National Commission, 2011:143-144)

In the meantime, BP raised the unprecedented idea of applying dispersant directly at the well. Some scientists were optimistic, believing that dispersant would be more effective in the turbulent deep waters. As a result, a protocol was created by NOAA and BP scientists and adopted by EPA on May 10, that limited subsea application to 15,000 gallons[54] per day and required monitoring and compliance with established environmental toxicity guidelines. (National Commission, 2011: 143-145) As we shall see in the following chapter (3) the use of dispersant revealed to be very damageable for the GoM ecosystems, residents and responders.

2.5.3.5 Ecological Engineering or the Relevance of Taking Actions

The techniques mentioned above, such as burning, skimming, 'booming', and so on have thus been used to mitigate the negative effects of the spill, but we could wonder whether we should not have let the oil disappear naturally. Some people promoting ecological engineering[55] claim that so-called cleanup efforts often lead to worse conditions than leaving the oil disappear 'naturally'. In the GoM, the use of chemicals to protect marsh and soils has created other pollution problems on the long term. According to H.T. Odum[56], a famous ecologist of the 20th century, nature has the ability to self-organize, adapt and form new ecosystems as conditions change. In his classification of US coastal ecosystems, Odum proposed a class of coastal ecosystems that have developed in response to human-caused pollution. He calls this specific category of ecosystems “emerging new systems”. (Mitsch, 2010: 1608)

According to Mitsch, through natural process, the oil in the Gulf will ultimately dissipate, evaporate or be consumed by oil-degrading microbes. The phenomenon is stimulated every year by the warm water summer temperatures (especially in 2010, just after the spill) in the Gulf and the abundance of nutrients coming down from the Mississippi river. Consequently, according to ecological engineers, there is no need to import 'oil-eating microbes' to clean up the Gulf. However, more problematic according to Mitsch is the accumulation of oil in anaerobic marsh soils (see section 3.2). This could preserve oil for decades, preventing its degradation. An efficient ecological engineering method was used in the GoM during the spill : diversion structures were opened to spread water flow of the Mississippi through the

54 15 000 gallons represent 56781,18 liters.

55 Ecological Engineering is the design of sustainable ecosystems that integrate society within its natural environment for the benefit of both (Royal Haskoning, 2010).

56 Howard T. Odum (1924 – 2002) was an American ecologist, famous for his pioneering studies of energy flows in ecosystems, and for the application of those same principles to energy use in society (Cleveland, 2008).

delta so that oil was prevented from penetrating deeply into estuaries and marshes. (Mitsch, 2010: 1608)

The choice of acting is often crucial. A major problem preventing the wide use of ecological engineering methods is the public opinion. Indeed, if the state and federal governments had not used controversial method such as dispersant, there would have been criticized for doing nothing to reduce the spill, or at least not enough. The multiple mitigation techniques would have removed up to 19 000 barrels[57] of oil per day from the Gulf water. Nevertheless, major threats for the wildlife and human health did not disappear. (Narayan, 2010: 58)

2.5.4 Safety and Economical Measures

During the oil spill, some hard measures impacting directly local populations had to be made. Indeed, prohibiting seafood (2.5.4.1) or imposing a moratorium (2.5.4.4) was a heat blow for the coast industry (this point will be developed in the third chapter), but were necessary in order to prevent any other blowout of the same kind from happening and to protect people against the possible contamination of seafood. Furthermore, specific measures were also needed for emergency volunteers that were exposed to pollutants (2.5.4.3). In this section we shall focus on these different sanitary and safety measures and the mitigation processes put in place in order to reduce the negative impacts on people involved in sectors affected by these measures (2.5.4.2 and 2.5.4.4).

2.5.4.1 Seafood Safety

The GoM is a very rich fishing ecosystems, indeed, there are plenty of crabs, shrimps, oysters, and finfish fisheries. All this fishing diversity has of course been affected by the oil spill. In order to protect people against potential contamination, fishing zones were closed. The Louisiana Department of Wildlife and Fisheries and the Department of Health and Hospitals were the first entities beginning closing fisheries and oyster grounds in state waters (3 miles[58] or less from shore) on April 30, because of the geographical proximity of the disaster. (National Commission, 2011:140) Similarly, due to the issue raised by seafood safety, on 2 May 2010, the NOAA, decided the closures of federal waters to commercial and recreational fishing (Doke et alii, 2011: 1062). NOAA's NMFS first closed an area spanning approximately 6.817 square miles[59] (3 % of the Gulf federal fishing zone). On May 7, NOAA increased the closed area to 4.5 % of that zone. At their maximum, the closures covered about 37% of the GoM (225,290 km²). Following the federal and Louisiana examples state fishery closures progress-

57 19 000 barrels represent 86.36 m³.
58 3 miles represent 5.556 kilometers.
59 6.817 square miles represent 12.625084 km².

ively extended to Alabama (June 2), Mississippi (June 4), and Florida (June 14). (National Commission, 2011:140)

Reopening began on June 23. On 24 November 2010 the NOAA re-closed 10,911 km² to deep-water fishing for royal red shrimp northwest of the wellhead. However on 21 January 2011, only 0,4% (2697 km²) of the federal waters located in the immediate surrounding of the well were still closed. All GoM federal waters were accessible for fisheries on 19 April 2011. (Doke et alii, 2011: 1062)

2.5.4.2 Participation of the Fishing Sector

The fishing industry and local workers being severely impacted by the fisheries closures, local decision-makers convinced BP and the Unified Command to include fishermen as well as residents in the clean-up job. Out-of-work fishermen were considered to be useful thanks to their experience in the GoM and knowledge of the shoreline. (National Commission, 2011:140) Consequently, BP resorted to local commercial and charter fishing vessels and crews of the Gulf Coast through a program called the Vessels of Opportunity (VoO), providing some indirect income to affected residents and fishermen of the GoM (B.P. 2010. “Factsheet on BP Vessels of Opportunity Program”: 1). The program resorted on private vessels to conduct response efforts such as skimming, booming, and transporting supplies (National Commission, 2011:140-141). Depending on the size of the boat, the program provided between \$1200 and \$3000 per day whereas individual crew members made \$200 for an eight-hour day (B.P. 2010. “Factsheet on BP Vessels of Opportunity Program”: 4). Despite its crucial role, for local fishermen and residents prevented from working, the program was slow to develop eligibility requirements. However, in spite of the numerous efforts, these hundreds of vessels looking for oil did not contribute significantly to the response (see 2.5.6). Indeed, aircraft were more effective at locating oil and placing booms requires skill and training. (National Commission, 2011:140-141)

2.5.4.3 Voluntary Responders' Safety

The human toll generated by the 20 April 2010 BP disaster in the GoM was quite heavy. Indeed, besides the eleven people who died on the rig, tens of thousand of workers, especially volunteers, have worked in difficult unsafe conditions in order to stop the leak and mitigate the impact of the oil spill on the coastal environment and wildlife. By doing so a lot of them were exposed to serious health and safety risks. This situation was due to a lack of existing regulatory measures to deal with cleanup workers' safety and health in the aftermath of an oil spill. Despite the lack of safety, thousands of cleanup responders joined the cleanup efforts without adequate training and guidance. Oil is toxic but it is also the case of the tons of dispersant that have been used. In order to cope with this problem, the Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational

Safety and Health (NIOSH) tried to settle on policies concerning training for cleanup workers and appropriate equipment gear. Fortunately, OSHA and NIOSH were able to respond quickly enough to mitigate the negative impact of cleanup activities on volunteers. Indeed, OSHA sent extra personnel to the region to look after the volunteers and was able to overcome a series of significant jurisdictional problems, such as extending the reach of the safety authority beyond the 3 nautical mile[60] limit from the shoreline to protect volunteers working offshore. From the very beginning of the crisis, OSHA and NIOSH developed a matrix of the various tasks performed by the workers in order to better plan possible workers response in the future. Additionally the data concerning the workers were compiled in order to study possible health effects on the long term. These efforts were characterized by a series of failures. Too many workers were given inadequate training on the use of personal protective equipment. Still more problematic for safety and health monitoring was the insufficient understanding of the risks linked to chemical exposure, given the fact that the formula of the dispersant was kept hidden. (Bratspies et alii. 2010: 1-2)

Besides volunteers, residents of the Gulf region were also affected (burning oil, seafood...). But the Centers for Disease Control and Prevention had not planned that an oil spill could affect the health of the broader neighboring population and hesitated on the role health agencies might play in such an event. Moreover, the Department was concerned that neither the Oil Spill Liability Trust Fund nor BP would pay for the cost that would be generated by activities such as long-term health surveillance. In order to organize the health response, a Senior Health Policy Advisor was sent in June to support the NIC. (National Commission, 2011:141)

2.5.4.4 Offshore Drilling Moratorium

On May 27, a six-month moratorium was established, on the order of Secretary Salazar, on all drilling at a water depth of more than 500 feet[61] in the GoM and the Pacific Ocean (National Commission, 2011: 152). The Secretary said that the moratorium would provide the necessary time to make sure similar accidents would not occur, and that rig operators were prepared to deal with worst-case scenarios. Furthermore according to Department officials, it would also give time for the National Commission to begin its investigation and for MMS to undertake needed safety reforms. Criticisms regarding the moratorium were issued by Republican leaders, Gulf state officials and Gulf Coast residents, arguing that this measure would aggravate the Gulf economic situation. (Cohen Tom, 2010) The moratorium took effect on May 30 and was lifted on October 12. A few weeks before lifting the ban, new regulations were promulgated by the Department on topics such as well casing and cementing, BOP, safety certification, emergency response, and worker training. From that time onwards, compli-

60 3 nautical miles represent 5,56 kilometers.
61 500 feet represent 152.4 meters.

ance with the new rules is a conditional requirement for obtaining offshore drilling permits. (National Commission, 2011: 152)

In order to support the rig workers of the GoM directly impacted by the moratorium, a charitable fund of $100 million was established by BP on July 30, 2010. This measure was encouraged by the federal government that considered that the ban could temporarily result in up to 8,000 to 12,000 fewer jobs in the GoM, especially in small businesses. (National Commission, 2011: 152)

2.5.5 Wildlife's Protection

Besides the damages cause to the human component of the Gulf; the spill has also affected wildlife health. The first oiled bird was discovered on April 30 (National Commission, 2011:141). Animal response and rehabilitation efforts were supervised by the US FWS, NOAA’s Fisheries Service, state wildlife agencies, and academic organizations. (US Fish & Wildlife Service and the NOAA, s. d: 1) Animals found by wildlife responders were taken to one of several treatment centers, where they were washed, monitored, and then released. (US Fish & Wildlife Service.“Oil Spill Response” 2010: 1) Many volunteers were eager to help and according to the Audubon Society[62], more than 12,000 people, volunteering for wildlife rescue, signed up to help with these efforts during a single week in early May (National Commission, 2011:141).

2.5.6 Where is the Oil?

On August 4, 2010, the federal government released a report focusing on the fate of the Macondo well oil that had gushed into the Gulf. The “Oil Budget” was the first public estimate of the total volume of oil released during the 87 days. It amounts to roughly 4.9 million barrels[63]. The government obtained this number thanks to its current flow-rate estimate, ranging from 62,200 barrels[64] per day on April 22 to 52,700 barrels[65] per day on July 14, just before the oil flow was stopped. According to this oil budget, approximately 50% of the oil is gone (evaporated, dispersed, burned, skimmed or recovered from the wellhead, see figure 13). (National Commission, 2011:167- 169)

62 The National Audubon Society (Audubon) is an American, non-profit, environmental organization. The entity is active in conservation and restoration of natural ecosystems and focuses especially on birds, other wildlife, and their habitats. He society further considers the benefit of these ecosystems for humanity and the earth's biological diversity. (Audubon. “About us”)

63 4,9 million barrel represent 77903777 m³.

64 62 200 barrels represent 98890,1006 m³.

65 52 500 barrels represent 8378.63071 m³.

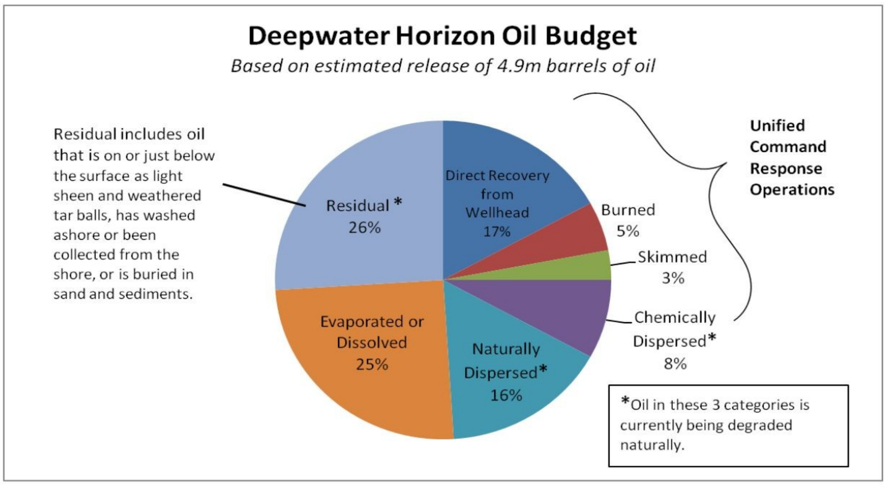


Figure 13: The DeepWater Horizon Oil Budget
Source: *(National Commission, 2011:168)*

On November 23, 2010, the Federal Interagency Solutions Group (part of NOAA), released a peer-reviewed report entitled "Oil Budget Calculator"[66] revising the government's oil budget. This report largely corresponds to the previous results (see figure 14). The most striking change is a significant increase of the amount of oil classified as "chemically dispersed". (US Department of Commerce (NOAA), 2010) These changes bring the "residual" oil down from 26% to 23 % (National Commission, 2011:167- 169).

Figure 14: Comparison Between the Two Oil Budgets

Source: (US Department of Commerce (NOAA), 2010)				
Oil Budget (Released Aug. 4)		Oil Budget Technical Report (November)		Results
Category	% of Total	Category	% of Total	Change
Direct Recovery	17%	Direct Recovery	17%	None
Burned	5%	Burned	5%	None
Skimmed	3%	Skimmed	3%	None
Chemically Dispersed	8%	Chemically Dispersed	16%	+8%
Naturally Dispersed	16%	Naturally Dispersed	13%	-3%
Evaporated / Dissolved	25%	Evaporated / Dissolved	23%	-2%
Other	26%	Other	23%	-3%

In the reviewed version, chemical dispersant has broken down 16%. Response technology such as skimming and burning removed only 8 % of the oil. In spite of the only 5% of oil removed thanks to the burning method, responders considered burning an important success because it had never before been attempted on this scale. Additionally, burning techniques were progressing during the spill. Skimming was not very successful (only 3%) in spite of the participation of hundreds of ships and thousands of people in the framework of the VoO program (see 2.5.4.2). (National Commission, 2011:167-169)

66 The full 217-page report, including appendices and peer-review team comments is available online at <http://www.noaanews.noaa.gov/stories2010/PDFs/OilBudgetCalc_Full_HQ-Print_111110.pdf >.

2.5.7 Communication and Information

In this last part of the crisis management section, we shall focus in particular on the various strategies used by BP to restore and conserve its image and to distance itself from the disaster. The explosion of the BP DWH oil rig in the GoM on April 20, 2010, has been presented in the media as an unprecedented event. The disaster has indeed become the second most publicized environmental catastrophe in decades after Chernobyl nuclear meltdown. The belief in the extraordinary character of the disaster has also been reinforced by the politicians' attitudes, President Obama has himself referred to the DWH blowout as “potentially the worst environmental disaster in American history”. (Jernelöv, 2010: 353) If some people expected that BP's image would be completely destroyed by the catastrophe, they were mistaking, BP has successfully managed to deal with the crisis as to appear almost as a victim. How BP did this, is the topic of the two following sections.

2.5.7.1 BP's Decoupling Strategy

BP successfully applied a decoupling strategy. Indeed the petroleum corporation dissociated itself from being responsible for the cause of the accident and presented itself simultaneously as the savior. This was not the case of the political actors, not perceived by the population as providers of solution in this crisis. A crisis as the Macondo blowout, threatens the priority of a corporation and causes a huge amount of media attention. After the explosion and sinking of the rig, BP proposed and tried various techniques to stop the gush of oil (see 2.5.1), until finally the leak was permanently closed on September 19, 2010. (Kleinnijenhuis, Schultz et alii, 2011: 97) In order to restore the narrative of control, BP tried to communicate mainly about the solutions of the crisis. Indeed the petroleum company focused on the solutions and the compensations for the victims, but at the same time took indirectly the responsibility for the damages. BP paid a lot of attention to the oil spill itself but very little to the causes. (Kleinnijenhuis, Schultz et alii, 2011: 98-99) Consequently, the crisis was presented by BP as an event with external origins. The strategy was surely chosen to avoid responsibility in the press and in judiciary procedures. BP brought new technological solutions with symbolic and impressive names:'top hat' 'to kill', 'static kill' and so on. By not relating in the media other actors such as the White House to the resolution of the predicament, the company prevented the government and other state entities to be considered as solution providers. (Kleinnijenhuis, Schultz et alii, 2011: 103-104)

In addition to the immediate interaction with the media, BP was from the very beginning planning its image preservation and restoration during the whole process of sealing and mitigating.

2.5.7.2 BP Image Preservation and Restoration

The corporate image of British Petroleum has been tremendously challenged since the spill. The giant has resorted to many strategies in order to preserve and restore its image. One strategical method chosen by BP to restore its image was interaction with individuals and interest groups through social media channels, such as Facebook , Twitter, YouTube and Flicker. (Dillistone et alii, 2011: 226)

BP has taken the responsibility for the disaster and spent billion of dollars in compensation and clean-up efforts but has nevertheless not stopped to blame its subcontractors (Transocean, Halliburton, Cameron, and so on). As soon as the news of the spill was released, the corporate was severely criticized by the federal and state governments, activists and environmental groups, and ordinary citizens (in particular inhabitants of the Gulf Coast). Criticisms issued concentrated on the damages caused by the spill and the failure to respect the safety measures and environmental laws. As a result,BP decided to engage in image restoration discourse. (Dillistone et alii, 2011: 226).

One should never forget that audience perception is crucial in defining a company's identity and image. Corporations are responsible for their actions through public reactions. (Dillistone et alii, 2011: 230) BP has always had a poor environmental track record (see BP safety culture, section 2.3.2.2). Consequently, in order to distance itself from its previous misadventure, the company has created a new logo (see figures 15 and 16). (Dillistone et alii, 2011: 227) As a result, before the 2000's, BP enjoyed a highly successful reputation as international oil conglomerate. (Dillistone et alii, 2011: 230)

Figure 15: BP's Former Logo
Source: (Loewy, 2009)

Figure 16: BP's New Logo
Source: (B.P.'s Official Website)

The biggest challenge for the image corporation was without any doubt the oil spill in the GoM. The wave of attacks resulting from the rig blowout was unprecedented for BP. Tony Hawyard (BP's CEO) first adopted a defensive posture, the company used around $50 million on advertisements defending its record. Another campaign launched by BP's CEO aimed at apologizing but did not resonate with the pubic. The brand of BP once famous for green energy (see figure 16) was then assimilated to 'disaster' and shame'. (Dillistone et alii, 2011: 227) In period of crisis, communication becomes crucial for a corporation. Image restoration is the strategy used by a company or individual at fault or accused to restore their image. Five major sub-strategies can be used: (1) denial, (2) evasion of responsibility, (3) reducing offensiveness, (4) corrective action, (5) mortification. (Dillistone et alii, 2011: 228)

Corrective action and compensation were the two most dominant techniques in BP's image restoration strategy. The other technique also promoted was mortification. The social network helped to initiate a dialogue between BP and its 'members'. (Dillistone et alii, 2011: 230) The company did not respond immediately to the public concern by using the social networks. Indeed, the first exchange on the web occurred on April 27. The corporation began using them after having realized that the spill had already affected their image. In order to create an image of transparency the corporation opted for an update taking place through social media, to inform people of BP's efforts in cleaning-up the gulf. Providing immediate information helps to reduce uncertainties, anger and fear. Nevertheless and despite all these efforts BP's corporate image is still tremendously damaged. BP has taken responsibility for the spill, has compensated affected individual and businesses and continues to pay for the clean-up efforts. The effectiveness of the three major techniques used by BP (corrective action, compensation and mortification) cannot yet be considered to have worked effectively. (Dillistone et alii, 2011: 231) However, BP has regained momentum in the Gulf since the spill, as we shall see in the fourth and last chapter of this thesis. Before dealing with the 'after BP', let us first of all, in the third chapter, identify and discuss the impacts that have been generated by the blowout and how it affected the Gulf Coast region.

3 Consequences of the Rig Explosion in the Gulf of Mexico

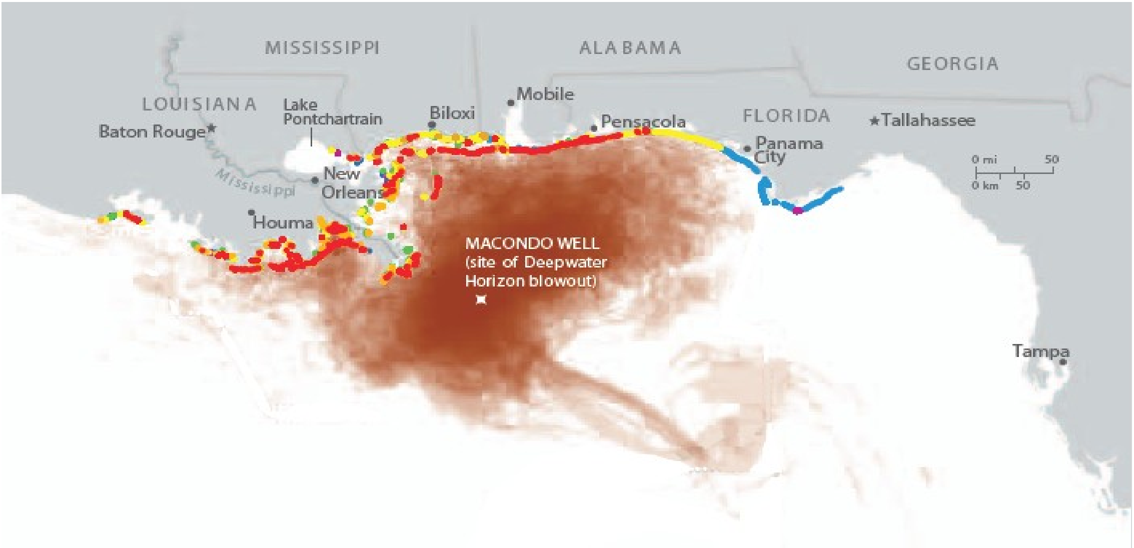


Figure 17: Repartition of the Oil Pollution in the GoM

Source: (National Commission, 2011: 198)

The chronic crises generated by the explosion of the BP oil rig and the spill that followed will be discussed in this chapter. These impacts will require not months but decades of national effort to address and repair (National Commission, 2011:173-174). The consequences resulting from the DWH blowout are multiple and involves all life aspects related to the GoM, such as business, fisheries (3.3), environment (3.2), and health (3.1). Some of them, like environmental and human health damages might take decades to unveil (Tao et alii, 2011). As far as ecological and human impacts are concerned, they may differ from other blowouts or oil slick because of the depth of the blowout, the large volume of oiled that has gushed into the Gulf, the size of the region impacted by the pollution (see figure 17), and the unprecedented quantity of dispersant used next to the well and on the surface. (Doke et alii, 2011: 1062)

3.1 Human and Social Impacts

The spill of the GoM lasted 5 months and released approximately 5 million barrels[67] of oil into the

67 5 million barrels represent 79,4936,500 liters.

GoM, soiling more than 600 miles[68] of shoreline in Florida, Alabama, Louisiana and Texas, and impacting a considerable amount of individuals. Indeed, residents and tourists have been affected by wandering on the beaches or by breathing the smoke produced by the mitigation burning technique. Moreover, a lot of volunteers and official responders have joined the clean-up teams in order to protect their regions, and have consequently been exposed to oil and dispersant. The consequences on the long-term of such an exposition are not yet well-known, but are already a real concern. On top of that, the spill has destabilized the region's fishing industry by threatening seafood safety. Resulting from these observations, major questions concerning potential impacts on human health (physical and psychological) have been raised. (Grattan et alii, 2011: 838).

Concerns regarding health and safety persisted even after the well was sealed (July 15). Furthermore, as we shall see, besides physical impacts, the local populations have also been psychologically affected by the spill. In the following sections, we shall pay attention to three main problems that have appeared in the wake of the blowout: health concerns (3.1.1), seafood safety (3.1.2) and psychological troubles (3.1.3).

3.1.1 Health

The residents, tourists and volunteers ' health state will be discussed in this section. We shall first of all pay attention to the pollution risk to which responders were exposed (3.1.1.1), secondly the exposition of residents and tourists to dangerous substances through tar balls will also be considered (3.1.1.2), and finally, we shall deal with the issue of oily debris (3.1.1.3).

3.1.1.1 Cleaning-up Teams and Residents

As previously mentioned a lot of volunteers have participated to the cleaning-up of the beaches and other areas, such as marshes impacted by the oil slick. Health risks are already high for professionals but tend to be higher for the many non-professional emergency responders. The latter do not have the training and equipment of professional responders. Following the explosion of the BP platform in the GoM, a relative high amount of acute health problems have been reported. More than 40 100 emergency responders have been active in the zone reached by the oil slick. Health concerns are due to the oil itself but also to its constituents such as benzene, toluene, ethylbenzene and xylene, gases and substances produced by intentional oil burning. Furthermore, the use of dispersant is a major concern raising consequential health questions. The particularity of the BP disaster is its unprecedented scale and length. Both responders and the public will probably suffer from short- and long term health effects. But it is very difficult for the NIOSH to evaluate the amount of symptoms such as dizziness, fainting,

68 600 miles represent 965.61 kilometers.

and headaches that might have resulted from too long an exposition. Furthermore health effects have not been limited to people in contact with oil or living next to soiled beaches. Indeed, residents living as far as 50 miles[69] inland have reported strong odors, others have had to double their asthma medication, and some people could hardly breathe. (Weinhold, 2010: A348- A350)

In order to learn more about the medical impacts of the BP pollution in the GoM on the emergency responders and clean-up workers, the National Institute of Environmental Health Sciences (NIEHS) has launched the most complete study ever organized on the health consequences of an oil spill. The study entitled the Gulf Long-Term Follow-Up (GuLF) has as objective to enroll 55,000 workers and volunteers who were involved in the BP oil spill response and will include 5000 controls. The NIEHS has already obtained the fund allowing the study to be in function during five years, but the researchers hope to make it last at least twenty years. This length is the minimum scientific period that will allow the organization to assess links between oil spill response and rare cancers. The GuLF study distinguishes itself from previous health investigation by its size and prospective design which strongly contrast with the short-term analysis that have already been organized. The GuLF study will concentrate on respiratory, neurological, and hematological outcomes that are due to oil constituents. Besides health problem, the study will also investigate psychological outcomes relating to cleanup and living in the gulf. (Schmidt, 2011)

3.1.1.2 Tar balls

Volunteers, professionals and near-inhabitants of the spilled beaches, as well as tourists have been exposed to oil and dangerous bacteria through contact with tar balls that have appeared on the Gulf states coasts, shortly after the beginning of the spill. The identification of higher levels in these balls of Vibrio Vulnificus, a human pathogen abundant on the Gulf coasts and causing severe wound infections by contact with contaminated surface, is quite appalling and requires more investigation in order to inform and protect the local population and other citizens. The Vibrio are among marine gamma-proteobacteria and include human pathogens. These are abundant in coastal system and are also crucial in the carbon cycle. They are really effective at degrading different carbon sources including some polycyclic aromatic hydrocarbons constitutive of crude oil. (Arias et alii, 2011)

The Vibrio Vulnificus is a concern for public health authorities in coastal areas of the southern US because it is the prime cause of seafood-borne fatalities nationwide. Ingestion of contaminated seafood can lead to septicemia, while exposure to contaminated seawater, fish, shellfish, or fishing gear cab cause severe wound infections. Between 20% and 30% of people infected will succumb. The major problem is that since the oil slick many inhabitants of the Gulf coast have encountered tar balls by

69 50 miles represent 80,4672 km.

stepping on them or inspecting them on the beaches. Very few information is available concerning oil pollution as source of bacterial contamination. It is furthermore very probable that the bacteria has benefited from byproducts of the microbes that degrade weathered oil. The pathogen counted in the tar ball is really significant while the quantity in seawater and sand are similar to the sample previous to the oil slick. During the warmer months, tar balls are especially sticky and difficult to get rid of. It is particularly dangerous for vulnerable people that should avoid any contact with them. (Arias et alii, 2011)

Another risk of contamination for residents of the Gulf is related to oily debris and their storage, that we shall discuss in the next section.

3.1.1.3 Oily Debris

After the well was capped and most of the oil removed or disappeared (invisible), the different types of material used during the mitigation period, such as booms or the typical spill-responder uniform of rubber gloves and protective coverall, had to be stored somewhere in order to be destroyed or buried. The plan of BP was to send the thousands of tons of oily debris to ordinary municipal landfills. This was allowed because oil exploration and production debris are classified as non-hazardous by law. This signifies that they do not require specialized disposal. Nevertheless, on June 29, 2010, a directive was issued by the CG and EPA requiring BP to test its waste for hazardous elements, to publicize the results, and to consult with the communities where oily debris were to be stored. Additionally, EPA would conduct its own testing and would post the results online. (National Commission, 2011:170)

Besides exposition of people to polluted and toxic substances the risk of contamination through the food chain by ingestion of contaminated fishes or crustaceans is also very present.

3.1.2 Seafood

Seafood contamination in the Gulf has been, since the spill, a major concern for government agencies, fishing business and consumers. The Institutes of Medicine and the Oil Spill National Commission recommend continued analysis of the seafood in the GoM in order to determine potential long-term health impacts and restore the confidence of consumers in the fisheries. Seafood contamination is dependent on a variety of factors such as the type and quality of the oil, the proximity of the spill to fishing grounds, the temperature and weather conditions, as well as species and ecosystemic parameters. PAHs (organic pollutants, responsible for cancers) originating from oil, tend to accumulate in fishes and shellfish. In important quantities, they can be considered unsafe. Furthermore, metals concentration in seafood is also problematic. Indeed, metals are normal constituents of crude oil and drilling fluids injected in the wells. Metallic bioaccumaltion on the long term is a real concern for the competent authorities. Accumulation of different metals (Zn, Mn, Cr, Se, Cu, V, Ni, Sb, V, As, Hg, Cd, Sn..) have already been detected in sediments and marine organisms harvested from oil spill zones. The dispersant (mix of solvents and sulfactants) used to break up oil into droplets, also raises major questions. Indeed, if dispersant may benefit wildlife during a surface oil spill, little is known about their long-tern effect in deep water. (Doke et alii, 2011: 1062-1068)

Peter Roopmarine, curator of geology at the California Academy of sciences has launched since the spill a study concerning crude oil's impact on organisms in the Gulf. The challenge is to identify which substance and contaminants found in the mollusk are directly due to the DWH oil spill. The researchers concentrate on several organisms, such as the Eastern oyster, the clam, the marsh mussel and the marsh periwinkle. Roopmarine and his colleagues seek to determine if any components from the crude oil are incorporated into the shells and tissues of several organisms. Thanks to that, we could have an idea of how these substances might be distributed throughout the food web. Preliminary results turn out to indicate a significantly higher concentration of vanadium, lead and chromium in the shells of the oysters collected after the oil slick whereas the tissue contained higher levels of vanadium, lead and cobalt. Hydrocarbon trace in tissue are also scrutinized. It is generally known that heavy metals are not harmful to oysters, but they endanger the life and health of other animals throughout the food web, including human beings. (Baker, 2012)

The various health concerns as well as environmental damages (3.2) and economic impacts (3.3) have generated a lot of stress and anxiety within the Gulf population, as we shall see in the next section.

3.1.3 Psychological Impact

A survey has been led by the university of Florida to assess the acute environmental and health impacts (especially psychological effects) of the spill among the fishing communities living on the Florida and Alabama coasts. The investigators worked with community agencies and leaders from two Gulf Coast fishing communities. The inhabitants of the Gulf Coast have become acquainted with daily media reports about the spill and have for some been involved in cleaning-up efforts or preventing oil from reaching the coast. Fear concerning the quality of seafood caused a drastic reduction of seafood harvesting and a lack of products. The psychological sequels resulting from indirect exposure to oil spills and other environmental catastrophes are already well-known but the very impact of the BP blowout in the gulf has hardly been studied from a psychological point of view. This survey has focused on two types of people:

(1) a group whose members were directly exposed to the pollution and lived in a community whose shoreline had been reached by the oil spill, and

(2) a group of inhabitants indirectly exposed to oil, living in a community where oil did not reach the coastline, but who were impacted through economies, fishing recreation and tourism.

The exposed group was mainly composed of professional male fishermen while the indirect exposed group was constituted of retired professionals who were active in tourism industry. (Grattan et alii, 2011: 839-842)

From this study were drawn several general observations concerning the psychological impact of the BP blowout in the GoM. Inhabitants with direct impacts had higher level of anxiety and depression, similar to people living in communities whose shores had been soiled. People suffering from income losses resulting from the spill also reported more tensions and anxiety. Mechanisms of adjustment (coping with tragedy and resilience capacity) were lacking for people suffering from income loss. Income decline is thus assimilated to a reduced resilience and leads more straightforwardly to depression. Participants to the study considered television and newspaper to be the most reliable source of human information during the event. Broken people tended to believe also local fishermen (directly impacted) and the department of health. This study highlights the importance of also targeting population not living in the direct spill areas. People risking income loss are a particularly vulnerable section of the population. (Grattan et alii, 2011: 842)

Unfortunately, OPA 1990 and related policies do not provide efficient tools and means for addressing mental and physical effects resulting from a spill (National Commission, 2011:191). The Gulf Coast Compensation Fund has announced that damages for mental illness caused by the spill would not be paid. According to the organism, financial support has been awarded to other competent organisms to deal with this issue. Indeed, the health departments of affected Gulf coast states (excluding Texas) have already received $42 million for mental health from BP. Similarly the Substance Abuse and Mental Health Administration has also benefited from $10 million from the oil company. (National Commission, 2011:194)

Besides providing fisheries and recreational activities for residents and tourists, the GoM is also a very rich ecosystem that has been severely impacted by the spill (3.2). A damaged ecosystem especially in the Gulf means severe consequences for tourism and fishing industries, as will become clear later (3.3).

3.2 Environmental Impact

The DWH oil spill has also had significant negative effects on the Gulf ecosystems. Indeed, some significant recreational and wildlife areas were lying within the spill trajectory. These areas included the Gulf Islands National Seashore (Alabama, Florida and Mississippi), the Padre Islands National Seashore (Texas) and the Jean Lafitte National Historical Park (Louisiana) (Narayan, 2010: 58). Furthermore, kilometers of beaches and various aquatic ecosystems have been polluted by the spill (National Commission, 2011: 174). On top of that Louisiana's fragile delta habitats have been heavily affected. (National Commission, 2011: 178).

The GoM is characterized by an exceptional marine biodiversity with 15,419 recorded species among which 10% are endemic. The lushness of fauna and flora is mainly due to the geographical localization of the GoM, within a transition area benefiting from temperate and tropical waters. (Campagna et alii, 2011: 394-395) Contrary to oil spills usually witnessed and appearing on the surface, the DWH spill spewed from the depths of the ocean (between 3,300[70]–13,000 feet[71] deep) and affected a multitudes of organisms living in the depth, swimming next to the surface or flying and wandering along the coasts. (National Commission, 2011:174) In this section, we shall try to identify the various ecological damages that have been caused not only by the oil slick but also by the mitigation measures that have been used to reduce the impacts of the tragedy

3.2.1 The Gulf of Mexico : a Complex Ecosystem [72]

The GoM is inhabited by a multitudes of species (fauna and flora) living in various ecosystems. Contrary to what most people think, the cold, constantly dark areas of the GoM characterized by high pressure are inhabited by an abundant and diverse marine life, with organisms such as cold-water corals, fish, worms, bacteria, mussels, and tubeworms. (National Commission, 2011:174) Higher, where light and temperature gradually increase, different species are observable: sharks, hundreds of fish species, shrimp, jellyfish, sea turtles, sperm whales and dolphins. Just beneath the surface, there is a multitude of plankton, fish larvae, floating seaweed beds (sargassum), and schools of fish drifting with surface currents and winds. The seaweed beds covering the surface are habitats, lure sea turtles, tuna, dolphins, and numerous game fish and represent the basic food for snails, shrimp, crabs, and juvenile species seeking shelter in this environment. (National Commission, 2011:175) Above the water a multitudes of seabirds (migratory or sedentary) feeding in the ocean and coastal estuaries are also present. (Ribic et alii, 1997: 1). The spill following the Macondo blowout impacted all these organisms as oil spread from the bottom of the sea to the surface and then to the shoreline.

3.2.1.1 About the Impact of the Oil Slick on Fauna and Flora

When the oil gushing from the Macondo well spread under water or reached the surface, it came into contact with this multitude of organisms, living in the marine and coastal environments, as well as

70 3 300 feet represent 1005.84 meters.
71 13 000 feet represent 3962.4 meters
72 See annex 5 for a scheme of the coastal and marine environment.

those living into the salt marshes, mudflats, mangroves, and sandy beaches (see 3.2.1 and annex 5). (National Commission, 2011:175) The interdependency between species is so developed that a significant effect on any of them can affect others (Biello, 2010). During the spill, organisms were exposed to oil through ingestion, filtration, inhalation, absorption, and fouling (Ober Holly K, 2010: 1-4). Indeed, predators may ingest oiled organisms or mistaking oil particles for food whereas filter feeders (ie. some fish, oysters, shrimp, krill, jellyfish, corals, sponges, and whale sharks) may consume oil particles floating in the water (National Commission, 2011:176). Additionally, oil droplet functions as flypaper for numerous small creatures, causing entrapment and death. Some bigger organisms can inhale or ingest the oil that sticks on their membranes as they swim through the emulsion. The proportion and concentration of oil to which they are exposed will affect or killed them. (Jernelöv, 2010: 356) Surface-breathing mammals and reptiles were also deeply affected by the spill, because of the possible inhalation of oily water or fumes. Furthermore oiled animals can be prevented from walking, flying, swimming, and eating. Regarding plants, oil can impede transpiration and photosynthesis, and smother coastal sediments in which they anchor, as well as organisms living below. ((National Commission, 2011:176)

Oil has also impacted animals floating and living above the surface, such as seabirds. These are very sensible to oil because it reduces the natural insulation of their feathers and leads to hypothermia (Jernelöv, 2010: 356). Through November 1, 2010, 8,183 birds, 1,144 sea turtles, and 109 marine mammals affected by the spill (alive or dead) were collected by wildlife responders ("Deepwater Horizon Response Consolidated Fish and Wildlife Collection Report, 2010) but these figures are only the tip of the iceberg, many more specimens were not intercepted because of the scavenging, sinking, decomposition, and the reduced size of the search area (Hampton, 2012). On top of that, one hundred mammals, among which a majority of bottlenose dolphins, (NOAA, 2011), and more than 600 sea turtles (National Commission, 2011:181) were found dead.

Another major problem linked to the spill is the the massive development of green algae, months or years after the spill. The oil having poisoned snails and other algae grazers, the green algae have grown up and developped without any predator. Still more problematic is that when the former organisms want to re-settle, they find it difficult because the algae now occupy the place. A long time is consequently needed for the original balance to re-establish. (Jernelöv, 2010: 356)

3.2.1.2 Protection Concerns

A major issue raised by the DWH oil spill concerns the list of species that benefits from a protection or restoration program. Indeed, 14 marine species are protected in the GoM by the US ESA, the MMPA, and the Migratory Bird Treaty Act (MBTA). Besides, 40 other marine species living in the gulf area, not mentioned in any American federal law, are listed as threatened on the International Union for Conservation of Nature[73] (IUCN) Red List. (Campagna et alii, 2011: 393)

The oil spill of 2010 has modified the threat status of some of these species. In the US, restoration is supervised by the Natural Resource Damage Assessment (NRDA), department of the NOAA. NRDA (under OPA) is the primary legal authority capable of assessing damages and providing for recovery of coastal and marine species. The NRDA is also the organ determining the injury to public trust resources and the methods of restoration that will be applied. (Campagna et alii, 2011: 393) The IUCN has listed 322 species in the Gulf (53 are in the threatened categories and 29 are considered as 'near threatened'). Threatened species include species such as the bluefin tuna, seagrasses, the whale shark, the Kemp's Ridley sea turtle[74], and the West Indian manatee (see annex 6 for more information). Priority must be given to species with high commercial value, species critical to the integrity of coastal and marine ecosystems, species of population in decline before the disaster and species now in greater danger of extinction. (Campagna et alii, 2011: 394-395) The real number of endangered species is underestimated by the ESA, for this reason the NRDA now active in the GoM should include data made available by the IUCN regrouping a more extensive and complete list of endangered species living in the gulf waters (the whole year or on a seasonal basis). As appears from the list of the IUCN (see annex 6), a large amount of species that deserves protection are not even included by the federal organizations. The non -listed species should nevertheless be part of the damage, monitoring and restoration assessments and actions. (Campagna et alii, 2011: 396)

3.2.1.3 Plumes

In addition to these visible threats, researchers have found out that huge clouds of nearly invisible droplets are hovering deep below the surface. These clouds located more than 1,5 km under the water surface could substantially increase estimates of the total amount of oil that has been spilled in the waters of the Gulf. Moreover these hydrocarbon clouds could poison deep-welling critters that form the base of the marine food web. The question concerns how this oil will end up since the major part of it is still lurking under water and has not floated to the surface where it could progressively disappear. According to some scientists, if the droplets are very small or that water is cold, they could mix, forming a mixture that could naturally be buoyant and hover below the surface. It is not yet clear to what extent the use of dispersant has aggravated this phenomenon. Fortunately, plumes and methane concentration diminished with distance from the Macondo well. Nevertheless, the oil clouds are probably directly influenced by bottom currents, driven by different water densities, due to temperature and salinity and by the varying seafloor topography. Contrary to big fishes and cetaceans that could fly the

73 The red-list assessment process is a scientific evaluation of species global status, providing mechanisms for trans-boundary impact assessments and a forum of coordination of international conservation action. (Campagna et alii, 2011: 394)

74 The Kemp's ridley is a turtle whose only nesting beaches in the world are in the western GoM (National Commission, 2011: 181).

contaminated regions, small and larval fish probably succumbed to the hydrocarbon clouds. Plankton and other tiny plants and animals (base of marine food) floating with the current were and will still be killed by the pollution. (Raloff, july 2010: 5)

A scientific debate surrounding the evolution of these clouds is still raging between the scientific considering that the plumes in the Gulf are stable and those convinced that hydrocarbon clouds are degrading quickly. The plumes located 1100 m below the surface could be 2 kilometers wide and 200 meters high and could travel at about 6,7 kilometers each day. If some molecule disappear rather quickly other constituting the plumes are rather persistent, lasting years even decades. Depending on the tools used to measure pollutants' concentration, plumes seem to be apparent or not but reason seems to suggest that chemical substances and oil cannot disappear as quickly as some seem to believe. (Raloff, September 2010: 5) Some specialists advance that even if oil has disappeared the toxicity of dissolved oil would last much longer. Finding out regions were oxygen is abnormally low could also indicate that the oil has been broken down. Even if oil has disappeared it has certainly changed the fabric of the ecosystems: generations of fish could have been wiped out, marsh erosion could accelerate and the microbial population of the Gulf could already be changing. (Gupta, 2010) On top of that, disquieting observations have lately been made. Indeed, recent surveys report dead or dying deepwater corals living on rock outcrops. These could have been killed by the deep plumes. (National Commission, 2011: 182)

3.2.2 Wet Zones

Other vulnerable areas, that have been impacted by the oil spill and that are still suffering, are coastal wetlands. These productive zones are really sensitive to oil contamination. Furthermore, traditional mechanical cleanup practices are efficiently limited and can even involve more damages than the oil itself. (Tao et alii, 2011) Salt marshes cover almost the entire coast of Lousiana (over 4500 km²) and are a habitat dominated by smooth cord-grass, salt meadow cor grass and black needle-rush. The specific nature (salinity, anaeoroby) of the soil is viable for only a tiny number of plants. The marshes serves as buffers against strong winds and tidal waves on the coast. Moreover, salt marshes are the shelter and the nursery of species like shrimps, crabs, fishes and birds having a commercial value. For this reason, the region is also among the most vulnerable coastal environment from a social, and economic perspective. (Cho et alii, 2011: 176-177) To some extent, marsh grasses tolerate surface coating by weathered oil fairly well[75] (National Commission, 2011: 177). Indeed, we should not forget that the coastal salt marsh sediments are used to a certain petroleum exposure, since there exist more than 1000 natural oil seepage sites (see section 1.2.4) reported in the Gulf (Tao et alii, 2011). Nevertheless, salt marshes will not survive if oil penetrates the saturated sediments and is absorbed by the root sys-

75 For more information on the tolerance of some ecosystems to petroleum, please consult the work of Howard T. Odum.

tem. When the plants' root systems degrade, the marsh erodes, consequently threatening the habitat on which a wide variety of animals depend. (National Commission, 2011: 177) Furthermore, besides the coating of the plant and soil surface provoking temperature stress, oil reduces the plants' capacity to photosynthesize, and the ability of salt marsh vegetation to tolerate salinity because the stomata transpiration pathways are blocked. (Cho et alii, 2011: 176-177)

On top of that, the mitigation means deployed to protect the various ecosystems are susceptible to damage the marsh. As previously mentioned, summer storms pushed booms deep into the marshes, and these could only be removed by intrusive methods, causing additional harm to the marshland (National Commission, 2011: 177). Indeed, post-spill damages were also due to cleaning-up activities such as skimming, oil collection, burning, flushing use of dispersant, and plant cutting. The first quantitative assessment focusing on the ecological impact of the spill in the salt marsh habitats was carried out more than one year after the blowout. The researchers have reported major transformations. Combining data coming from satellite and ground analysis, the objective was to quantify the impact of the oil and dispersant on the salt marshes as far as photosynthetic capacity and physiological status are concerned. The two main variables that were monitored are the distribution of canopy chlorophyl content and the above ground green biomass during the growing season (May October) of 2009 (pre-spill) and of 2010 (post-spill). The result of such a survey allow to delineate the critical hotspots of marsh stress in order to prioritize the areas needing immediate restoration.(Cho et alii, 2011: 176-177) The data confirmed considerable loss of productivity in salt marsh habitat during the 2010 growing season (Cho et alii, 2011: 181-182). The lingering residual oil will involve long-term impacts on the health and productivity of the Gulf Coast salt marsh. Recently, BP has committed $1 billion to contribute to the environmental restoration (see further in chapter 4) (Cho et alii, 2011:184)

3.2.3 Environmental Impacts on Distant Ecosystems: the Case of Migratory Shorebirds

Hundred of isles of the US northern GoM coastline were affected by the 2010 DWH oil spill. These areas represent crucial habitat for migratory shorebirds. During the 2010-2011 non-breeding season, more than one million migratory shorebirds were exposed to the oil spill. More than 650 miles[76] of the northern GoM coastline constituted of beaches, mudflats and wetlands were soiled by a mixture of crude oil and chemical dispersant. The risk of oil contamination are very high for shorebirds because they rely on subsurface probe-foraging behavior and on intertidal habitats to survive. The northern GoM are important habitats for 34 species of shorebirds among which 6 species are considered resident and 28 are migratory species. The breeding location of the nonresident species extends on a very large territory, going from the temperate prairie and wetlands of North America to high Arctic. During

76 650 miles represent 1046.07 kilometers.

the non-breeding season, the American GoM hosts more than 5 % of the total north American avian population, welcoming 12 of the 28 American migratory species. Shorebirds can be affected by oil in a variety of ways: oil exposure is not necessarily fatal and repeated exposure within and between seasons may cause sub-lethal effects potentially leading to population decline, resulting from diminished health and reproductive fitness. (Henkel et alii, 2012: 676-678)

Through migration the effects of the spill may be transported to ecosystems far removed from the immediate contaminated area (Henkel et alii, 2012: 679-680). Shorebirds affected by oil can suffer from reduced fraying success and be weakened (weight loss and diminished health) by the lesser quality of their environment (lesser food abundance). These factors are delaying the birds' departure, reducing the number of individuals that will survive during the migratory journey. Furthermore, oil contaminants such as PHA's (carcinogenic) can remain in the environment for decades and be incorporated into the food chain. This could be problematic for avian predators such as peregrine falcons and merlins not directly in contact with the spill but consuming contaminated preys. (Henkel et alii, 2012: 681-682)

The situation of waterfowls in upland prairies and the disturbance of the food chain in the Arctic regions are two eloquent examples illustrating the potential impact of contaminated shorebirds in far removed breeding areas. Several species of shorebirds concerned by the DWH oil spill breed in the mixed-grass prairie habitat of North America. Prairie food webs are very complex, so that a potential decline in shorebird abundance could have considerable impact on the prairie ecosystems. Both shorebird and waterfowl nests are important resources for predators in the prairie. Consequently, it is quite probable that a decline in shorebirds abundance increases the predation pressure on waterfowls, threatening their very survival. Similar phenomena are observable in Arctic and subarctic regions. According to estimations, 30 million shorebirds breed in the high Arctic and another 7 million breed in the Taiga (boreal forest of North America). The annual abundance of shorebirds into these ecosystems represents a crucial food source for predators such as the snowy owl or the Arctic fox (eggs). Just like in the prairie ecosystem, any significant decrease in shorebirds productivity could severally impact local predators. These regions are even more vulnerable given the low diversity of Arctic terrestrial vertebrate communities, that would hardly succeed in adapting themselves. These two examples give the reader the opportunity to seize the potential negative impacts generated by the DWH blowout and following spill in the GoM on distant ecosystems. (Henkel et alii, 2012: 683)

Besides the negative impacts discussed above, the BP DWH oil blowout will probably have a positive impact as far as ecosystem damage valuation is concerned. This interesting and very active scientific field is going to be discussed in the following section.

3.2.4 Ecosystem Damage Evaluation: a Positive Outcome of the Disaster?

According to some economists and ecologists the DWH oil spill will most probably sharpen the tools of ecosystem damage valuation. The techniques used in order to estimate and calculate direct losses to fishers, boaters, tourists sunbathers or scuba divers and the business in which there are incorporated are complex. But applying this technique to tally ecosystem damage, not directly impacting what human buy, consume or earn, make it still more difficult to evaluate. Indeed, how can we evaluate the worth of a brown pelican, sea turtle or marsh section? Or what is the value of the resilience of the gulf ecosystem? The challenge is to valuate nature and the costs of restoration that will be needed to recreate the ecosystems that have been lost in the tragedy. (Nash, 2011: 259)

To realize an accurate quantification of damages, well-established baseline conditions are necessary. However, scientists lack of sufficient information regarding the pre-spill state. It is particularly important in the GoM, where many coastal habitats have been progressively degraded over decades. (National Commission, 2011: 184). Evaluating ecosystems is a long-term enterprise and the fund needed to do so will appear as the researches progress. According to some, it will never be possible to provide an accurate natural resource damage assessment, it is for this reason very difficult to evaluate the some of money BP should give in total to restore ecosystems. Consequently, the best the government can do is to negotiate for a sum that is large enough to cover all possibilities (Goldenberg, 2012: 1-2). According to temporary estimations, 1500 kilometers of coastal salt marshes, beaches, mud flats, and mangroves would still be oiled. The efforts that have been made to mitigate and limit the extent of the pollution represent stressing factors for the Gulf ecosystem. Furthermore, some effects may not be apparent for several years. (Nash, 2011: 260)

The valuation process in the GoM can be addressed through the OPA that explicitly describes the process for assessing the damages caused by an oil spill and then the sum of money needed to address those damages. Under the Act “natural resource trustees,” are designated to be responsible for assessing the “natural resources damages” of the spill. (National Commission, 2011: 183) Unfortunately, certain zones are beyond any restoring, for this reason, the NOAA uses a 'device' allowed by the OPA: substitution. A marsh somewhere else could be considered as of equivalent value and could be protected in order to compensate the loss of another marsh area. (Nash, 2011: 260)

Identifying the services rendered to human beings by ecosystems is quite challenging. However, it is undeniable that marshes and mangroves provide storm surge protection, water filtration, or fish nursery habitat. Moreover it offers oyster habitat and allows carbon sequestration in plants. These different factors can be monetized and evaluated in terms of jobs or other impacts on humans. This method of giving a monetary value to ecosystem services is called 'Ecosystem Service Economics'. A recent report has evaluated that the Mississippi River Delta ecosystem provides at east $12 billion to $47 billion of benefits per year to humans and have an asset value of about $1,3 trillion. This is a way of bolstering environmental protection on the basis of economic self interest and to integrate scientific knowledge into policy. Some detractors of this approach advocate that considering ecosystem services as the foundation of our conservation strategies would imply that nature is only worth conserving when it can be made profitable to humans. (Nash, 2011: 260-261) Proponents of legal rights for nature argue that their approach offers ecosystems far higher level of protection and a stronger foundation for sustainability. Besides, a group of international plaintiffs has brought a suit against BP in the constitutional court of Ecuador on the basis of the survival rights granted to ecosystems in that country 's 2008 Constitution. Unlike the Latin American country, US law and the NRDA consider the Gulf's ecosystem as property owned by the citizenry. Every damage occasioned to the ecosystem is in this way a violation of the property rights of the American citizens as a whole. Under US law, corporations as BP enjoy constitutional rights, whereas natural systems do not. (Nash, 2011: 263)

The various environmental degradations have of course strongly impacted local population through economic instability and financial losses. As mentioned in the previous section, ecosystems provide services allowing the GoM inhabitants to be safe, happy and run businesses. Consequently the disappearance of these services or their qualitative alteration is negative for the communities relying on them. The following section will investigate the kaleidoscopic consequences of the spill on local business and on the US as a whole. One eloquent example of the crisis, namely the Gulf Coast Shrimp supply chain, will also be discussed.

3.3 Economic Impacts

Besides being an ecological and social disaster, the BP blowout and subsequent spill have also already proved to be a regional economic tragedy. (Birkland and DeYoung, 2011: 471). In this section we shall describe the importance of the Gulf region from an economic point of view and discuss how the various economic sectors have been impacted by the spill. The Gulf coast's economy depends heavily on commercial fisheries, tourism, and energy production (National Commission, 2011: 185). Indeed, tourism and fishing generate more than $40 billion of economic activity annually in the five Gulf States (see figure 18) (National Commission, 2011: 187). These sectors are furthermore particularly sensitive to both direct ecosystem harm, and public perceptions and fears of contaminated seafood and soiled beaches (National Commission, 2011: 185).

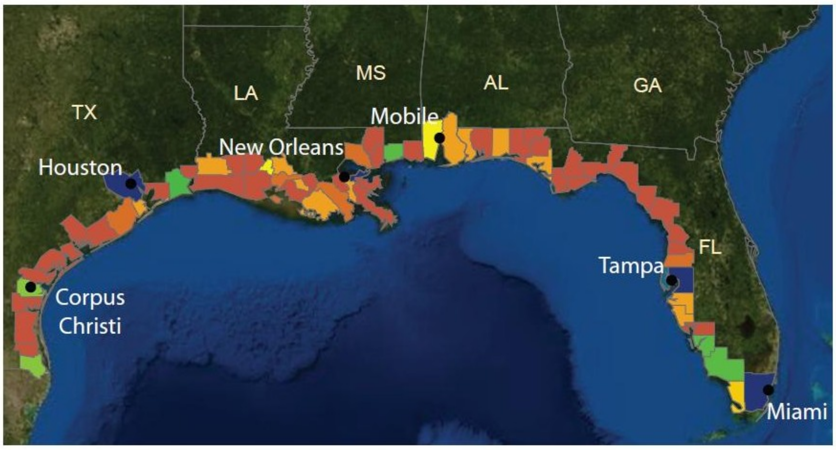
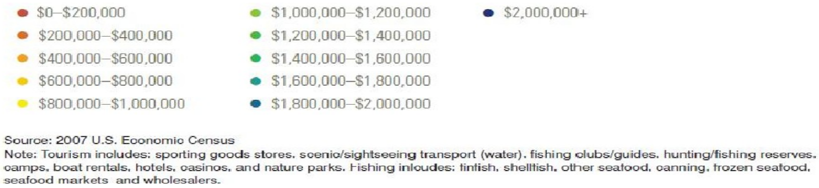


Figure 18: Annual Tourism and Fishing Revenue: Economic Activity by County



Source: (National Commission, 2011: 186)

3.3.1 Tourism

The Gulf Coast region with its marshes, mangroves, swamp forests, and beaches is one of the favorite recreational and touristic location in America (Brent et alii, 2008: 12). The region generates roughly $19.7 billion of tourism activity annually (National Commission, 2011: 191), and employ 620,000 workers (see figures 19 and 20) (Brent et alii, 2008: 2). The State of Florida represent more than 50 % of the total (National Commission, 2011: 191). The Recreational fishery sector is also very productive in the GoM. In 2010, marine recreational participants took more than 20.7 million trips catching 145.4 million fish from the GoM and surrounding waters (representing over 59.3 million pounds) (U. S. Environmental Protection Agency,"General Facts about the Gulf of Mexico", 2011).

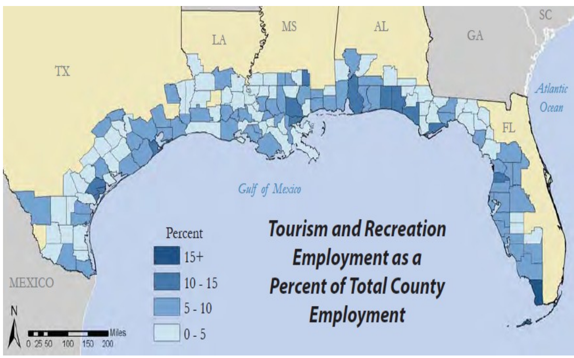


Figure 19: % of County Employment -Tourism and Recreation in the Gulf Coast Region
Source: . (NOAA. (Lead Author, 2012)

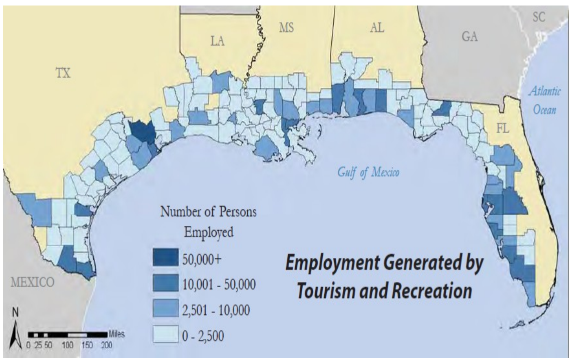


Figure 20: Employment Generated by Tourism and Recreation in the Gulf Coast Region
Source: (NOAA. (Lead Author, 2012)

The Gulf tourism was severely impacted by the spill. Indeed, public perception that beaches were oiled led to declines in hotel bookings, restaurant seatings, and a wide array of coastal activities, generating a considerable amount of professional activities (National Commission, 2011: 185).

3.3.2 Fishing and Maritime Industry

The fishing industry is also crucial for the economy of the Gulf Coast, the seafood sector produces in the GoM more than one-third of the nation's domestic seafood supply (Baltimore and Simao, 2010). Indeed, gulf fishermen catch 73 % of the nation's shrimps (half from Louisiana waters). Louisiana accounts for 67 % of the nation's oyster production and 26 % of the blue crab production. (National Commission, 2011: 187) According to the NMFS, the commercial fish and shellfish harvested from the five US Gulf states in 2010 represented approximately $639 million (U. S. Environmental Protection Agency,"General Facts about the Gulf of Mexico", 2011).

Much of the fishing and processing industry were suspended by Federal and state closures of commercial fisheries. Public concern raised nationwide regarding seafood safety. (National Commission, 2011:185) When the US government reopened fisheries areas in the federal waters to fishing and claimed that all seafood caught in the newly opened areas was safe to eat, it did not prove to be particularly efficient and the commercial fishing industry keeps on suffering from an acute image problem. (Noussia, s.d.: 175) Continued testing, improvements, and a coordinated marketing campaign are necessary to improve the image of the GoM seafood. To reduce the adverse impact resulting from the spill, in November 2010, BP accepted to give Louisiana $48 million and Florida $20 million for seafood testing and marketing. The oil company was recently considering a similar request from Alabama. (National Commission, 2011:188)

Due to its strategical location and the richness of its fisheries, the Gulf also harbors four of the top seven fishing ports in the nation by weight, and eight of the top twenty fishing ports in the nation by dollar value (US Environmental Protection Agency,"General Facts about the Gulf of Mexico", 2011). On top of that, the Port of South Louisiana (New Orleans) and the Port of Houston are two of the ten busiest ports in the world by cargo volume (US Environmental Protection Agency,"General Facts about the Gulf of Mexico", 2011). Consequently when the region is suffering, this is the whole nation that is affected. The following table (see figure 21) shows the various tonnage of the different important American ports and underlines the importance of the Gulf ports in the American economy. (National Commission, 2011: 197)

Top Ten Ports in the United States Ranked by Tonnage in 2006

Rank	Port	Millions of Short Tons*
1	South Louisiana, LA	225.5
2	Houston, TX	221.1
3	New York, NY and NJ	157.6
4	Long Beach, CA	84.4
5	Beaumont, TX	79.5
6	Corpus Christi, T	77.6
7	Huntington – Tristate, WV-OH-PA	77.2
8	New Orleans, LA	76.9
9	Los Angeles, CA	66.0
10	Mobile, AL	59.8

Figure 21: Leading US Ports in 2006 by Tonnage

[77] Source:(NOAA. (Lead Author, 2012)

3.3.3 The Energy Sector

Besides its fishing and recreational aspects, the region is also essential for the American oil supply. Indeed, the Gulf region produces one-third of all domestic oil. (Institute Of Energy Research, s. d.: 2). According to MMS, offshore operations in the Gulf produce 2% of the US domestic natural gas and 12,5% of its oil and would employ more than 55,000 US Workers (U. S. Environmental Protection Agency,"General Facts about the Gulf of Mexico", 2011). Consequently, the moratorium imposed on deepwater drilling heavily affected the regional economy.

At President Obama's urging, BP agreed to place in escrow a $20 billion fund[78] to help address financial losses. As of November 23, 2010, more than $2 billion administered by the Gulf Coast Claims Facility have been distributed to roughly 127,000 claimants. (National Commission, 2011 185)

As far as BP is concerned and even despite the different strategies adopted (see 2.5.7: Communication and Informational Aspect), the supermajor has lost in 2010 almost half of its market capitalization. This situation was probably due to growing public anger toward BP and multiple risks of prosecution. (Beloff, 2010: 331-332) Nevertheless, as we shall see further, on the long term, BP has not done a bad job and most people have already forgotten the disaster, except maybe the people still directly impacted and some scientists.

Furthermore, municipalities could also have to cope with decreased tax revenues directly or indirectly related to business closures. Because of the spill short- and long-term uncertainties, residents as well as business along the coast do not feel secure to invest or consume (Noussia, s.d.: 140).

77 A short ton is a unit of mass equal to exactly 2,000 pounds, or 907.18 kilograms ("Short Ton", s.d.).
78 BP has established a $20 billion trust for payment of a number of types of claims arising from the DWH incident and resulting oil spill, and for costs related to the restoration of natural resources.

3.3.4 The Case of the Gulf Coast Shrimp Supply Chain

To illustrate how the spill has impacted sectoral businesses and especially small and medium ones, along the coast, we are going to take a closer look at the Gulf Coast Shrimp supply chain which has been disrupted by the gulf spill (Duhon et alii, 2011: 223-224).

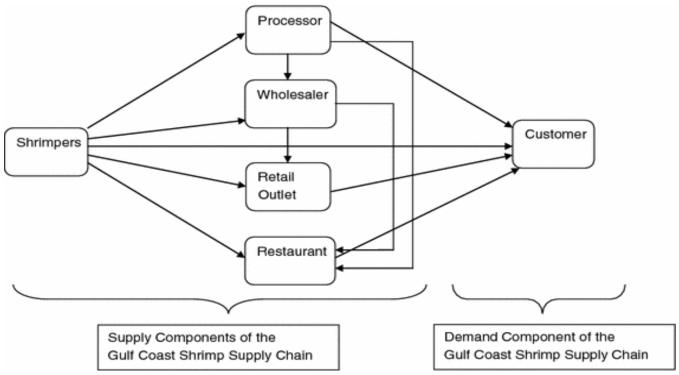


Figure 22: Actors of Gulf Coast Shrimp Supply Chain

Source: (Duhon et alii, 2011: 226)

The DWH BP oil spill in 2010 disrupted the supply of shrimps that were harvested in the GOM. The perturbations continued even after the well was under control and capped. On November 24, 2010 the NOAA announced the closure of approximately 4200 miles²[79] of gulf waters to Royal red Shrimping, as of January 9, 2011. (Duhon et alii, 2011: 223-224) The saltwater brown shrimp season constitutes a crucial business time for the stakeholders of the gulf coast shrimp supply chain. All the actors of the chain: shrimp fishermen of the oil spill impact zone, fresh shrimp processors, seafood wholesalers, fresh shrimp retail markets and restaurants were directly impacted by the disruption (see figure 23 for details of their respective roles in the chain). From an organizational point of view, many of the businesses in the shrimp supply chain are family businesses. Consequently these businesses are small and have limited resources. It is still currently difficult to assess to what extent these small businesses can endure, the BP oil spill of 2010. (Duhon et alii, 2011: 226-227)

79 4200 square miles represent 10877.95 km².

Figure 23: Description of Relationships Between the Stakeholders of the Gulf Coast Supply Chain

Source: (Duhon et alii, 2011: 236)						
Entity	Shrimpers	Processors	Wholesalers	Retail outlets	Restaurants	Local region consumers
Description	Small family operators to corporate fleets	Fully dependent upon local shrimpers to provide them with shrimp to prepare and package for wholesale markets	Dependent upon local markets, plus outside the region domestic and imported product	Dependent upon local markets, plus outside-the-region domestic and imported product. Driven to meet consumer demand.	Not as dependent upon local demand; local consumers not as choosy in restaurant setting; some substitution for other than- local product	Strongly faithful to Gulf Coast Shrimp, but increasingly open to imported shrimp; concerns about seafood safety.
Supply Chain Connections	Sells directly to processors, wholesalers, retail outlets, restaurants, and to local region consumers.	Obtains shrimp directly from shrimpers	Obtains shrimp from shrimpers and from processors as well as others in the wholesale supply chain.	Obtains shrimp from shrimpers, from processors, from wholesalers.	Obtains shrimp from shrimpers, from processors, from wholesalers.	Obtains shrimp directly from the water when engaged in fishing, from shrimpers, from processors, from retail outlets and from restaurants
Alternative business function when supply chain is interrupted	During BP oil spill, many shrimpers were engaged in spotting for oil, oil cleanup, or were out of business when fishing waters were closed	During BP oil spill, many were shut down	During BP oil spill, many struggled to find alternative sources of fresh gulf shrimp as well as acceptable substitute fresh gulf shrimp. Many shrimp were transferred into LA and MS from TX. Imported shrimp introduced as an alternative.			During BP oil spill, many bought fewer shrimp then were purchased in previous years, substituted imported shrimp when local shrimp not available.

Today, the shrimp supply chain is still struggling with the aftereffects of the BP oil spill. Some stakeholders have quit the industry. The 2010 oil spill has significantly deteriorated the supply side of the gulf coast shrimp supply chain. All the stakeholders (known and unknown) rely for their survival on their dexterity and flexibility (Duhon et alii, 2011: 232-233), except if they are able to obtain compensation for their financial losses from BP. Image gap is now the major concern in the Gulf. Indeed, even if all of the private and governmental entities assert the safety of gulf coast shrimps for harvesting and consumption, consumers remain skeptical. (Duhon et alii, 2011:237-238)

4 After the DeepWater Horizon Blowout

In this last chapter, we shall attempt to identify the improvements and changes brought about by the DWH catastrophe in the GoM. In a first section, we shall shortly present the recommendations issued by the National spill Commission (4.1) that the government has promised to take into account when revising the regulatory system overseeing offshore oil exploitation. A second section will be devoted to the new measures that have been taken and changes that have been operated at various levels (4.2). The third section of this last chapter will furthermore discuss the impacts of the regulatory measures on small-and medium-size businesses of the GoM energy sector (4.3). On top of that, we shall sketch the current drilling situation in the Gulf characterized by an intensification of drilling activities (4.4). The two last sections of this fourth chapter will be more prospective since they will focus on financial compensations that one could expect from BP and other subcontractors (4.4), as well as on the probable evolution of offshore drilling in the US (4.5).

The measures adopted during and after the spill were not to everybody' taste, the oil industry and the vast majority of Republicans did not appreciate at all the moratorium and the tightening of safety measures regarding offshore drilling. The Conservatives and Mitt Romney have tirelessly accused President Obama of not acting in the interest of the nation, as far as energy is concerned. Representative Doc Hastings, chairman of the House Natural Resources Committee, criticized the Obama plan and described it as “a giant step backward for American offshore energy production.” Republican wrongly continue to believe that a country with only 2 % of the world’s oil reserves can become energetically independent while Mr. Obama, like most democrats rightly considers drilling as one element among others in the American energy policy. (The New York Times, 2012)

In the electoral context, the polemic is still raging. Republican are still criticizing the drilling moratorium that was imposed by the Obama Administration after the DWH spill. (Walsh, “Nearly Two Years On, Did the BP Oil Spill Have to Happen to BP?”, 2012) Furthermore, Rep. Ed Markey, a Massachusetts Democrat, issued a statement in April 2012 underlining the Republican refusal to pass critical reforms to protect the workers, environment and economy of the Gulf. Similarly, Drew Hammill, a spokesman for California Democrat and minority leader Nancy Pelosi, also blamed Republicans for lack of action. (Zeller, 2011) The American energy policy and more specifically the fate of offshore drilling seem to be the favorite topic of the Republicans during this election campaign. America's addiction to oil is real but the necessity to be responsible and plan on the long-term regarding resources, environment and social justice also need be taken into account.

4.1 Recommendations for Future Oil Development

On May 22, 2010, President Barack Obama established the National Commission on the BP DWH Oil Spill and Offshore Drilling. This independent organism's mission was to provide the American nation with a detailed analysis on the BP blowout including its causes, management and consequences as well as a series of recommendations in order to make offshore drilling safer. (National commission, 2011: vi) The recommendations issued by this commission have been made public in January 2011. This series of recommendations should be taken into account when revising the offshore oil regulation in the US. Here below are the main themes targeted by the recommendations:[80]

- ✗ "improving the Safety of Offshore Operations",
- ✗ "safeguarding the Environment",
- ✗ "strengthening Oil Spill Response, Planning, and Capacity",
- ✗ "advancing Well-Containment Capabilities",
- ✗ "overcoming the Impacts of the DWH Spill and Restoring the Gulf",
- ✗ "ensuring Financial Responsibility", and
- ✗ "promoting Congressional Engagement to Ensure Responsible Offshore Drilling". (National Commission, 2011: 250 288)

The above recommendations (more detailed in annex 7) were not always welcomed by the oil industry as was mentioned in the introductory section of this chapter. Consequently, the sector issued several critiques. Indeed, they argue that companies with good safety records should not follow costly new rules and warned that a major new set of regulations would slow production and drive up prices. (Vick, 2012)

Last April, two years after the spill, a report has been released by Oceana[81] in order to grade the improvement or failure of the US government and the oil and gas industry as far as these recommendations are concerned. In this report, the government and industry received "F" grades in most of the categories, but in three instances the government earned "D" grades (see figure 24). (Rprokop, 2012) This underlines the lack of proactive attitude of the federal actors in implementing the various promises made after the spill.

80 For further information, please see annex 7 or the Final report of the National Commission at <http://www.oilspillcommission.gov/sites/default/files/documents/DEEPWATER_ReporttothePresident_FINAL.pdf >)

81 Oceana is international organization that was founded in 2001. It is the largest entity focusing on ocean conservation. (Oceana, s. d.)

Figure 24: Categories of Recommendations - Grades

Source: (Oceana, 2012)	
Improving the safety of offshore operations: government's role	D
Improving the safety of offshore operations: industry's role	F
Safeguarding the environment	D
Strengthening oil spill response, planning and capacity	F
Advancing well-containment capabilities	F
Overcoming the impacts of the Deepwater Horizon spill and restoring the Gulf	D
Ensuring financial responsibility	F
Promoting Congressional engagement to ensure responsible offshore drilling	F
Moving to frontier regions	F

On top of that, a group of former members of that National Commission, now calling itself Oil Spill Commission Action, assessed the government's implementation of those suggestions. According to this group; the Administration and industry have made significant progresses but this is not the case of the Congress. Republican members have even introduced a variety of bills aiming at speeding offshore drilling and loosening regulations. (Zeller, 2011)

In spite of these negative observations made by Oceana and the Oil Spill Commission Action, several changes have taken place within the government (4.2.1), the industry (4.2.2) and the American legislation (4.2.3) since the spill, as will be exemplified in the following sections. Unfortunately, the current political climate characterized by the coming federal elections in November 2012 are no favorable time to pass new rules. The beginning of the new legislature will be crucial to either strengthen the regulations and further compensate people, or to loose them and favor the oil industry. The outcome of these recommendations will depend on the orientations and attitude of the new president and its administration. Indeed, Republicans and Democrats do not approach the issue of offshore drilling and oil production from the same angle.

4.2 New Measures and Changes

Two years after the spill, the impact are still being felt, tar balls are still washing up along the Gulf beaches, and an unusually high number of dolphins are dying. (Walsh, "Nearly Two Years On, Did the BP Oil Spill Have to Happen to BP?", 2012) The DWH disaster has by its impacts and scope certainly had an influence on how Americans now consider offshore drilling and oil exploitation in general. Lessons have been learned from the disaster, as will be demonstrated further. According to Adam Fetcher, a spokesman for the DOI, "the Obama administration undertook the most aggressive and comprehensive reforms to offshore oil and gas regulation and oversight in US history." (Zeller, 2011)

After the blowout, a moratorium suspended drilling activities and several studies were realized by organisms such as the National Commission on the BP Deepwater Horizon Oil Spill, the Safety Oversight Board, the National Academy of Engineering ("Two years after Macondo", 2012), and the Secretary Mabus' Commission ("Global Conference of Ocean, Climate and Security", 2012). These reviews and reports were considered in order to correct the damages, restore and improve safety for future offshore drilling. ("Two years after Macondo", 2012) Additionally, the NOAA and EPA have decided to plan for 10 years from now in order to be better prepared if such an accident should occur again (Bea, 2010).

4.2.1 Changes within the DOI

As was made clear above (see section 2.3.3), MMS has failed to properly oversee both safety and response planning in the DWH oil spill. Consequently, in April 2011, MMS was remade (Vick, 2012). In its place Interior Secretary Ken Salazar created on June 18, 2010 (Birkland and DeYoung, 2011: 474-475) the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) (Burroughs, 2011: 60), that was charged with overseeing the safety and environmental consideration regarding the development of energy and mineral resources on the OCS. The creation of this new agency and the adoption of a new name were positive signals. (Birkland and DeYoung, 2011: 474-475). In October 2011, the duties of BOEMRE were divided between the Bureau of Ocean Energy Management (BOEM), and the Bureau of Safety and Environmental Enforcement (BSEE) (Bureau of Ocean Energy Management, Regulation and Enforcement, s. d). Resulting from further reorganization, the regulatory framework is now being administered by three different agencies within the US DOI: the BOEM, the BSEE, and the Office of Natural Resources Revenue (ONRR)[82].

Figure 25: The New Agencies Overseeing the Offshore Activities

The BOEM oversees resource development of the US OCS and is charged with offshore leasing, review and implementation of new development plans, and environmental studies. Regarding the BSEE, it is responsible for implementing and enforcing new regulations, issuing new permits, oil spill response, and training as well as controlling environmental compliance[83]. As far as ONRR is concerned, the office collects revenue from offshore drilling for the Federal Treasury. ("Two years after

82 Formerly, MMS was constituted of two operational programs: the Offshore Energy and Minerals Management, and the Minerals Revenue Management (MRM) program. In October, 2010, the functions of MRM were officially transferred to ONRR. (Office of Natural Resources Revenue, 2012)

83 BSEE's proposed fiscal year 2013 includes a budget increase to "support BSEE's efforts to ensure that drilling permit applications are judiciously and efficiently processed (Greenberg Jerry. s.d.).

Macondo", 2012)

The separation of BOEM and BSEE has several purposes. Indeed, it separates resource management from safety oversight, permitting a greater independence, more budgetary autonomy and clearer senior leadership focus. This dichotomy further provides a structure that ensures robust environmental analyzes and gives appropriate weight to resource management in BOEM during decision-making. On top of that, the separation strengthens the role of environmental review and analysis in both organizations. (Bureau of Ocean Energy Management, Regulation and Enforcement, 2010) However the new agencies still lack the resources (insufficient financing), personnel, training, technology, enforcement tools, regulations and legislation they need to do their job properly (Vick, 2012).

Many oil industry officials worry that the new environmental and safety requirements will discourage future exploratory investments because of the slowing down of the development of new wells and higher costs (Vick, 2012). In spite of its anxiety, the oil industry has been active to update and adapt to the new requirements imposed by the legislation and the public opinion.

4.2.2 Changes within the Oil Industry

The correction of the industry shortcomings was rapidly implemented in the operational infrastructure. Indeed, joint industry task-forces were created in order to address safety, containment, and area spill responses. Furthermore the oil industry had to adapt to the new measures issued by BOEM and BSEE, imposing new well designs based upon a concept called Worst Case Discharge (WCD). WCD implies an increased complexity of well designs as well as a reevaluation of drill pipe, landing strings, casing, casing hangers, and well heads. ("Two years after Macondo", 2012)

The major obstacle (after the spill) to obtain drilling permits was until fairly recently the requirement for a well containment response system providing rapid containment capabilities in the event of an underwater problem. As a result, industry had to wait until a containment system was developed and approved by the regulatory agencies. Two such systems were developed by two containment companies: the Marine Well Containment Corporation (MWCC)[84] and the Helix Systems Containment Group. Following the availability of these containment systems, several deepwater drilling permits began to be granted in late February 2011. (Greenberg, s.d.) Besides containment technologies, guidelines have been established to ensure safety and the compliance with regulations. Indeed, the Center for Offshore Safety (COS)[85] has begun training and certifying third party inspectors to evaluate the COS Safety En-

84 MWCC is a non-profit company formed by a partnership including ExxonMobil, Chevron, ConocoPhillips, Shell and BP. The MWCC interim containment system includes a subsea capping stack with the ability to shut in oil flow or flow the oil to surface vessels. An expanded containment system is being developed and will be available to the GoM offshore industry this year. (Greenberg, s.d.)

85 COS is an industry organization created to implement best practices in the area of safety and learning processes ("Two

vironmental Management System (SEMS) programs. VAM USA[86] has also participated in its implementation. Furthermore,the API began in June 2010, a new working group called API RP 96 'Deepwater Well Design Considerations' in conjunction with member companies. API RP 96 serves as a deep well design consideration tool that can be used by drilling and completion engineers in order to plan or drill deep wells. Resulting from the WCD requirements and the techniques developed in the API RP 96, the industry is coping with the emergence of new sizes, connections, and connection verification. Consequently, new rigs and company with expertise will be necessary to fulfill the new requirements and higher standards. ("Two years after Macondo", 2012)

4.2.3 Legal Evolutions and Landmarks

Besides internal restructuring of the DOI and "self-improvement" of the oil industry, the federal government has also taken measures at the legal level in order to prevent any similar event to occur again. After the moratorium on deep-water oil and gas drilling imposed by the Obama administration, extending from July 2010 to 12 October 2010, the US government considered it as appropriate that offshore activities resume. Nevertheless, operators must now certify compliance with all existing rules and requirements, even those recently adopted. The recent safety rules include the Drilling Safety Rule, issued on 30 September 2010, strengthening requirements for safety equipment, well control systems, and blowout-out prevention practices on offshore oil and gas operations. (Noussia, s.d.: 148)

Furthermore, in order to cope with the health issues raised by the action of emergency cleanup workers, a piece of legislation entitled the Oil Spill Accountability and Environmental Protection Act of 2010, has been passed. This recent act includes provisions requiring that the party liable for an incident or pollution pay for the personal injuries caused by the incident in question. This legislation will complete the OPA of 1990 under which this type of payment was not taken into account[87]. (Weinhold, August 2010: A 350)

Another major issue raised by the recent crisis is the liability limit of the liable party (this was one of the Commission's recommendations). Under the existing OPA, responsible parties are strictly liable for removal costs and certain damages (detailed in the Act) resulting from a spill (see 1.4 and 2.4). It became rapidly clear that the damages from the DWH oil spill were greater than the existing cap. Consequently, Congress began to consider raising that cap significantly (to as much as $10 billion) or eliminating it. (National Commission, 2011: 245) This initiative is motivated by the fact that one cannot assume that a future responsible party would, like BP, have sufficient resources to fully com-

years after macondo", 2012).

86 VAM USA is the world leader for premium connection solutions for the oil and gas industry (V.A.M.. s.d.).

87 In this respect, a guideline document entitled The 'National Response Framework' (NRF) existed before the DWH episode but was frequently ignored. (Weinhold, August 2010: A 350)

pensate for the damages. Furthermore, an increased cap would also serve as a powerful incentive for companies to pay closer attention to safety. However, a substantial portion of the offshore industry in the Gulf is made up of smaller, independent operators (see 4.3), for whom higher insurance premiums could be disadvantageous and even harmful. Consequently, Congress and industry are considering a series of more nuanced measures to mitigate adverse impact on weaker businesses. (National Commission, 2011: 246)

Also worth mentioning is the Restore Act[88] (introduced by 9 Gulf Senators and recommended by the National Commission) that was passed in June of 2012 and signed into law by the President on July 6, 2012. Thanks to this Act, at least 80% of the fines (under CWA) owed by BP and other liable parties will be returned to the Gulf in order to restore the region's communities, economies and environments. ("The Restore Act", s. d.) Without this piece of legislation, the penalties potentially ranging from $5 to $21 billion will go into the US treasury. (Audubon, s.d. "Restore Act") This Act will be really beneficial to the region's wildlife and habitats. Furthermore, according to a recent study conducted by Duke University, the penalties could provide a long-term investment in ecosystem restoration and create jobs benefiting to more than 140 businesses across 37 states. ("The Restore Act", s. d.)

4.2.4 Restoration

Estimations suggest that 22% (see oil budget, section 2.5.6) of the spilled oil could still be existing in the Gulf basin: as surface oil, shorelines tar balls, as sediment oil or as submerged 'oil mats' associated with the benthos (Arias et alii, 2011). The spill itself is a regional issue, but the slow-motion decimation of the GoM's coastal and marine environment was already underway before the spill (National Commission, 2011:197-198). After the spill, Secretary of the Navy and former Governor of Mississippi Ray Mabus was commissioned by President Obama in June, to study Gulf coast recovery and propose ways to address chronic Gulf marine and coastal issues as well as problems related to ecosystem restoration, human health, economic recovery, and the nonprofit sector. Furthermore, in October 2010, President Obama also created a Gulf Coast Ecosystem Restoration Task Force constituted of federal agency and state representatives whose objectives are to coordinate intergovernmental responsibilities, planning, and exchange of information in the framework of a broad restoration process. The sum of money needed for a full restoration of the Gulf would range between $15 billion and $20 billion, implying: a minimum of $500 million annually for 30 years. (National Commission, 2011:210) The restoration of the GoM is even more important for the region because the economies, such as fisheries, and tourism are strongly conditioned by the environment quality (National Commission, 2011:212- 213). On July 6th 2012, President Obama signed into law a bill that included the critically

88 The Act is also entitled the Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economy of the Gulf Coast Act of 2011 ("The Restore Act", s. d.).

important Restore Act, (see legal measures, section 4.2.3) (Audubon, s.d.). This act is a great opportunity for the federal and state governments to undertake a major and comprehensive restoration program in the GoM.

4.2.5 Scientific Funding

A more positive element related to the catastrophe are the funding injections by BP initiated in Summer 2010. The money, fueling studies in the Gulf Coast, is raising hopes that the DWH event could provide answers to long-standing questions on the nature of cellular toxicity. While oil was still gushing into the Gulf, BP made the announcement of plans for their $500 million research program and established the Gulf of Mexico Research Initiative (GoMRI)[89] to administer the funds. This sum will support independent research on ecosystem assessment, impacts, and recovery efforts, research program designed to study the impact of the oil spill and its associated response on the environment and public health in the GoM. The funding will be level-loaded over a period of ten years In June 2010, The GoMRI administered $40 million that were divided between several Gulf State universities, research consortia, and the National Institute of Health. Similarly, the National Science Foundation provided rapid financial response so that researchers were able to start collecting data immediately after the blowout. In April 2011, the GoMRI announced the financial plan according to which the remaining BP funds would be administered over the next 10 years. (Alvania, 2011: 343-344)

4.3 Economic Impacts of the Regulatory Measures

The moratorium and other measures taken by the Obama administration to increase safety, have also impacted negatively the oil sector. Due to the moratorium and new safety regulations, leasing activities were halted officially during six months, but in the fact during more than a year. Major development projects were stopped. Major service companies had to change strategies, either moving more to onshore operations or into international areas when possible. Equipment manufacturers, repair, and maintenance companies were in harsh conditions, left with little work. Similarly, rig catering companies were out of work. The deepwater drilling moratorium was officially lifted on October 12, 2010, and many in the industry thought deepwater drilling and production activity would quickly return to pre-Macondo levels. However, it was another few months until the BOEMRE (now BSEE and BOEM) began granting drilling permits because of the new requirements (developed by the industry, see 4.2.2) including containment systems. Following their availability, several deep-water drilling permits began to be granted in late February 2011. (Greenberg, s.d.)

89 The GoMRI's mission is to improve society's ability to understand and mitigate the impacts of hydrocarbon pollution and stressors of the marine environment in the GoM (Gulf of Mexico Alliance, s. d.).

As mentioned and illustrated here above the oil industry, has suffered from the moratorium and regulatory measures resulting from the spill. But the victims of these measures were frequently local and smaller-size businesses of the GoM, not the targeted international companies. Indeed, small- and medium-size businesses are still suffering. These have had to shed employees, dip into personal savings or move elsewhere to stay afloat. According to a study released by an economic development agency Greater New Orleans Inc.(GNO)[90], as a result of the permit slowdown and insecurity about the future of the GoM, businesses are laying off workers, reducing hours and salaries and limiting new hires.[91] (Investor's Business Daily, 2012)

Eloquent of what has just been exemplified is the evolution of the distribution of companies, currently active in the Gulf. Indeed, the proportion has significantly changed. In 2008, the 6 major operators had 55% of the permits granted. As of February, 2012, three major operators have almost 70% of the total permits issued. ("Two years after Macondo", 2012) We have thus witnessed the creation of new monopoles that are intensifying their activity in the Gulf (see next section) to the detriment of small- and medium-size businesses.

4.4 Drilling is on the Roll in the GoM

In 2012, two years after the 2010 explosion, exploration and production in the Gulf will soon surpass the pre-Macondo levels. Indeed BP and other oil companies are intensifying their offshore activities in the region. The reason of this phenomena is to be found in the continuing high demand for energy worldwide. In early 2012, five drilling rigs (just like before the blowout) belonging to BP were active in the gulf and the oil company plans to have three more platforms drilling in the gulf by the end of this year thanks to the resumed auctions of December 2011. Indeed, in December 2011, the first offshore auction since the spill was held and BP successfully bid for 11 of the 191 available drilling blocks. (Vick, 2012) BP does not seem to suffer that much two years after the dramatic event, the same cannot be said for impacted populations and ecosystems. Moreover, nearly two dozen deepwater and ultra deepwater development projects are scheduled for the period from 2012 to 2014 in the GoM, including 14 projects during 2012, three during 2013 and six in 2014, in water depths from about 2,700 ft[92] to more than 9,000 ft[93]. (Greenberg, s.d.)

Everything seems to be back to normal for big companies, did the Macondo blowout really occurred? Yes of course, the regulation has changed, safety has been improved but more wells are drilled into

90 About 100 business owners or company executives from fields associated with the oil and gas industry responded to the GNO Inc. Survey (Investor's Business Daily, 2012).

91 9% of the companies in the survey have laid off employees as a result of the moratorium. 52.5% surveyed have not hired new employees since the moratoria. Some 41% of the companies surveyed are not making a profit, a statistic that does not bode well. About 76% of the businesses have lost cash reserves. (Investor's Business Daily, 2012)

92 2700 feet represent 822.96 meters.

93 9000 feet represent (2,743 m)

ever more dangerous areas. Consequently, other oil spill will happen, the question is just to know when. BP will have to compensate for the damages it has caused. The company will pay high fines and will probably have to do so for several decades since most damages are going to unveil progressivelly. In the next section we shall attempt to understand what the company could be forced to pay and say a few words about the expectations of the public and specialists.

4.5 What Can Impacted Parties Expect from BP?

In this section we shall try to understand and to evaluate what claimants can expect from the oil company and its contractors; it is not always easy since the federal trial has not taken place yet (January 2013). However, we nevertheless try to evaluate what the compensations could represent.

Last March, BP has been in talks with the Department of Justice to settle pollution claims. These claims could reach $17.6 billion. The company has already set up a $20 billion trust and agreed on March 2 to a $7.8 billion settlement with residents and businesses (from fishermen to Gulf hotel owners.). The oil company has also announced that it would pay additional funds directly if the fund was exhausted. (Bloomberg. 2012) According to Wes Kungel, regional representative for Louisiana Senator Mary Landrieu, CWA penalties against BP should total between $5 billion and $21.5 billion. These amounts of money are based on fines of $1,100 (simple negligence) to $4,300 (gross negligence) per barrel and an estimated 4.9 million barrels[94] spilled. (Buchanan, 2010) The government wants to increase the penalties that BP has to pay and will try to prove BP's gross negligence. (Bloomberg. 2012) Louisiana is expected to receive a greater share of BP's CWA penalty money because the state has received 60 % to 90 % of the spill pollution. Worth mentioning is also the possibility that BP will have to cough up fines, resulting from violations of the ESA, MMPA and the MBTA. In total, along with compensation from the NRDA (under OPA), as much as $130 billion in money can be expected from BP. Moreover BP might also have to pay for methane gas that leaked from its well (under CAA) (Buchanan, 2010).

The federal trial starting in New Orleans in January will clarify the situation for all the stakeholders involved in the case. This trial will not be the last, since states, business and individuals can seek to prosecute BP. Unfortunately the scope of this thesis is too narrow to deal in details with the judiciary prosecutions.

The DWH blowout in the GoM as well as the multiple prosecutions against BP have slowed down offshore drilling but did not stop it forever, the activity is already regaining momentum in the Gulf as was explained above (4.4). Furthermore, the Obama administration has planned to support offshore drilling

94 4.9 million barrels represent 77,9037.77 m^3.

in new OCS areas. The prospect of the oil industry as well as the future leasing plan of the government will be presented in the following section. We shall see that even if the regulation is stricter, areas of offshore drilling are extending and risks are increasing.

4.6 Probable Evolution of Offshore Drilling in the US

Offshore wells representing 33% of current US oil production, are a the heart of the US energy policy. The proportion of American oil production originating from offshore drilling will most probably increase in the next decades. Indeed, the OCS contains an estimated 85 billion barrels of oil, considered as technically recoverable. (National Commission, 2011: 294) In spite of the BP disaster and the evidence of high risks linked to this type of activity, the US government has decided to open vast areas of its territory to offshore drilling, especially in the GoM and in the Alaskan region as we shall see in a moment.

Since the spill, the plans on offshore drilling have been modified but continue to expand. On March 31, 2010, President Obama proposed to open vast expanses of American coastlines to oil and natural gas drilling. However, that idea was postponed by the GoM blowout of April 2010. In December 2010, the administration abandoned the decision to expand offshore oil exploration into the eastern GoM and along the Atlantic Coast. Drilling in these areas will remain under a moratorium for at least the next seven years, in order to give time to the government and industry to adopt stronger safety and environmental standards. However, drilling, will continue under a new set of standards in the central and western parts of the GoM. In November 2011,the five-year plan for offshore oil drilling was announced, it includes the opening of new areas in the GoM and Alaska but bars development along the East and West Coasts. (Vick, 2012) The administration's drilling plan covering the years 2012 to 2017 is quite similar to the one of March 2010, and authorizes 12 large lease sales in the GoM and three smaller in the Beaufort and Chukchi seas and the Cook Inlet (AK) (see map on annex 8). (The New York Times, 2012)

4.6.1 The Gulf of Mexico

Offshore drilling will venture into deeper areas situated in the GoM to find oil. Obama's plan expands the areas in the GoM, including some near Florida that were off limits. (Vick, 2012) Thanks to new technologies such as TLP (tension leg platform), semi-submersibles, spar, FPSO (floating production, storage and offloading), production costs have practically become independent from the depth of the well. Nevertheless the costs are so high that only the big companies are able to afford them. Besides deep water drilling, companies are already focusing on ultra-deep drilling, between 1500 and and 3000 m water depth. The wells located at these depths will require the creation of new technologies. In contrast with deep drilling, the technologies for ultra-deep wells cannot be extrapolated from shallow waters techniques. (Boy de la Tour, 2004: 139-143) Indeed, drilling in extreme water depths represents challenging obstacles. Risers that connect a drilling vessel to the BOP on the bottom of the sea, need to be lengthened. Moreover, these will be exposed to stronger currents characteristic of the central GoM. Additionally, higher volumes of mud and drilling fluid will be required, complicating the drilling process. Another major problem will be raised by the lack of existing infrastructure due to the greater distance from the coast. (National Commission, 2011: 51-52) Today, technology enables the oil industry to drill in waters twice as deep as Macondo (5000 feet or 1524 meters). This implies that the safety standards will need to be continuously adapted. (National Commission, 2011:. 299)

Moreover, we should keep in mind that drilling in the GoM is not solely a matter for US consideration. Both Mexico and Cuba have expressed interest in deep-water (> 500m) drilling in the Gulf in the near future. (National Commission, 2011: 300) In February 2012, the Transboundary Agreement was signed between the US and Mexico. This agreement concerns the exploration and development (by the US and Mexico's national oil company, Pemex) of oil and natural gas resources along the ultra deep-water maritime boundary of the two countries. It would concern about 1.5 million acres[95] on the US OCS, estimated to hold approximately 172 million oil barrels[96] and 304 billion cubic feet (bcf)[97] of natural gas. The targeted transboundary reservoirs, called the Western gap were off limits to both countries under a previous treaty that imposed a moratorium along the boundary through 2014. (Greenberg, s.d.)

Besides the GoM, the Alaskan region is also part of the new leasing program of the Obama administration. This region poses conditions quite challenging as well.

4.6.2 The Alaskan Region

In the 1980s, companies had already their sights set on the Arctic region. Since the 1960s, major firms had produced oil from Alaska’s Kenai Peninsula and Cook Inlet. In 1977, the massive onshore Prudhoe Bay field on the North Slope was already pumping oil through the Trans- Alaska Pipeline. (see the map of Alaska on annex 8). The industry temporarily lost its craving for the Arctic after disappointed drilling and congressional and presidential moratoriums on leasing in Bristol Bay (site of the world’s largest commercial salmon fishery) following the Exxon Valdez oil spill in 1989. However the

95 1.5 million acres represent 607028.46 ha.
96 172 millions bbl represent 27345815.6 m³.
97 304 billion cubic feet represent 8608321363.97 m³.

industry gained access to the Beaufort and Chukchi Seas. (National Commission, 2011:35-36) additionally, as we have seen, the government has decided to extend the leasing areas in the Alaskan region (see 4.5). On August 4, 2011, Royal Dutch Shell was granted conditional approval to begin drilling exploratory wells in the Arctic Ocean in summer 2012. (Vick, 2012)

Finding and producing those potentially important supplies of oil offshore of Arctic Alaska require the utmost care, given the special challenges and risks (Vick, 2012). Indeed, access and working conditions in the Alaskan Arctic are affected by extreme cold, extended seasons of darkness and ice, hurricane-strength storms, and pervasive fog. These conditions limit exploratory drilling and many other activities to the summer months. (National Commission, 2011: 302) Additionally, depending on the environment in which oil is released its toxicity and disappearance will occur more or less rapidly. Tropical habitats have warm temperatures accelerating the processes of weathering and disappearance of oil. In contrast, Arctic habitats are characterized by cold temperatures and unique physical features generated by ice and seasonally restricted or unrestricted access to light. Oil spilled off Alaska is likely to degrade more slowly. Moreover, biodegradation occurs more rapidly in warm waters (< 10°C), suggesting that bioremediation, a mitigation technique using the biodegradtion (see chapter 2) would not be really useful in arctic or antarctic spill situations. (Shigenaka, 2011: 1010-1014)

The stakes for drilling in the US Arctic are also raised by the richness and rarity of its ecosystems. The Macondo blowout of April 2010 has shed light on the human and environmental risks associated with deep-water drilling. (Larry and Jacinda, 2011: 226-228) The marine mammals (ie. seals, cetaceans, whales, walruses) in the Chukchi and Beaufort Seas are among the most diverse in the world. On top of that, the Chukchi Sea harbors about 50% of America's and 10% of the world's polar bears. This region also supports millions of shorebirds, seabirds, and waterfowl, as well as abundant fish populations. Additionally, the Inupiat Eskimos of Alaska rely heavily for their subsistence on resources from the marine environment, playing moreover a decisive role in their cultural customs and heritage. (National Commission, 2011: 303)

Conclusion

The present work has tried to provide the reader with an overview (absolutely not exhaustive) of the DWH blowout tragedy. The ins and outs of the issue are relatively complex as we have seen. In the first chapter we have sketched the context of offshore drilling in the US by discussing its origin and evolution from historical and legal perspectives. In the second chapter; we have tried to understand what happened on April 20, 2010, and to identify the causes of the blowout from a punctual and systemic point of view. Indeed, if the oil companies and contractors are obviously responsible, the oil industry in its whole as well as the lax federal government have also their share into it. Another section of this chapter has also focused on the crisis management process and the various mitigation means used during and after the spill. In a third chapter, we have also had the occasion to discuss the human, economic and environmental impacts that have been generated by the spill. The consequences resulting from the spill have also been broached. As we have seen some of them will unveil progressively, over years and even decades. However, everything is far from being negative. Indeed something seems to have changed in the US as was made clear in the last chapter. Measures have been adopted, restoration is operated on scales never reached before. Things have changed as we have seen but maybe not sufficiently, given the future prospects of the oil industry and federal government.

The natural capital assets, such as the natural richness of the GoM, and other public goods cannot be systematically ranked after private interests. Better regulations and stronger incentives regarding offshore drilling should be adopted in order to protect an environment that supports most (not to say all) human activities. No country is shielded from a similar natural catastrophe impacting environment, people and industry. (Noussia, s.d.: 174-176) The oil sector and the lax American government are not the only ones to blame in this tragedy. Indeed, every single people bear some personal responsibility. The offshore activities of oil companies and the negative effects that they generate on the neighboring communities and environment are initially motivated by greed and supported by our addiction to oil. In order to satisfy our unsustainable demands, they explore farther, faster and deeper, frequently going beyond the possibilities of safe technology. (Beth Beloff, 2010: 331-332)

Ceaseless efforts to dig deeper and go further out to sea for oil resources will inevitably lead to other oil disasters. The DWH spill was not the first one to occur in the US (there was 1969 Santa Barbara blowout, the Exxon Valdez oil spill in Prince William Sound Alaska, in 1989), and will probably not be the last. Some pretend that the DWH spill by its scope and impacts have aroused awareness, in contrast more pessimist people maintain that the BP blowout will not change drastically the American approach toward oil. (Mitsch, 2010: 1610) However, Obama's approach and discourse are encouraging as his speech reflects: “If we refuse to take into account the full cost of our fossil fuel-addiction- if we don't factor in the environmental costs and national security costs and true economic costs – we will have missed our best chance to seize a clean energy future". (Lee, 2010) This type of discourse comforts environmentalists, strongly hoping that Obama will be re-elected, if not, safety and environmental measures could never be implemented by the Conservatives, blindly supporting the American oil industry. However, in spite of this type of discourse, the Obama administration has lately opened vast areas of the American territory in the GoM and the Alaskan region to offshore drilling. This growing exploitation will inevitably lead to other accidents and major pollutions. It is now time that the American nation begins a transition to a cleaner, more energy-efficient future. (National Commission, 2011: 294) We must find more rational comprehensive clean energy and climate policies. The BP blowout in the GoM is only some further tragic evidence of the cost of our addiction to oil. (Beth Beloff, 2010: 331-332)

Let us hope that the comment from Sheik Ahmed Zaki Yamani, Saudi oil minister during the 1970's: "The Stone Age didn't end for lack of stone, and the oil age will end long before the world runs out of oil" (Maass, 2005), will soon become true, and that people will move toward safer and cleaner energy resources, more respectful of people and of our natural environment. The DWH blowout was a wake-up call the question is whether we will answer to it and response or whether we will continue to turn a deaf ear to that crucial issue.

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Annexes

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- Annex 2: History of Offshore Oil and Gas in the United States
- Annex 3: Laws Affecting OCS Oil and Gas Development
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Annex 1: Table of Conversion of Some Relevant Measurements:

Volumes	http://metricunitconversion.globefeed.com/Volume_Conversion_Table.asp	**Area**	http://www.infoplease.com/ipa/A0001661.html
1 cubic foot (ft^3)	28.32 liters	1 square foot	929.030 square centimeters
1 gallon (gal)	3.79 liters	1 square mile	258.999 hectares
1 barrel (bbl)	119.24 liters		
1 liter (L)	0.0353 (ft^3) 0.2642 (gal) 0.0084 (bbl)		
Length	http://www.infoplease.com/ipa/A0001661.html	**Weight**	http://www.infoplease.com/ipa/A0001661.html
1 km 1 m	0.621 mile	1 ton, net or short	0.907 metric ton
1 foot	0.305 meter	1 pound	453.59 grams
1 mile (statute or land)	5,280 feet 1.609 kilometers		
1 mile (nautical international	1.852 kilometers 1.151 statute miles 0.999 U.S. nautical miles		

Annex 2 : History of Offshore Oil and Gas in the United States:

History of Offshore Oil and Gas in the United States (National Commission, 2011: 23)	
1896	First offshore oil production in the United States—from wooden piers off Summerland, California
1936	First Gulf of Mexico discovery well in state waters; first free-standing production platform in the ocean—Creole field offshore Louisiana
1947	First well drilled from fixed platform offshore out-of-sight-of-land in Federal waters —Kermac 16 offshore Louisiana
1953	Submerged Lands Act & Outer Continental Shelf Lands Act
1954	First federal Outer Continental Shelf lease sale & Maiden voyage of the Mr. Charlie submersible drilling vessel, industry's first "day rate" contract
1962	First semi-submersible drilling vessel, Blue Water 1, and first subsea well completion
1969	Santa Barbara blowout/oil spill (California)
1978	Shell Oil Company's Cognac production platform (first in 1,000 feet of water) & OCS Lands Act Amendments
1981	First Congressional Outer Continental Shelf leasing moratorium
1982	Creation of the Minerals Management Service (MMS)
1988	Piper Alpha disaster in the North Sea
1994	First production from Shell's Auger tension-leg platform in 2,860 feet of water
1995	Deepwater Royalty Relief Act
1996	First spar production facility in the Gulf of Mexico at the Neptune field
1999	Discovery of BP's Thunder Horse field in 6,000 feet of water; at 1 billion barrels of oil equivalent, the largest discovery in the Gulf of Mexico
2006	Successful test at the Jack 2 field, in 7,000 feet of water and more than 20,000 feet below the seafloor, establishing the viability of the deepwater Lower Tertiary play
2010	Arrival of Deepwater Horizon at Macondo well in January

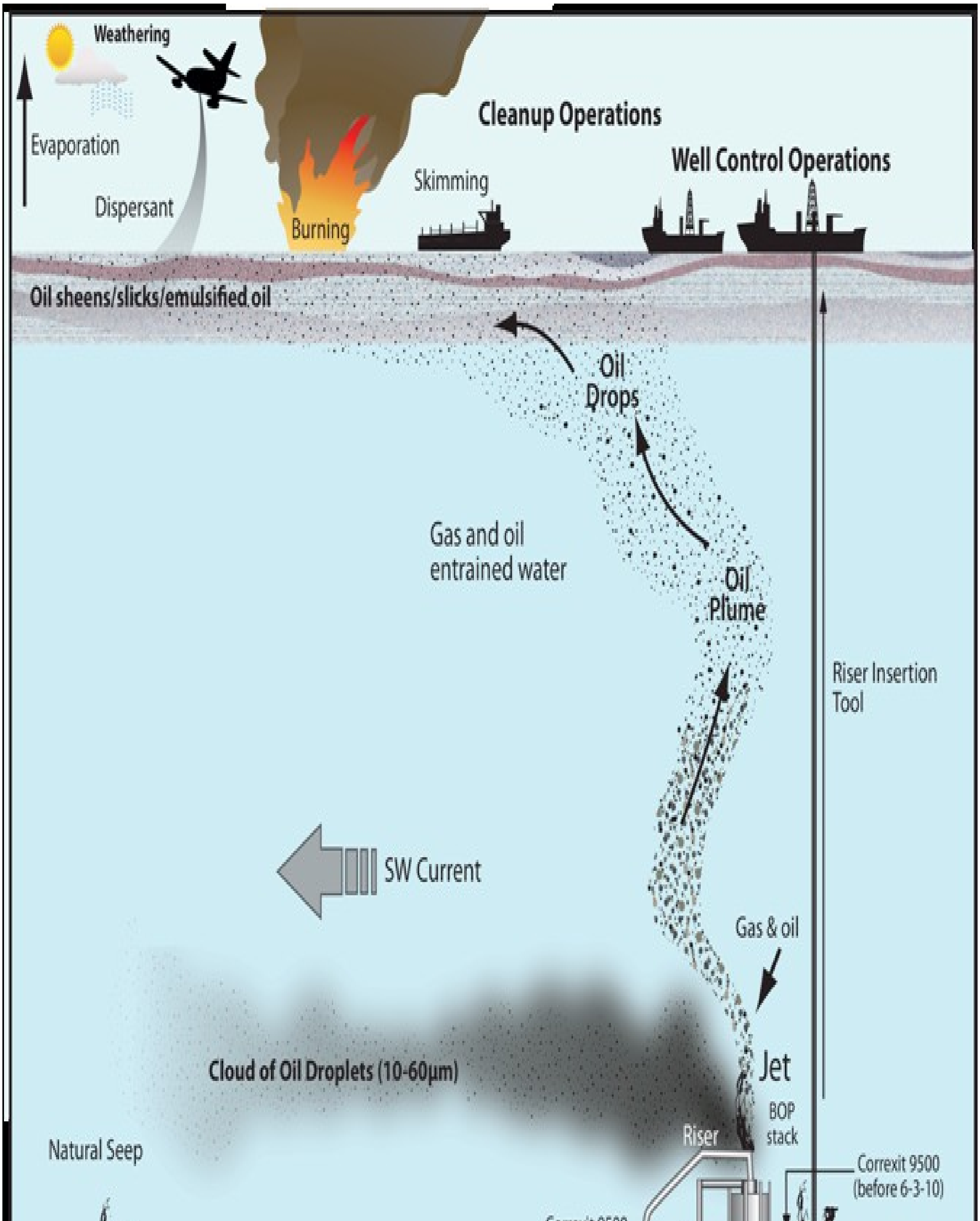
Annex 3: Laws Affecting OCS Oil and Gas Development:

TABLE 4.3
Laws affecting outer continental shelf oil and gas development.

Law	*Federal Agency*	*Objective*
OCS DEVELOPMENT		
Submerged Lands Act, 1953	Department of the Interior	Separate federal and state submerged lands
Outer Continental Shelf Lands Act, 1953 and 1978	Department of the Interior	Control leasing of federal offshore lands; environmental impacts
OCS Deep Water Royalty Relief Act, 1995	Department of the Interior	Encourage deepwater drilling by reducing royalties collected
Gulf of Mexico Energy Security Act, 2006	Department of the Interior	Share leasing revenues with Gulf producing states and reallocate leasing plans
OIL POLLUTION		
Federal Water Pollution Control Act Amendments, 1972 and revisions	U.S. EPA	Control operational discharges from oil and gas operations
Clean Air Act, 1990	U.S. EPA	Control air pollution from oil facilities
Oil Pollution Act, 1990	U.S. Coast Guard, Department of the Interior	Control and clean up oil spills
LINKS TO OTHER USES		
National Environmental Policy Act 1969	Department of the Interior and other federal agencies	Identify environmental consequences of federal actions
Coastal Zone Management Act 1972, 1990	Department of Commerce	Ensure that federal actions remain consistent with state plans for the coast
Rivers and Harbors Act	U.S. Army Corps of Engineers	Site offshore oil facilities away from shipping lanes
Endangered Species Act	Department of the Interior	Limit oil impacts on endangered species
Marine Mammal Protection Act	Department of Commerce	Limit oil impacts on marine mammals
Fishery Conservation and Management Act	Department of Commerce	Plan for interactions with commercial fisheries

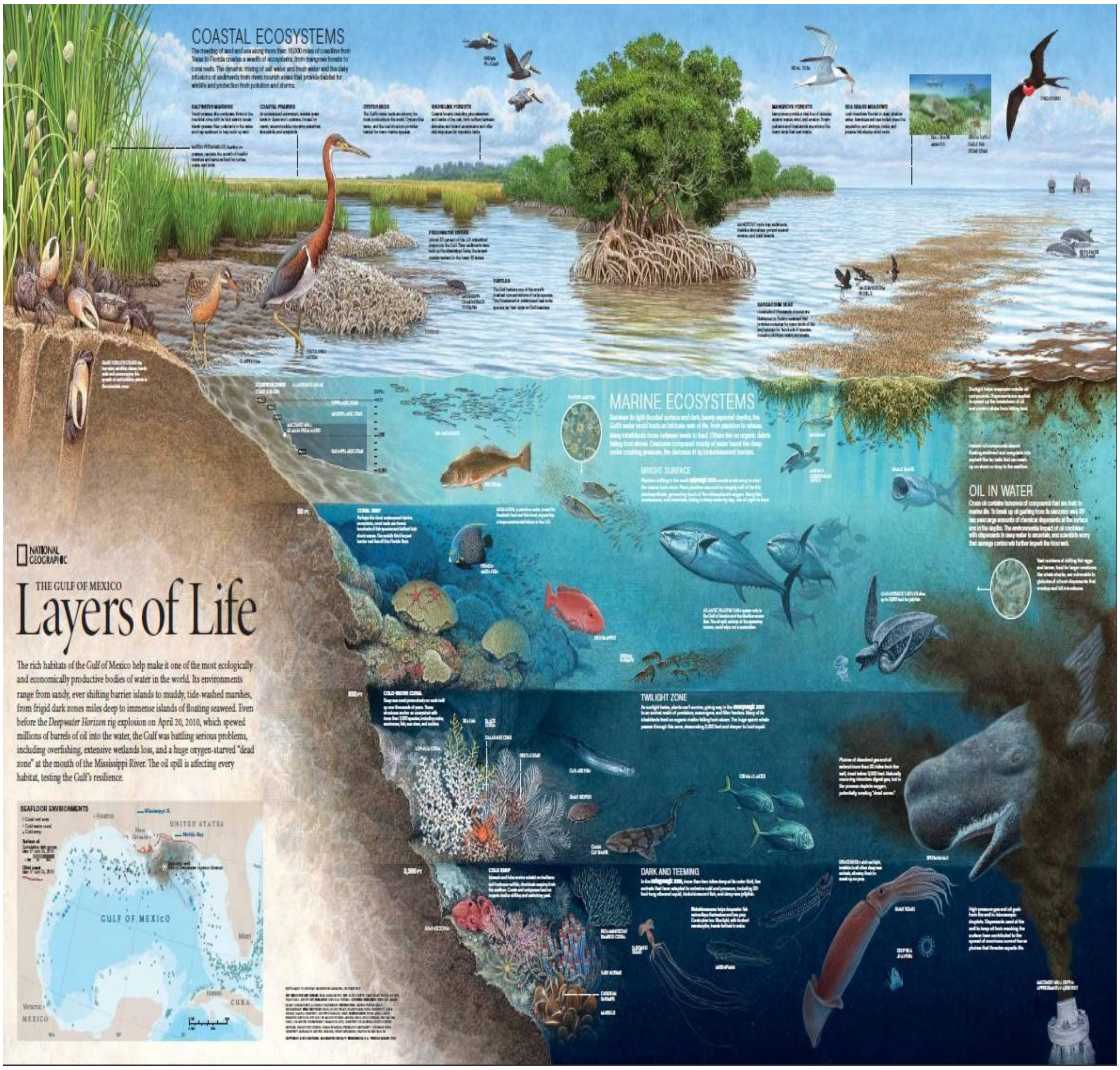
(Burroughs, 2011: 57)

Annex 4: Various Means to Control and Mitigate the Effects of the Macondo Blowout:



(Atlas and Hazen, 2011: 4)

Annex 5: Biodiversity Present in the GoM, According to the Different Coastal and Marine Levels: (National Geographic, s. d.)



Annex 6: Marine Species in International Union for Conservation of Nature threatened Red List Categories of the GoM (Campagna et alii, 2011: 394)

Marine species in International Union for Conservation of Nature threatened Red List categories that have a distribution directly overlapping the area of the oil spill, or that are found in the greater Gulf region extending from Texas to Miami, Florida.

Red List category species name	Common name	Protection status
Critically endangered		
Lepidochelys kempii	Kemp's ridley turtle	ESA-E
Eretmochelys imbricata	Hawksbill turtle	ESA-E
Dermochelys coriacea	Leatherback turtle	ESA-E
Thunnus thynnus	Atlantic bluefin tuna, western stock	
Epinephelus drummondhayi	Speckled hind	
Epinephelus itajara	Atlantic goliath grouper	
Epinephelus nigritus	Warsaw grouper	
Pristis pectinata	Smalltooth sawfish	ESA-E
Pristis perotteti	Largetooth sawfish	
Narcine bancroftii	Lesser electric ray	
Acropora cervicornis	Staghorn coral	ESA-T
Acropora palmate	Elkhorn coral	ESA-T
Endangered		
Balaenoptera borealis	Serving whale	ESA-E, MMPA
Balaenoptera musculus	Blue whale	ESA-E, MMPA
Balaenoptera physalus	Finback whale	ESA-E, MMPA
Pterodroma caribbaea	Jamaica petrel	
Pterodroma hasitata	Black-capped petrel	MBTA
Caretta caretta	Loggerhead turtle	ESA-T
Chelonia mydas	Green turtle	ESA-E, ESA-T (by range)
Sphyrna lewini	Scalloped hammerhead shark	
Sphyrna mokarran	Great hammerhead shark	
Montastraea annularis	Boulder star coral	
Montastraea faveolata	Mountainous star coral	
Vulnerable		
Trichechus manatus	Manatee	ESA-E, MMPA
Physeter macrocephalus	Sperm whale	ESA-E, MMPA
Epinephelus flavolimbatus	Yellowedge grouper	
Epinephelus niveatus	Snowy grouper	
Mycteroperca interstitialis	Yellowmouth grouper	
Lachnolaimus maximus	Hogfish	
Alopias superciliosus	Bigeye thresher shark	
Alopias vulpinus	Common thresher shark	
Carcharhinus longimanus	Oceanic whitetip shark	
Carcharhinus obscurus	Dusky shark	
Carcharhinus plumbeus	Sandbar shark	
Carcharhinus signatus	Night shark	
Centrophorus granulosus	Gulper shark	
Cetorhinus maximus	Basking shark	
Carcharodon carcharias	Great white shark	
Isurus oxyrinchus	Shortfin mako	
Isurus paucus	Longfin mako	
Carcharias taurus	Sand tiger shark	
Odontaspis ferox	Small-tooth sand tiger shark	
Rhincodon typus	Whale shark	
Sphyrna zygaena	Smooth hammerhead	
Squalus acanthias	Spiny dogfish	
Gymnura altavela	Butterfly ray	
Agaricia lamarcki	Lamarck's sheet coral	
Montastraea franksi	Montastraea coral	
Dendrogyra cylindrus	Pillar coral	
Dichocoenia stokesii	Elliptical star coral	
Mycetophyllia ferox	Rough cactus coral	
Oculina varicose	Large ivory coral	
Halophila baillonii	Clover seagrass	

ESA-E, endangered under the ESA: ESA-T, threatened under the ESA; MBTA, listed on the Migratory Bird Treaty Act; MMPA, listed on the MMPAt. *Source*: IUCN 2010.

Annex 7: Recommendations Issued in January 2011, by the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling: (National Commission, 2011: 252-290)

A Improving the Safety of Offshore Operations	A1: The Department of the Interior should supplement the risk-management program with prescriptive safety and pollution-prevention standards that are developed and selected in consultation with international regulatory peers and that are at least as rigorous as the leasing terms and regulatory requirements in peer oil-producing nations.
	A2: The Department of the Interior should develop a proactive, risk-based performance approach specific to individual facilities, operations and environments, similar to the "safety case" approach in the North Sea.
	A3: Working with the International Regulators' Forum and other organizations, Congress and the Department of the Interior should identify those drilling, production, and emergency-response standards that best protect offshore workers and the environment, and initiate new standards and revisions to fill gaps and correct deficiencies. These standards should be applied throughout the Gulf of Mexico, in the Arctic, and globally wherever the international industry operates. Standards should be updated at least every five years as under the formal review process of the International Organization for Standardization (ISO)
	A4: Congress and the Department of the Interior should create an independent agency within the Department of the Interior with enforcement authority to oversee all aspects of offshore drilling safety (operational and occupational), as well as the structural and operational integrity of all offshore energy production facilities, including both oil and gas production and renewable energy production.
	A5: Congress and the Department of the Interior should provide a mechanism, including the use of lease provisions for the payment of regulatory fees, for adequate, stable, and secure funding to the key regulatory agencies—Interior, Coast Guard, and NOAA—to ensure that they can perform their duties, expedite permits and reviews as needed, and hire experienced engineers, inspectors, scientists, and first responders. (See Recommendation G2.)
B. Safeguarding the Environment	B1: The Council on Environmental Quality and the Department of the Interior should revise and strengthen the NEPA policies, practices, and procedures to improve the level of environmental analysis, transparency, and consistency at all stages of the OCS planning, leasing, exploration, and development process.
	B2: The Department of the Interior should reduce risk to the environment from OCS oil and gas activities by strengthening science and interagency consultations in the OCS oil and gas decision-making process.
	B3: Congress, by enacting legislation, and the Department of the Interior, through its lease provision, should require the oil and gas industry to pay fees that support environmental science and regulatory review related to OCS oil and gas activities to enable cooperating agencies to carry out these responsibilities. (See Recommendation G2.)
C. Strengthening Oil Spill Response, Planning, and Capacity	C1: The Department of the Interior should create a rigorous, transparent, and meaningful oil spill risk analysis and planning process for the development and implementation of better oil spill response
	C2: EPA and the Coast Guard should establish distinct plans and procedures for responding to a "Spill of National Significance."
	C3: EPA and the Coast Guard should bolster state and local involvement in oil spill contingency planning and training and create a mechanism for local involvement in spill planning and response similar to the Regional Citizens' Advisory Councils mandated by the Oil Pollution Act of 1990
	C4: Congress should provide mandatory funding for oil spill response research and development and provide incentives for private-sector research and development.
	.C5: EPA should update and periodically review its dispersant testing protocols for product listing or pre-approval, and modify the pre-approval process to include temporal duration, spatial reach, and volume of the spill.
	C6: The Coast Guard should issue guidance to establish that offshore barrier berms and similar dredged barriers generally will not be authorized as an oil spill response measure in the National Contingency Plan or any Area Contingency Plan.
D. Advancing Well-	D1: The National Response Team should develop and maintain expertise within the Federal government to oversee source-control efforts.

Containment Capabilities	D2: The Department of the Interior should require offshore operators to provide detailed plans for source control as part of their oil spill response plans and applications for permits to drill.
	D3: The National Response Team should develop and maintain expertise within the federal government to obtain accurate estimates of flow rate or spill volume early in a source-control effort.
	D4: The Department of the Interior should require offshore operators seeking its approval of proposed well design to demonstrate that: • Well components, including blowout preventer stacks, are equipped with sensors or other tools to obtain accurate diagnostic information—for example, regarding pressures and the position of blowout preventer rams. • Wells are designed to mitigate risks to well integrity during post-blowout containment efforts.
E. Overcoming the Impacts of the *Deepwater Horizon* Spill and Restoring the Gulf	E1: The Coast Guard, through the Federal On-Scene Coordinator, should provide scientists with timely access to the response zone so that they can conduct independent scientific research during an oil spill response and long-term monitoring in the future.
	E2: The Trustees for Natural Resources should ensure that compensatory restoration under the Natural Resource Damage Assessment process is transparent and appropriate.
	E3: EPA should develop distinct plans and procedures to address human health impacts during a Spill of National Significance.
	E4: Congress, federal agencies, and responsible parties should take steps to restore consumer confidence in the aftermath of a Spill of National Significance.
	E5: Congress should dedicate 80 percent of the Clean Water Act penalties to longterm restoration of the Gulf of Mexico
	E6: Congress and federal and state agencies should build the organizational, financial, scientific, and public outreach capacities needed to put the restoration effort on a strong footing.
	E7: The appropriate federal agencies, including EPA, Interior, and NOAA, and the Trustees for Natural Resources should better balance the myriad economic and environmental interests concentrated in the Gulf region going forward. This would include improved monitoring and increased use of sophisticated tools like coastal and marine spatial planning. Many of these tools and capacities will also be important to manage areas of the OCS outside the Gulf.
F. Ensuring Financial Responsibility	F1: Congress should significantly increase the liability cap and financial responsibility requirements for offshore facilities.
	F2: Congress should increase the limit on per-incident payouts from the Oil Spill Liability Trust Fund.
	F3: The Department of the Interior should enhance auditing and evaluation of the risk of offshore drilling activities by individual participants (operator, driller, other service companies). The Department of the Interior, insurance underwriters, or other independent entities should evaluate and monitor the risk of offshore drilling activities to promote enhanced risk management in offshore operations and to discourage unqualified companies from remaining in the market.
	F4: The Department of Justice's Office of Dispute Resolution should conduct an evaluation of the Gulf Coast Claims Facility once all claims have been paid out, in order to inform claims processes in future Spills of National Significance. The evaluation should include a review of the process, the guidelines used for compensation, and the success rate for avoiding law suits.
G. Promoting Congressional Engagement to Ensure Responsible Offshore Drilling	G1: Increase and maintain congressional awareness of the risks of offshore drilling in two ways. First, create additional congressional oversight of offshore safety and environmental risks. Second, require the appropriate congressional committees to hold an annual oversight hearing on the state of technology, application of process safety, and environmental protection to ensure these issues receive continuing congressional attention.
	G2: Congress should enact legislation creating a mechanism for offshore oil and gas operators to provide ongoing and regular funding of the agencies regulating offshore oil and gas development.

Annex 8: Map of Alaska:
(Enchanted Learning, s.d.)