

The BP Macondo Oil Spill: The Failure of Corporate Risk Management and Government

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Introduction: The Changing Scale and Nature of Risks

This afternoon I wish to talk about the increasing **scale and nature of risk** – the complex challenges in assessing risk – the means of managing risks by corporations and government – through the vehicle of the BP oil spill in April 2010.

Risk management is about estimating the **highly complex interconnections** between the individual factors in risk.

These include environmental, geophysical, geotechnical, economic, social, and human errors.

Risk management is so difficult because it is **about predicting the future** with all its uncertainties in combining and integrating individual risks to estimate the required margin for safety.

Introduction (cont.)

While complex technologies require complex risk assessment **public policy** is going in the reverse direction with “smart” or limited regulation.

In our institute at the University of Calgary we are trying to investigate the **dynamics of energy systems** for both corporate management and government regulations.

As the BP case shows some of our most destructive events are **low probability / high risk events** which for financial reasons are often viewed as no probability – both tech-based and extreme weather-based – **Katrina more damage** to US Energy than any terrorist.

Also for both industry and government, it is easier and more straight forward to **estimate the benefits than the risks** – until too late and a bad accident occurs.

But it is essential after such an event **to assess and to ponder** the management and regulations essential so there is **no repetition**.

Introduction (cont.)

This study is a product of the **huge amount of sworn testimony** and reporting analysis in the reports of the enquiries into this event including the US Presidential Inquiry. I have given this in a more technical version to two of the major drilling companies in the Gulf.

There is no one “Smoking Gun” explanation and there is no Silver Bullet solution to events described. It is a story of **many layers of risk interacting** – like an onion, layer after layer.

How relevant is it to Canada? We have deeper wells than Macondo off the east coast of Canada.

Are there **common risks** with **other major disasters**? Yes! The Fukushima Daiichi nuclear power plant meltdown scale of problems was increased enormously by the failure of the **secondary emergency power system** essential for cooling pumps. Similar role in the BP event as we shall see with the BOP’s.

BP – The Company

Every major disaster has a **historical component** with previous events a precursor to the event in focus.

BP had long and privileged history – **unique in oil business** – Anglo-Persian bought by Winston Churchill before WWI for RN supply – Government finally out in 1987.

Key events – Middle Eastern assets nationalizes in 50s-70s – turned to North Sea (Forties), North slope of Alaska, in the 1980's deep Gulf offshore.

Huge **expansion in late 1990s** when it bought Amoco (\$62 B) and ARCO (\$32 B) – tripled in size – US Co – rival to Exxon and Shell at the top – **culture conflicts**

John Browne (CEO) bought when cheap - \$10 per barrel – **driven by financial constraints** – other oil company's by **operational engineering** issues

Changed the image and the brand to **“Beyond Petroleum”** – accepted the climate change science and Kyoto – renewable focus – **Exxon** saw them as a betrayal of the industries – Green and Yellow Sun brilliant rebranding and marketing campaign.

75 BP (2012/04/10)

BP – The Company

Debt load from the merger force BP to slash costs and staff – (25% in one year) – Now too thin on the ground – “**Do more with less!**” – philosophy

In 2005, Texas City, Texas refinery explosion – 16 killed and 180 injured – inquiry found “**systemic**” **deficiencies** in safety practices – BP ordered to improve.

Browne out for lying about his private life – new CEO, **Tony Hayward** – given safety as his first priority – some reforms - \$1 B spent – but the culture did continue.

Contradiction between public message on Beyond Petroleum and being the **most aggressive deep water drillers** in Gulf – Pipeline spills in Alaska.

BP – The Company

Employee and Contractor Fatalities (from BP 2009 SD Report)

2005 – 27 deaths

2009 – 18 deaths

Environmental and Safety Fines

2005 - \$56 M

2009 - \$66.6 M

BP did take steps to try **to rectify their performance**. In 2009, they brought in a new VP Safety in Houston but he quit in frustration by December 2009 claiming senior management had made it impossible to bring US BP up to industry standards.

But there were also problems with **weather in the Gulf** – Huge production platform badly damaged by Hurricane Dennis in 2005 – **Thunder Horse** – see next slide – 4 year to full production – over \$5 billion in cost – 250,000 b/d – hugely successful.

BP Thunder Horse Platform



Over \$5 B
hurricane

BP's mighty Thunder Horse platform was out-muscled by Hurricane Dennis in 2005 as it was being readied for service. Evacuated crews returned to find the semi-submersible production facility listing badly. After repairs and thorough analysis, additional problems were discovered that put the platform further behind schedule. For BP it was worth the wait. By 2009 Thunder Horse was producing a whopping quarter-million barrels a day.

Getty Images/U.S. Coast Guard photo/PA3 Robert M. Reed/digital version by Science Faction

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The Gulf Scene

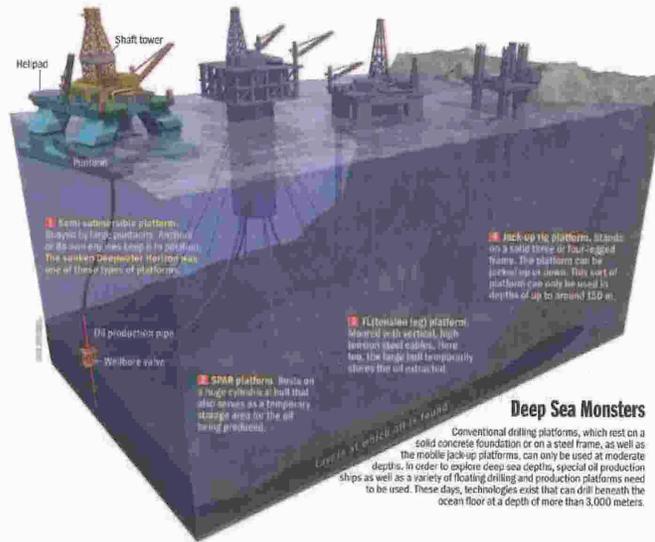
The Gulf of Mexico – incredibly rich and productive aquatic ecosystem which supported the largest ocean fishing and **seafood industry** in the Americas.

The Gulf was also the **most active area** of US drilling with over 36,000 wells (some now rusting and abandoned) and some 3,000 production platforms – in the last two decades expansion into deeper and deeper water.

Generally reservoir **pressures increase** as you go deeper with complex **control measures** – including the weight and downward pressure of the drilling fluids in the pipe balancing upward pressures out of the oil or gas reservoir.

Spectacular **development of technology** from jack up platforms, through floating drill ships, to huge semi-submersible postage rigs (*see diagram*) – high cost, high risk, high reward with economies of scale.

Deep Sea Monsters



Deep Sea Monsters

Conventional drilling platforms, which rest on a solid concrete foundation or on a steel frame, as well as the mobile jack-up platforms, can only be used at moderate depths. In order to explore deep sea depths, special oil production ships as well as a variety of floating drilling and production platforms need to be used. These days, technologies exist that can drill beneath the ocean floor at a depth of more than 3,000 meters.

DER SPIEGEL 19/2010

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The Gulf Scene

No major blowout in the Gulf since the Mexican Pemex. IXTOC well in 1979 which blew out for 10 months until 3 relief wells closed the flow.

BP were well aware there was a risk of a blowout but it was now so remote it was not taken seriously and there was absolute confidence in the ability of the technology to handle any situation.

Containment and Cleanup Plan not resourced.

The Macondo Well

BP acquired the deep water lease in march 2009 from MMS (Dept. of the Interior). **The Marianas** (the first drilling rig) was damaged by Hurricane Ida in fall of 2009 and had to return to port for repairs.

The Marianas was replaced by the **Deepwater Horizon**, a modern well-equipped rig with an experienced American crew and a lengthy accident free record.

The dealings with the **regulator (MMS)** were limited. The well received exemptions on some requirements and speedy approvals for well plan changes.

By April 2010 the **Macondo well** was a modest 50 million barrel discovery which luckily could be tied into an old production platform 20 miles away.

Ownership Structure

Deep offshore wells **are expensive** (\$200 M) so companies seek to spread the risks with partnerships. Here **BP** as owner/operator held 65%, **Anadarko** 25%, and **Mitsui** 10%. These numbers later become important as government allocates liability issues to well owners.

The rig owner was **TransOcean** with the largest fleet of drilling rigs in the world. It had extensive deep offshore experience including BP.

There were a number of technology and service providers including **Halliburton** (drilling mud and cementing) and **Cameron International** (BOP).

These kind of **project partnerships** bring added expertise but create management challenges for effective communication in decision making or project charges. Both of these were **problems** in Macondo.

Drilling the Well

On 6 Feb 2010, Deepwater Horizon resumed drilling **months late and well over budget** – but problems continued to plague the well – Houston upset 40% of days were down time – pressure to speed completion and limit costs.

The **technical problems** included: pore pressure gas “kicks” back up the well; equipment jammed and new drilling route had to be found; disputes between parties; excess pressure from drilling mud led to gradient fractures and mud loss out of the well.

Staff refer to Macondo as “**the Well from Hell!**”

There were few problems with **MMS the regulator** who gave speedy approvals and exemption from some regulations – few inspections unannounced.

As the well proceeded **many changes in plans** but no formal assessment of the risks involved with the changes – individually small, collectively huge.

The Events – April 20/22

On the evening of April 20th crew were preparing to **temporarily seal the well**, to be re-opened later for production. The tough job was done, just closing up they thought.

(A) **Halliburton** was responsible for the **bottom cement sealing** but it turned out to be far from routine

- lab tests on the stability of the cement formula were unclear or wrongly interpreted as positive
- centralizers to guide cement flows cut
- the Schlumberger cement test team sent home without testing – save money

When signals were unclear it was assumed to be positive.

(B) Then the required **negative pressure tests** were executed – once the crew were uncertain of the results but assumed the well was sealed from inflow of oil/gas – in fact a blowout had begun.

(C) Unknown to the control room 20,000' above, **hydrocarbons** under great pressure **were entering the well** and pushing upwards by 7 p.m. – unchecked and unknown, they pushed through the BOP's at the well head on the ocean floor, entering the riser up to the rig.

The Events – April 20/22

- (D) The bridge only became aware that they had a serious “**well control situation**” when drilling mud then gas burst into the rig. Unsure it was a blowout they diverted the gas into rig, not vented it directly overboard (human error).

- (E) The **general alarm** which was normally linked to the gas alarm had been disconnected to speed operations and for 10/15 critical minutes crew confusion on the seriousness of the situation.

- (F) Once into the rig the **gas spread quickly** to the engine room where spark ignited the gas, creating a fire ball of exploding gas mushrooming upwards through the top of the rig – killing 11 crew members and injuring many more.

- (G) With the explosion the **central power and hydraulic systems** ceased – dark smoke filled passageways – crew failed to activate the emergency secondary power systems – therefore BOP could not be activated – conditions impossible, order given to abandon ship – great heroism of the crew in evacuating the injured to supply ship alongside.

The Events – April 20/22

- (H) **Fire boats and rescue vessels** arrive the next day – no impact on the billowing clouds of fire rolling upwards – one crew member commented, “Like pissing at the forest fire.”

- (I) At 10:00 a.m., 36 hours after blowout, further explosions, **rig keels over and sinks** in 5,000’ of ocean – tears open the riser in the process – now allowing for the first time unchecked flow of oil/gas mixture into the sea at the ocean floor.

- (J) Luckily the **rig fell away** from the well head or containment much longer.

- (K) Now the **challenge of containment** which would take 3 months for top kill (lid on the BOP) and a further 2 months for bottom kill (relief well drilled) - series of frustrating failures while the world watched on CNN – use small robots to attach technology – too deep for divers – methane crystalizes in cold water – most fortunate with weather / no hurricanes – no proper equipment or design of BOP.

Deepwater Horizon – April 21, 2010



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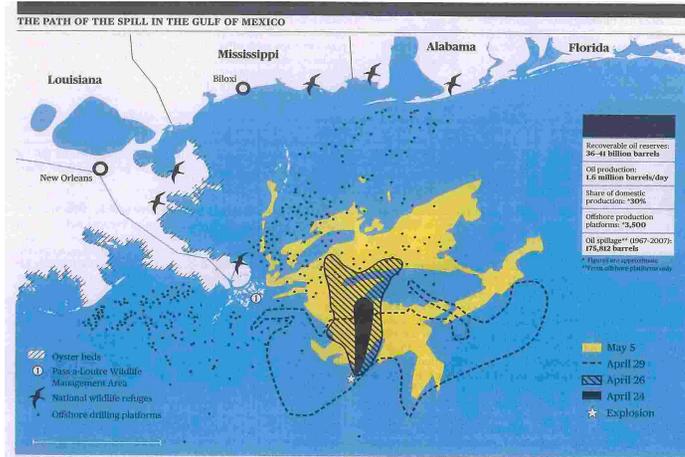
Poised for dramatic expansion, high-tech offshore drilling was considered ultrasafe. Then came BP's Deepwater Horizon disaster. What the company—and the industry—must do to bounce back
By Peter Coy and Stanley Reed

Lessons of the Spill

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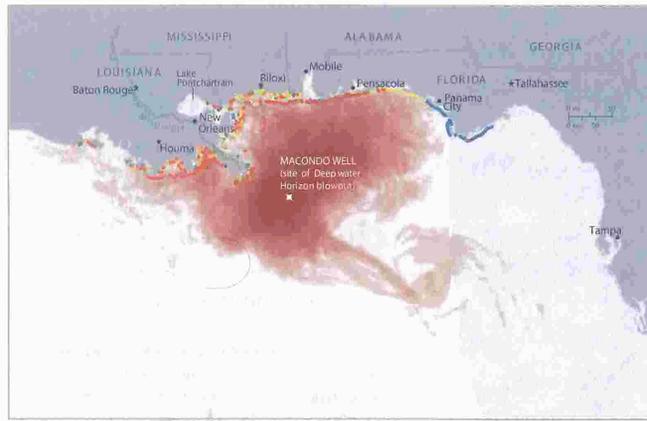
The Macondo Well (2009-2010)

The Macondo well was in deep water 48 miles off the Louisiana Coast in just **5,000' of water and the well itself over 13,000' down** into the ocean floor – neither of these exceptional for the drilling in the area of the Mississippi Canyon.



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FIGURE 7.1: Maximum Extent of Oil



- | Oil | Tarballs | Surface Oil* |
|---------------------|-------------------|---------------------|
| ● Very Light Oiling | ● Light Tarballs | ○ 1 to 10 Days |
| ● Light Oiling | ● Medium Tarballs | ● 10 to 30 Days |
| ● Medium Oiling | ● Heavy Tarballs | ● More than 30 Days |
| ● Heavy Oiling | | |

75 BP (2012/04/10)

Surface Oiling Surveys: May 17 - July 25
Shoreline Oiling: Most severe oiling observed through November

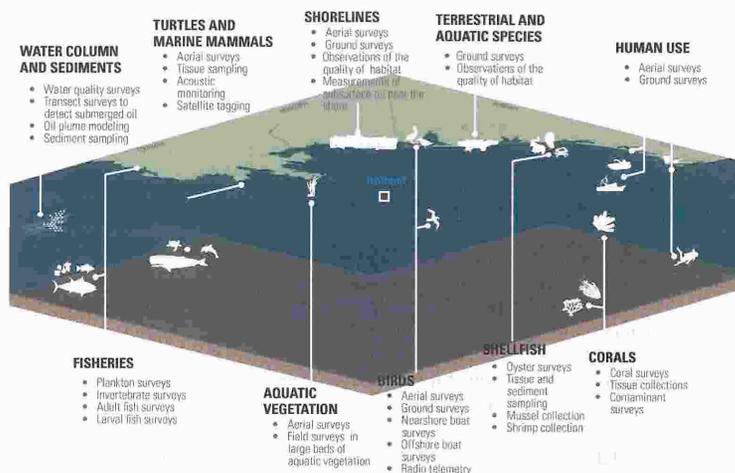
Map courtesy of National Geographic (surface oil) and modified by Commission staff, NOAA/Coast Guard SCAT map (shoreline oiling)

Pollution into Tidal Salt Marshes



75 BP (2012/04/10)

Figure 6.1: Assessment Categories for Natural Resource Damage Assessment



This figure represents the various natural resource categories being assessed as part of the Deepwater Horizon Natural Resource Damage Assessment. Such an assessment, which always follows an oil spill, is used to make the public whole for ecological damages caused by a spill. This graphic illustrates the three-dimensional challenges that an assessment of a deep sea blowout presents.

NOAA (adapted)

Financial Costs & Liabilities

- (A) **The cleanup costs** continue: In 2010 over 10,000 on staff to cleanup – **today \$9/\$10 B** – but only a rough estimate – no control over state official demands.
- (B) **Long-term Ecological Remediation:** To be determined by scientific panels - \$500 M for Gulf aquatic & terrestrial research – **then long term plan** – dispersal use on ocean floor locked water into mid water column – salt marshes with oil seepages deep into marsh not just surface. \$5 B? “BP will pay to make it right” – Obama.
- (C) **Stakeholder Losses:** After pressure from Obama, BP announced a **\$20 B compensation trust fund to cover property**, wages, or business lost – direct & indirect costs allowed from all 50 states – bad precedent? - \$7/\$8 B spent already – settlement of \$7.8 B – court cases? (Exxon Valdez went on for over 20 years)
- (D) **Clean Water Act and other fines:** Still hard to estimate CWA – **fine per barrel of oil spilled** – 4.9 million barrels
civil fine - \$1,100/barrel X 4.9 M = \$5.5 B
criminal conversion \$4300/barrel = \$21 B
- Many federal & state fines** which could total \$15/\$25 B gross negligence. Criminal convictions will also mean jail terms. Criminal convictions impact insurance and other issues. BP has formally challenged the US Fed numbers claiming essentially evidence of lower numbers was withheld by federal officials – recent fines in Alaska were about \$5,000 per barrel.

Financial Costs & Liabilities

- (E) **Market Capitalization:** Stock dropped over 50% and then has rebounded to remain 25% to 30% below share price on April 20, 2010 - \$30 B value lost – horrible consequences for some pension funds.
- (F) **Fatalities and Injuries** Compensation: \$1-7 billion
- (G) **Consumer boycotts** of gasoline sales: Losses were short lived as customers forgot – dealer anger.
- (H) Huge permanent **loss of reputation** and **brand** as an industry environmental leader as well as morale blow for employees.

Financing the Costs

Given the size of the **financial liabilities**, actions were taken quickly to manage debt and reassure investors as the stock price dropped from over \$60 to under \$30.

(A) **Dividend** suspended (later reinstated)

(B) **Sale of assets** – now over \$38 B with a target of \$45 B while these brought essential cash, they were cutting reserves and future production – Solar gone.

(C) BP also sought **help from partners** and major suppliers – some came voluntarily – Cameron International with \$250 M and Anadarko for \$4.1 B – Halliburton and Transocean refused and sued BP in turn – liability exemption clauses in their contracts – cancelled by gross negligence?

(D) **Law suits** began in late-February – testimony and cross-examination **gift to federal prosecutors** – each attack the other.

(E) Will help to define **partner liability** issues for future oil and gas joint ventures and ~~the criteria~~ **the criteria** for **criminal** (gross negligence).

Management Issues (General)

- (A) **Over Confidence:** BP was the most experienced, the most aggressive, and the most successful but this led to over confidence and complacency about the potential risks – Culture of “Drill Baby Drill.”
- (B) **Over Budget/Behind Schedule:** The Macondo well was months behind schedule and massively over budget which caused Houston to urge that costs be cut and completion speeded. Performance bonuses based upon economic not safety issues.
- (C) **Enterprise Risk Management (ERM):** BP had good ERM systems in place but their enforcement weakened as you moved from London, to Houston, and then out onto the isolated rigs.
- (D) **Enterprise Risk Management (ERM):** While the original well plan had been subject to risk assessment, the dozens of changes to the plan were not formally assessed for risk. Individually not significant, collectively very significant.

Management Issues (Specific)

- (A) **Containment and Clean Up:** While the required plans for blowout containment and cleanup were filed with the regulator, no resources of personnel or equipment were allocated as they were **never expected to be needed**.
- (B) **Accepting Responsibility:** Initially on the advice of their lawyers, BP did not accept responsibility and blamed others. Political fire storm in Congress forced reversal - \$20 billion trust fund.
- (C) **Critical Role of the CEO:** Tony Hayward held back and then made mistakes – “I want my life back” – goes yachting – BP lost control of the public battle with its critics very early never regained it.
- (D) **Judged in Historical Context:** Past safety and environmental violations – Texas City, Texas Refinery – **convicted in the court of public opinion** – no willingness to show any reason for sympathy or respect.

Management Issues (Specific)

(E) The Technical Issues on Drilling:

- The **cement** formula, centralizers, volume, and final testing all with questionable actions.
- The **negative pressure tests** results unclear and assumed to be okay.
- Failed communications to know blowout underway – pressure tests ignored.
- If there had been power, **BOP** had not been maintained – later jammed.
- **General alarm** disconnected from gas alarm.
- **Human errors** in diverting the gas causing explosion.
- Failure of the **emergency power** system to activate BOP.
- **Once riser severed** with sinking of the rig no means of working on the BOP and well head except robots on ocean floor.
- **Methane hydrates** block the cones over the well head.

Regulatory & Governance Issues

- (A) **Offshore drilling** regulation had never been strong but further weakened with the Bush/Cheney regime in the White House (2000-2008). Cheney former head of Halliburton.
- (B) **The Democrats** had attacked MMS under Bush but Obama took no immediate action when they came to power (oil lobby influence in D.C.).
- (C) **Structural Conflict of Interest:** the MMS suffered from a **basic internal conflict of interest**. It was mandated to promote development and with it government revenue generation while at the same time being the safety and environmental policeman in the public interest.
- (D) **Political Bypass:** Commitment of regulators to enforce rules weakened by the knowledge that charges could be reversed by senior officials in Washington.
- (E) **Regulatory Expertise:** The MMS had difficulty attracting quality staff, its starting salary for engineers was about ½ that of industry.

Regulatory & Governance Issues

- (F) **Size of the Staff:** There were too few inspectors to cover the 30,000 wells in the Gulf of Mexico.
- (G) **Technical Complexity:** As the offshore technology got more and more complex, the regulators were not able to keep up with all the changes to determine fully any risks.
- (H) **Relations with Industry:** It was frequently alleged that the regulators were too close to industry, gift giving was practiced, and some MMS officials joined industry when they left the service.
- (I) **Convictions** while charges were laid by able officials, convictions were not easy to secure, and a number in industry referred to the system as “self-regulation.”

BP's Safety Dilemma

Given the **11 deaths** and the many injured BP and Transocean will face tough scrutiny to ensure that government safety requirements were followed:

- **Both companies had clear commitment** to high safety standards and to workers having “The Right” to stop drilling in the event of unsafe conditions. However this did not happen for a variety of reasons.

- **Budget cuts** had eliminated some of the safety positions and the corporate culture did not promote whistle blowing – “Damn the Torpedoes and Full Speed Ahead.”

- **Changes in the drilling plan** were decided **without safety** assessment but there were safety committees.

- The BP Houston based **exec responsible** for offshore **safety** quit in December 2009 when he lacked support for industry standards to be implemented.

- In March 2010, a **rig survey found** 46% believed that there would be work place reprisals for reporting unsafe working conditions and 15% believed that staff levels were too low for safe working conditions.

Workers must be confident that management will support safety complaints if they are to be submitted. Also there must be a **culture of safety first** or workers will not volunteer the information.

US Regulatory Changes

The **Obama Administration** promised regulatory changes early in the event and the Minerals Management Service Congress determined.

Out of the old MMS – three new regulatory agencies emerged to avoid the conflict of interest:

- (1)The Bureau of Ocean **Energy Management** Regulation, and Enforcement (Technical Matters)
- (2)The Bureau of **Safety** and **Environmental** Enforcement
- (3)The Bureau of Natural Resource **Revenue**

With time we will learn how **efficiently and effectively** these operate – more staff and money – links to six other departments as well as Interior. –

Washington wishes to make a clear statement on offshore oil and gas regulation, now **Cuba is drilling** between Havana and Key West, Florida.

BP Spill and Global Offshore Policy

The BP event sent shock waves through foreign capitals with offshore potential like Canada, UK, China, Brazil, Nigeria, Russia, etc.

The most dramatic **reaction came in Brazil** where following a small offshore spill by Chevron:

- Officials were charged and so could not leave the country.
- Subject to huge fines.
- All oil and gas operations suspended.
- Threat of an \$11 billion fine to the company.

Environmental charges pretext for seizing assets – one of the huge new offshore fields.

Other regulatory charges have come in **China** (ConocoPhillips), **Nigeria** (Shell), **Norway** (BP).

Almost all have **increased their regulatory controls** on offshore drilling including Canada east coast and Arctic.

Conclusions

- BP oil spill brought to the **surface latent anti-oil sentiments** impacting all oil and gas projects across North America.
- **Legal battles** will go on for decade or two – lawyers are the big winners (Exxon Valdez).
- Serious precedent **US Justice Department** seeking **criminal convictions** and jail terms.
- Scale of costs - **\$60 B unprecedented** – BP sells 20% of productive assets.
- Corporate **Policies** vs. Corporate **Culture**
- As **technology gets more complicated** and drilling in more **extreme conditions**, this is not the time to be speeding and curbing regulatory processes in Canada or the US.
- Enterprise Risk Management a symbiotic process between corporate management and government regulation – the latter keeps the former honest in the public interest.