INFERENTIAL FOCUS BRIEFING

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TAKING RISK SERIOUSLY: LEARNING FROM THE DEEPWATER HORIZON DISASTER

Science Explores; Technology Executes; Man Conforms
– portal sign, Chicago World's Fair

It turns out, by the way, that oil rigs today generally don't cause spills. They are technologically very advanced.
– President Barack Obama

Making Up for Lost Risk

"What are the risks?" Such a question, scribbled as it was on a notepad during a meeting of oil executives to discuss offshore drilling, could have provided incentive to install essential tools to keep the Deepwater Horizon rig from blowing or to deal with a crisis should a low-probability event take place. Unfortunately, the cited quote was written down during an emergency meeting on April 23, three days after the Deepwater Horizon well had blown and was injecting tens of thousands of barrels of oil and an unmeasured amount of gas into the ecosystem of the Gulf of Mexico. What are the risks, indeed? (*New York Times*, 6/22/10)

"It never ceases to amaze me what little brains people have."

While those living and working along the Gulf Coast, watching images of devastation on their televisions or reading of the massive outflow of toxic substances online, might have been surprised by both the nature and the effects of the incident, those responsible for Deepwater Horizon should not have been surprised at all. Warnings about the risks and evidence of the likelihood of such a disaster appeared almost yearly for roughly a decade, as study after study showed that the in-place technology was deficient and fraught with risk. In other words, prior to the incident, those responsible for making decisions concerning stability and safety at the Deepwater Horizon rig had plenty of reason to make some

changes. The fact that they did not provides further evidence that errors in decision making in executive offices continue to cause society problems and cost stakeholders money. Consider the following evidence that was available to the owner, lessor and regulators of the oil rig that has produced the most costly and expansive man-made environmental disaster in United States history.

♦ In 2000, a confidential internal report to the owners of the Deepwater Horizon drilling rig revealed that the blind shear rams (BSRs), small devices inside the larger blowout preventer (BOP) system intended to shut down the rig's operation when a crisis hits, were vulnerable to a "single-point failure" – that is, should just one part (the shuttle valve) in the BSR fail, the whole system would fail and therefore be unable to seal a well. No redundancy or backup existed.

♦ Also in 2000, the Minerals Management Service (MMS), the government agency charged with monitoring and regulating offshore drilling, produced a study on deepwater drilling in the Gulf of Mexico and concluded that "spill responses may be complicated by the potential for very large magnitude spills." The report cited an industry study that said large spills could range from 5,000 to 116,000 barrels per day for 120 days. Then the report added, **"There are few practical spill-response options for dealing with submerged oil."**

♦ In 2001, the MMS commissioned a study on blowout preventers utilizing just one blind shear ram with no redundancy. The study found that BSRs had failed more than 100 times and concluded that for the integrity and security of the system, BOPs "should be equipped with two blind shear rams."

♦ In 2002 and again in 2004, studies completed by West Engineering Services of Texas, specialists in BOP operations, showed that BSRs could not cut through subsea pipes to seal off a well because ever-deeper wells were producing greater water pressures that were requiring more power than existing systems could supply, newer pipes were stronger than those in use when current BSRs were designed and frigid waters at the deeper and deeper sites were making pipe cutting even more difficult. Of the company's 14 tests, 7 BSRs failed completely and only 3 were able to cut through the pipe and seal off a damaged well.

♦ In 2003, high winds and Gulf currents moved the Deepwater Horizon rig away from its well site, prompting the crew to trigger the BOP. The BSR did work, but it was too weak to withstand the pressure, and the system's backup BSR was required to close the well securely.

♦ In 2004, Transocean, which owns the Deepwater Horizon rig, and BP, which leases it, agreed to remove the backup BSR, replacing it with a "test ram," a less effective but cheaper device. In a joint letter, Transocean and BP admitted that the change "will reduce the built-in redundancy" and raise the rig's "risk profile."

♦ In 2009, Transocean commissioned Norway's Det Novske Veritas to do a study of 11 incidents in which rig crews had deployed BOPs in the waters off North America and in the North Atlantic. The study found that in only 6 of those incidents did the BOPs and their BSRs operate correctly and seal the well, meaning, as the study concluded, that the devices had a 45 percent failure rate in real-world situations.

♦ In 2010, a draft of an industry study concluded that oil and rig companies typically cut corners on federally mandated tests of their BOPs. The report described these companies' perspectives as being: "I don't want to find problems. I want to do the minimum necessary to obtain a good test."

(*New York Times*, 6/21/10; *Rolling Stone*, 6/8/10; *Christian Science Monitor*, 6/14/10)

"Hold my calls. I don't want to know what's going on."

Not only were decision makers involved in the Deepwater Horizon rig avoiding critical information about increasing risks in drilling at such depths, they were maintaining the belief that such drilling was safe to the point of being able to convince two government administrations that little risk accompanied such frontier-pushing technology.

♦ In April 2007, the administration of President George W. Bush revealed its five-year plan for offshore drilling and noted that a "large oil spill" would spew only 1,500 barrels into the surrounding environment at most. The administration said the area where the Deepwater Horizon rig was drilling had a "low probability and low risk" of a blowout.

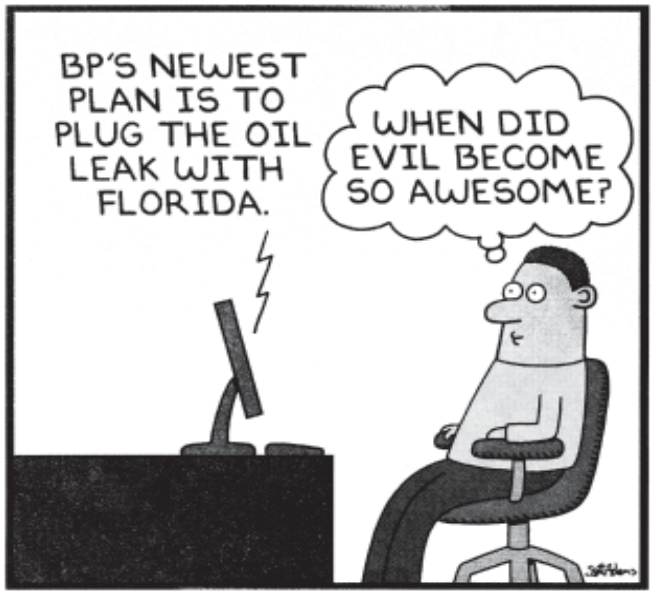
♦ In March 2010, the administration of President Barack Obama concluded "a year-long study" of deepwater offshore drilling practices and found them safe, leading the President to announce an expansion of offshore leasing.
(*Rolling Stone*, 6/8/10)

The failure of executives, managers and ultimately government authorities to act on warnings about failing equipment seems especially odd, given the inherent risks in deepwater drilling. Such decision-making errors are exemplary of nearly every kind of thought mistake identified in books such as Jerome Groopman, M.D.'s *How Doctors Think* (2007), an examination of errors that doctors make when diagnosing illnesses, and Malcolm Gladwell's *Blink* (2005), a look at the ability of the mind to make quick decisions and the errors the mind can make when doing so.

BP officials committed an **Affective Error** – that is, making decisions based on what one wishes to be true – by ignoring the MMS study that showed no credible spill reparation system in place but that spills in deep water would be costly. Those managing the Deepwater Horizon rig displayed a **Confirmation Bias –** that is, validating what one expects or wants by selectively accepting or ignoring certain information – when they chose to ignore studies that revealed the vulnerability of the blind shear ram and that called for installation of a second BSR to create redundancy. MMS officials and BP researchers committed the **Sufficiency Mistake** – that is, believing that the best answers or solutions have been reached and that no further investigations are necessary – when they produced reports on the risks involved in deepwater drilling (MMS' report for Secretary of the Interior Kenneth Salazar and BP's report for its executives), and neither mentioned the risk of a BSR failing nor noted the lack of a plan to halt a blowout should BOP systems fail. The Bush and Obama administrations both committed the **Alikeness Affinity Error –** that is, accepting a perspective from someone simply because that person is respected, trusted or simply a lot like them – when they accepted the industry's position that minimal risks were attached to modern deepwater drilling.

In going through all of these warnings and knowing they were ignored, one can easily envision a public relations officer deflecting responsibility by telling the public: "Mistakes were made." Indeed, executives and managers at BP, Transocean and MMS, as well as officials in two

administrations, made a wide-ranging and ongoing series of bad decisions. But they were only reflecting their culture.



Bad Culture, Good Culture

Some social critics have noted that Americans often get addicted to tobacco, high-calorie/high-fat foods, gambling – including engaging in excessively risky financial transactions – and perhaps even the Internet because they tend to do things in excess and then live in firm denial about those excesses while ignoring the potential consequences. While such a criticism may or may not be justified, the country's economy has had to deal with the added expense of treating more cases of lung cancer, obesity (and related diabetes) and financial failures, all caused by too many Americans willingly taking excessive risks.

Risk indifference seems most prevalent in instances in which the consequences of such behavior are seen as being distant. Smoking cigarettes now might lead to cancer later, but the impact is in the distant future and the pleasure is now. Eating too many calories or too much fat now might lead to obesity and even diabetes later, but that would happen only in some ambiguous and distant future and, again, the pleasure is now.

Peter Whybrow, M.D., director of the Semel Institute for Neuroscience and Human Behavior at the University of California in Los Angeles, notes that the brain's power of cognition – used to envision future consequences of current behavior – is charged with holding reward-seeking, self-indulgent behavior in check. Whybrow's psychological survey of the culture led him to conclude that years of affluence matched by years of confronting messages in support of instant gratification have left the self-control part of the brain "knocked out of whack." Without sufficient self-control among individuals, society has seemingly allowed government to apply controls – by mandating that some restaurants label the calorie content on the food they serve, by increasing taxes on cigarettes and curtailing smoking ads, and so on. (*New York Times Magazine*, 6/20/10)

"Stop! Wait! Government's no longer the problem–it's the solution!"

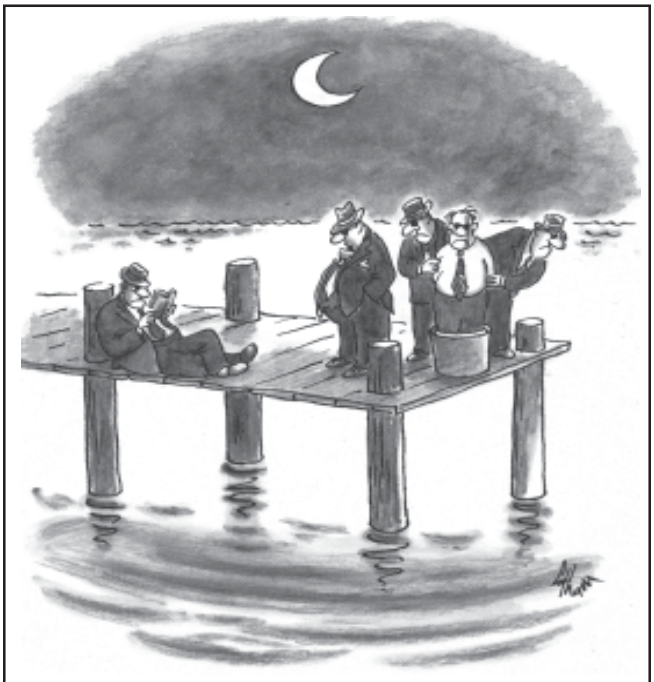
Big Risks Send Signals

Tony Hayward, the chief executive officer of BP, characterized the blowout at Deepwater Horizon as "a low-probability, high-impact event" – distant but costly. According to Robert Stavins, an environmental economist at Harvard University, when confronted with the kinds of events that rarely happen but that have immense impact when they do, people often make two kinds of mistakes: If such an event is hard to imagine, they underestimate its likelihood, and if such an event is easy to imagine, they overestimate its likelihood. (*Christian Science Monitor*, 6/14/10; *New York Times Magazine*, 6/6/10)

In the first mistake that Stavins identifies, those who created tricky financial instruments based on

overvalued real estate must have found it difficult to imagine that all major real-estate markets in the U.S. could implode at the same time, something that had not occurred since the Great Depression. And so they built complex financial models, confident that such an event would not occur. In the second mistake identified by Stavins, after the terrorist attacks of September 11, 2001, more Americans took to driving rather than flying, and as a result, the death toll on the roads increased by several thousand in the year that followed. With the 9/11 attacks fresh in their minds, these suddenly risk-conscious individuals found it very easy to imagine more such attacks using airplanes, and therefore they overestimated the risks of flying while underestimating the risks of driving (see "Emotion, Instinct and Reason: Thinking and Decision-Making in a Time of Crisis and Uncertainty," **Special Briefing**, 9/30/08).

Hayward, by mentioning the low-probability, high-impact characterization, seemed to be suggesting that such events are difficult to assimilate into risk profiles, although the elevated risks involved and the rate of failures likely in deepwater drilling had been given to him and to other managers over and over again, as the list of warnings cited earlier highlights. His indifference to actual risks might have origins in contemporary culture, but in ignoring the evidence, he was committing one last, significant error.



"I hope that what you're reading is relevant to the business at hand."

Evidence I Can See

Had Hayward and other decision makers involved in Deepwater Horizon wanted to think more seriously about the risks involved in that offshore enterprise, they could have taken a look at the **Power Law Curve** in mathematics and the concept of **Nonlinear Effects,** understood in science to be the kinds of consequences that take place in interdependent systems.

Recent work by physicist Neil Johnson of the University of Miami has shown that events such as terrorist or guerrilla attacks are not random, as is typically thought. Rather, they follow a pattern known in mathematics as the Power Law Curve. When Johnson charted the frequency of such attacks in Colombia, Iraq and elsewhere on a *y* axis and the extent of damage of these attacks on the *x* axis, he discovered that the resulting line starts high on and close to the *y* axis and then plunges to run along the *x* axis – the Power Law Curve, with frequent attacks causing little damage and less frequent attacks creating massive damage. But it also shows that large attacks will happen – that is, Hayward could have well known that "low probability" is not the same as "does not happen." In fact, the Power Law Curve verifies that low-probability events do inevitably happen. (*Discover*, 7/10)

Nonlinear Effects of incidences in interconnected systems should have told Hayward that once such an event does occur, the effects are much more massive and consequential than events that happen in isolation. In nonlinear phenomena, such as weather systems, small changes can lead to large effects, thus the difficulty weather forecasters face when predicting future weather conditions – small changes elsewhere can create huge dislocations nearby. A deepwater rig is directly connected to its ecological surroundings, which are part of a massive interdependent system. When disruption takes place, it can reverberate throughout the interconnected systems and create huge effects from a small problem. In the instance of Deepwater Horizon, the relatively small blind shear ram device failed to operate (and there was no backup), leading to an ineffective blowout preventer, leading to instability at the well, leading to an explosion that caused death and destruction, resulting in a massive amount of oil and gas being injected into the surrounding ecosystem that spread the toxic substances across an

ever-increasing span of open water, causing further death and destruction, and foisting on innocent, distant parties potential economic ruin. That is an event with Nonlinear Effects. (*BBC Knowledge*, 7/10)

Those involved with assessing the risks associated with the Deepwater Horizon rig should have known that low-probability, high-impact events do eventually occur (Power Law Curve) and that when they do, they can create massive effects well beyond the scope of the initial problem (Nonlinear Effects), unless prevented, blocked or planned for. But they chose to look elsewhere, and in doing so, they committed one last decision-making error: the **Streetlight Effect Mistake**.

The name of this error comes from the story of a man crawling on his hands and knees below a streetlight. When a police officer asked what he was doing, the man replied that he was looking for his wallet. The officer asked if he was sure he had lost his wallet in that area, and the man replied that he knew he had lost his wallet somewhere across the street. The officer then asked why the man was looking in the wrong place, and the man answered that he was looking in this particular spot because the light was better. In other words, committing the Streetlight Effect Mistake involves looking for answers where they are easy to find rather than where more complex but truer answers might be found. (*Discover*, 7/10)

This mistake has become more commonplace as individuals become habituated to search-engine research, a facile practice encouraged by the Internet. Why take the time to do original and difficult research when a quick keyword search can yield innumerable answers, all selected and prioritized by their popularity, no less? After all, easy answers can increase productivity and can even increase profits.

In early April, as BP was preparing to seal the well at Deepwater Horizon for later production, it used tactics that caught many industry observers off guard. The company used a well design that lacked sufficient protections against high-pressure gas rising up, it did not install a capping device at the top of the well with sufficient strength to keep gas from blowing through a critical seal and it did not execute a standard test to ensure the integrity of the well cementing. (*New York Times*, 6/21/10)

The company preferred easier and less expensive "solutions." Officials set aside tougher and more expensive solutions because the "light" (that is, profit) was better on "the other side of the street" (higher risk). Profits, ease of deployment and simplicity of operations seemed to be more important than heeding risk assessments – a very dangerous perspective, given both the Power Law Curve and the concept of Nonlinear Effects.

Yet are BP's decision makers alone in this? According to a recent study by SAS, 40 percent of financial-services firms still do not have clear risk strategies in place, roughly 21 months after the demise of Lehman Brothers, even though they likely have a strategy for profitability in place. Even more critical, the same study found that less than half of those involved in financial-services firms even understand the interaction of risk across business lines. In a world of Power Law Curve risks and Nonlinear Effects, such ignorance can represent an enterprise risk. (*USBanker*, 6/10)

"Things always get better after they get worse. So it's good to make things worse as quickly as possible."

Decisions Are Important

In BP's application to the U.S. government for permission to drill for the Deepwater Horizon well, the company claimed that an oil spill was "unlikely" and that

should such an unlikely event take place, there would be "no adverse impacts" on wildlife or fisheries and "no significant adverse impacts" on the region's beaches, wetlands and coastal nesting birds. To show its concern, however, BP included on the application the contacts it would use for "rapid deployment of spill response resources." **One such contact was evidently the Web address of a Japanese home-shopping network.** (*Rolling Stone*, 6/8/10)

BP's application proclaiming that "no adverse impacts" on the region would happen sounds strangely like words stated by Federal Reserve Chairman Ben Bernanke, when, in May of 2007 as the U.S. economy faced emerging trouble, he insisted, "We believe the effect of the troubles in the sub-prime sector on the broader housing market will likely be limited, and we do not expect significant spillovers from the sub-prime market to the rest of the economy or the financial system" (see "Return of the Bad Diagnosis: The 'Asian Flu' and the 'Sub-Prime Problem' in Context," **Special Briefing**, 8/17/07).

Hayward, Bernanke and the many leaders who have made devastatingly bad decisions in the past decade all committed similar kinds of mistakes: making decisions based on what they wanted to be true (Affective Error); relying on inadequate research (Sufficiency Mistake); depending too much on perspectives from sources like themselves (Alikeness Affinity Error); ignoring contrary evidence (Confirmation Bias); and, of course, looking only where they would find answers that served near-term preferences (Streetlight Effect Mistake).

Whether an earlier recognition of reality at the Federal Reserve as well as among decision makers in the Bush administration would have made the effects of the sub-prime crisis less severe is difficult to determine. But it is clear that fewer decision-making errors among those involved in the Deepwater Horizon's operation would certainly have lessened the likelihood of that rig's failure and the subsequent Nonlinear Effects, the sum total of which will not be known for years.

The willing disregard for real risks and the lack of preparation for the kinds of effects that extreme events cause have resulted in huge problems for society and the economy in a series of incidents: dot-com mania, Hurricane Katrina, highly questionable financial instruments based on dubious real-estate values, and now a systems failure on the Deepwater Horizon rig. How much damage can society continue to absorb? Moreover, despite so much lip service, does anyone really take risk seriously anymore?

"It's my fault–I wasn't worrying enough."