



## Part III

### Lessons Learned: Industry, Government, Energy Policy

**The private oil and gas industry is the lead actor in exploration and production of Gulf energy resources. In the wake of the BP *Deepwater Horizon* disaster—a crisis that was unanticipated, on a scale for which companies had not prepared to respond—changes in safety and environmental practices, safety training, drilling technology, containment and clean-up technology, preparedness, corporate culture, and management behavior will be required if deepwater energy operations are to be pursued in the Gulf—or elsewhere. Maintaining the public trust and earning the privilege of drilling on the outer continental shelf requires no less. As Chapter 8 explains, some of the required responses are under way; for other measures, there are useful precedents from other industries. Beyond the oil and gas industry’s response, the inadequacies in permitting and regulatory standards, practices, and oversight revealed by the crisis have already caused significant changes in the federal rules and procedures for deepwater drilling. But further action, including the creation of an independent safety authority, is clearly warranted, as described in Chapter 9.**

**Finally, the interplay of public incentives, security considerations, energy conservation and use, and alternative energy sources, among other factors, will shape future deepwater drilling in the Gulf and in other frontier areas, as discussed in Chapter 10. Because some of those frontiers are defined by greater well depths and pressures, and others are in settings as yet untapped (the Arctic, in particular)—with economies, environmental resources, and community characteristics different from those tested so severely in and along the Gulf Coast—learning the right lessons from the BP *Deepwater Horizon*, and adapting them to different contexts, must thoroughly inform the future of America’s offshore oil policy.**



# Chapter Eight

## “Safety is not proprietary.”

### Changing Business as Usual

The *Deepwater Horizon* blowout, explosion, and oil spill did not have to happen. Previous chapters have explained the immediate and root causes for why they nonetheless did. The American public, government, and the oil and gas industry need to understand what went wrong so they can pursue the changes required to prevent such devastating accidents from recurring.

This chapter examines how petroleum companies have been managing the risks associated with finding and producing oil and how they can do it better, individually and as a responsible industry overall. The record shows that without effective government oversight, the offshore oil and gas industry will not adequately reduce the risk of accidents, nor prepare effectively to respond in emergencies. However, government oversight, alone, cannot reduce those risks to the full extent possible. Government oversight (see Chapter 9) must be accompanied by the oil and gas industry’s internal reinvention: sweeping reforms that accomplish no less than a fundamental transformation of its safety culture. Only through such a demonstrated transformation will industry—in the aftermath of the *Deepwater Horizon* disaster—truly earn the privilege of access to the nation’s energy resources located on federal properties.

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Even as *Deepwater Horizon* burns, oil from the blown out well begins to spread across the Gulf. Preventing such disasters in the future will take more effective government oversight. Most crucial, however, will be the oil and gas industry’s commitment to fundamentally transform its own safety culture.

Offshore oil and gas exploration and production are risky. But even the most inherently risky industry can be made much safer, given the right incentives and disciplined systems, sustained by committed leadership and effective training. The critical common element is an unwavering commitment to safety at the top of an organization: the CEO and board of directors must create the culture and establish the conditions under which everyone in a company shares responsibility for maintaining a relentless focus on preventing accidents. Likewise, for the entire industry, leadership needs to come from the CEOs collectively, who can apply pressure on their peers to enhance performance.

Properly managed, the presence of risk does not mean that accidents have to happen. As Magne Ognedal, Director General of Norway's Petroleum Safety Authority, put it: "risk must be managed at every level and in every company involved in this business. . . . In this way, risk in the petroleum sector can be kept at a level society is willing to accept. And we can reduce the probability that major accidents will hit us again."<sup>1</sup>

## BP's Safety Culture

BP has proclaimed the importance of safety for its vast worldwide operations. "Our goal of 'no accidents, no harm to people and no damage to the environment' is fundamental to BP's activities," stated the company's Sustainability Review 2009. "We work to achieve this through consistent management processes, ongoing training programmes, rigorous risk management and a culture of continuous improvement." It added that "creating a safe and healthy working environment is essential for our success. Since 1999, injury rates and spills have reduced by approximately 75%."<sup>2</sup>

Yet despite the improvement in injury and spill rates during that decade, BP has caused a number of disastrous or potentially disastrous workplace incidents that suggest its approach to managing safety has been on individual worker occupational safety but not on process safety. These incidents and subsequent analyses indicate that the company does not have consistent and reliable risk-management processes—and thus has been unable to meet its professed commitment to safety. BP's safety lapses have been chronic.

### Safety Culture

The United Kingdom Health and Safety Executive formally defines the **safety culture** of an organization as "the product of individual and group values, attitudes, and perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organisation's health and safety management." A more popular description is that safety culture means doing the right thing even when the no one is watching. There are two kinds of safety: **occupational safety**, which refers to keeping people safe, and **process safety**, which refers to the procedures for minimizing risk more generally.

**Refinery accidents.** Between May 29 and June 10, 2000, BP's Grangemouth Complex on Scotland's Firth of Forth suffered three potentially life-threatening accidents: a power-distribution failure leading to the emergency shutdown of the oil refinery; the rupture of a main steam pipe; and a fire in the refinery's fluidized catalytic cracker unit (which turns petroleum into gasoline).<sup>3</sup> The U.K. Health and Safety Executive investigated the incidents. About the power loss, it said: "Subsequent investigations revealed a number of weaknesses

in the safety management systems on-site over a period of time which contributed to the succession of events that resulted in the power distribution failure.”<sup>4</sup>

It made virtually the same comment about the other two incidents.<sup>5</sup> The Executive’s wider conclusions included:

- “BP Group policies set high expectations but these were not consistently achieved because of organisational and cultural reasons;
- “BP Group and Complex Management did not detect and intervene early enough on deteriorating performance;
- “BP failed to achieve the operational control and maintenance of process and systems required by law;
- “The BP Task Force findings and recommendations properly addressed the way forward to ensure safe and reliable operations at the Complex.”<sup>6</sup>

**North Sea platforms.** It was not only BP’s refineries that had problems. In November 2003, a gas line ruptured on BP Forties Alpha platform in the North Sea, flooding the platform with methane. It was a windy day and there was no spark to ignite the gas,<sup>7</sup> so the platform avoided the fate of the Piper Alpha (operated by Occidental Petroleum), where a blown gas line led to explosions that killed 165 crew members and 2 rescuers in 1988 (see Chapter 3).<sup>8</sup> BP admitted breaking the law by allowing pipes to corrode on the Forties Alpha and paid a \$290,000 fine.<sup>9</sup>

On the platform that Thursday, November 27, 2003, was a BP engineer named Oberon Houston, who later resigned from the company. He told the Commission that BP focused heavily on personnel safety and not on maintaining its facilities. He added that BP was preparing to sell the depleted field, and was running it at minimum cost: “The focus on controlling costs was acute at BP, to the point that it became a distraction. They just go after it with a ferocity that is mind-numbing and terrifying. No one’s ever asked to cut corners or take a risk, but it often ends up like that.”<sup>10</sup>

**The Texas City refinery explosion:** a deficient safety culture. On March 23, 2005, a blast at BP’s Texas City refinery—the third largest refinery in the United States—killed 15 people and injured more than 170.<sup>11</sup> A U.S. Chemical Safety Board report on the Texas City refinery explosion found a recurring pattern. It concluded that “BP Group did not systematically review its refinery operations and corporate governance worldwide to implement needed changes identified in the Health and Safety Executive report and in its own Task Force report, even though the Group Chief Executive told staff in October 2000 edition of BP’s in-house magazine that BP would learn lessons from Grangemouth and other incidents.”<sup>12</sup>

Testifying in 2007 about the Texas City event before a U.S. Senate Subcommittee, Carolyn W. Merritt, Chairman and CEO of the Chemical Safety Board, described the equipment that caused the blast as “1950s-era” and “unsafe,” and stressed that it was equipment that “many companies around the world ha[d] long since eliminated. . . .”<sup>13</sup> Merritt added that BP had in fact considered eliminating the equipment in 2002, which had by then already

**Explosion at BP's Texas City Refinery**

BP is no stranger to serious accidents. In March 2005, an explosion rocked the company's Texas City refinery near Houston; 15 workers lost their lives. One year later a BP pipeline on Alaska's North Slope ruptured, spilling more than 200,000 gallons of oil onto the fragile tundra. Yet, the report notes, in recent years the company's safety record in the Gulf of Mexico has been excellent.

*William Philpott/AFP/Getty Images*

resulted in “a number of serious releases,” but had ultimately declined to do so “[f]or a variety of reasons—including cost pressures” and BP’s ability to take advantage of “the existence of an exemption under [U.S. Environmental Protection Agency] air regulations. . . .”<sup>14</sup>

The Safety Board’s report on Texas City noted that “while most attention was focused on the injury rate, the overall safety culture and process safety management program had serious deficiencies. Despite numerous previous fatalities at the Texas City refinery (23 deaths in the 30 years prior to the 2005 disaster) and many hazardous material releases, BP did not take effective steps to stem the growing risks of a catastrophic event.”<sup>15</sup> The report added: “Cost-cutting and failure to invest in the 1990s by Amoco (who merged with BP in 1998) and then BP left the Texas City refinery vulnerable to a catastrophe. BP targeted budget cuts of 25 percent in 1999 and another 25 percent in 2005, even though much of the refinery’s infrastructure and process equipment were in disrepair. Also, operator training and staffing were downsized.”<sup>16</sup>

The Safety Board further singled what it characterized as the “organizational causes embedded in the refinery’s culture,” including:

- “BP Texas City lacked a reporting and learning culture. Reporting bad news was not encouraged, and often Texas City managers did not effectively investigate incidents or take appropriate corrective action.
- “BP Group lacked focus on controlling major hazard risk. BP management paid attention to, measured, and rewarded personal safety rather than process safety.
- “BP Group and Texas City managers provided ineffective leadership and oversight. BP management did not implement adequate safety oversight, provide needed human and economic resources, or consistently model adherence to safety rules and procedures.
- “BP Group and Texas City did not effectively evaluate the safety implications of major organizational, personnel, and policy changes.”<sup>17</sup>

At the Chemical Safety Board’s instigation, BP established its own independent panel to review its safety procedures and find ways to improve them.<sup>18</sup> That panel, chaired by former U.S. Secretary of State James Baker III, issued its report a few months before the Chemical Board report in 2007. The Baker panel was no more charitable in its assessment. The panel found that BP management had not distinguished between occupational safety—concern over slips, sprains, and other workplace accidents—and process safety: hazard analysis, design for safety, material verification, equipment maintenance, and process-change reporting. And the panel further concluded that BP was not investing leadership and other resources in managing the highest risks.<sup>19</sup>

The Baker panel especially faulted BP for failing to learn the lessons of Grangemouth by repeating them in the events leading up to the Texas City refinery explosion. According to the panel, “in its response to Grangemouth, BP missed an opportunity to make and sustain company-wide changes that would have resulted in safer workplaces for its employees and contractors.”<sup>20</sup> Underscoring the depth of the organizational problem facing BP, the panel



singled out for criticism BP's overall approach to accident analysis: "BP's investigation system has not instituted effective root cause analysis procedures to identify systemic causal factors."<sup>21</sup>

**Prudhoe Bay pipeline leak.** In March 2006—one year after the Texas City refinery explosion and one year before the Chemical Safety Board report on it—BP had yet another significant industrial accident. Its network of pipelines in Prudhoe Bay, Alaska, leaked 212,252 gallons of oil into the delicate tundra environment—the worst spill ever recorded on the North Slope.<sup>22</sup> The leak went undetected for as long as five days.<sup>23</sup> Upon analysis, the pipes were found to have been poorly maintained and inspected.<sup>24</sup> BP paid more than \$20 million in fines and restitution.<sup>25</sup>

**Progress in follow-up on the safety recommendations.** The Baker panel report contained 10 recommendations "intended to promote significant, sustained improvements in BP's process safety performance."<sup>26</sup> Recommendation nine advocated that BP establish an independent expert to monitor and report on its progress in executing the panel's other recommendations in its U.S. refineries, in refining management, and at the BP board and executive management levels.<sup>27</sup> In the executive summary of the third annual report of that expert, covering January–December 2009, he remarked that:

Delivery against milestones related to implementation of the Recommendations remains a critical performance objective for the U.S. refineries. Virtually all of the milestones in the U.S. Refining's 2009 plans were delivered on schedule.

"While significant gaps have been closed and most of the new systems, processes, standards, and practices required for continued process safety improvements have been developed, much work remains to be done to fully implement them. BP must now demonstrate improved capability for systematic management of these systems, processes, standards, and practices so it can accelerate the overall pace of implementing the Recommendations."<sup>28</sup>

The independent expert also noted, apropos of the Baker panel report's final recommendation that BP use the lessons learned from the Texas City tragedy to transform the company into a recognized industry leader in process safety management:

BP is striving to transform the company into a recognized industry leader in process safety . . . and . . . has made significant improvements each year in response to all Recommendations. However, much work remains to fully implement the Recommendations. . . . BP will be an industry leader when its process safety performance is superior to that of its peers, and its peers recognize BP as a true leader to emulate.<sup>29</sup>

In recent years in the Gulf of Mexico, BP's safety offshore drilling record was reportedly excellent.<sup>30</sup>

### **Deepwater Horizon**

BP's safety culture failed on the night of April 20, 2010, as reflected in the actions of BP personnel on- and offshore and in the actions of BP's contractors. As described in Chapter 4, BP, Halliburton, and Transocean did not adequately identify or address risks of an accident—not in the well design, cementing, or temporary abandonment procedures. Their management systems were marked by poor communications among BP, Transocean, and Halliburton employees regarding the risks associated with decisions being made. The decisionmaking process on the rig was excessively compartmentalized, so individuals on the rig frequently made critical decisions without fully appreciating just how essential the decisions were to well safety—singly and in combination. As a result, officials made a series of decisions that saved BP, Halliburton, and Transocean time and money—but without full appreciation of the associated risks.

BP conducted its own accident investigation of *Deepwater Horizon*, but once again kept its scope extremely narrow.<sup>31</sup> Professor Najmedin Meshkati of the University of Southern California, Los Angeles—a member of the separate National Academy of Engineering committee investigating the oil spill—criticized BP's accident report for neglecting to “address human performance issues and organizational factors which, in any major accident investigation, constitute major contributing factors.” He added that BP's investigation also ignored factors such as fatigue, long shifts, and the company's poor safety culture.<sup>32</sup>

Upon reading the BP report, this Commission's Chief Scientific and Engineering Advisor, Richard Sears, commented that “it appeared that for BP, the accident happened at 9:49 p.m. on April 20; whereas in some ways, the blowout began in early 2009 when they initially designed the well.”<sup>33</sup>

### **The Culture on the Rig**

BP was operator of the Macondo well and in that capacity had both the overall responsibility for everything that went on and was in the best position to promote a culture of safety on the rig, including in the actions of its two significant contractors, Halliburton and Transocean. But the extensive involvement of those contractors in the mistakes that caused the Macondo well blowout underscores the compelling need for a fundamental shift in industry culture that extends beyond BP. As described in Chapter 2, offshore drilling and energy production involve a complex interrelationship among companies. No single company—not even at the major integrated oil companies—performs the full panoply of activities required for oil and gas drilling. All contract out for the services of other companies for critical aspects of their operations. For this same reason, whatever the specific contractual relationships, operating safely in this environment clearly demands a safety culture that encompasses every element of the extended drilling services, and operating industry.

Transocean, for instance, was a major contractor for the Macondo well and is the world's largest operator of offshore oil rigs, including the *Deepwater Horizon*; Transocean personnel made up the largest single contingent on the rig at the time of the accident, and 9 of the 11 men who died on April 20 worked for the company. As described in Chapter 4,

a number of the mistakes made on the rig can be directly traced to Transocean personnel, including inadequate monitoring of the Macondo well for problems during the temporary abandonment procedures and failure to divert the mud and gas away from the rig during the first few minutes of the blowout.

A survey of the Transocean crew regarding “safety management and safety culture” on the *Deepwater Horizon* conducted just a few weeks before the accident hints at the organizational roots of the problem.<sup>34</sup> The research, conducted at Transocean’s request, involved surveys and interviews with hundreds of employees onshore and on four rigs, including *Deepwater Horizon*, which was surveyed from March 12 to March 16. The reviewers found *Deepwater Horizon* “relatively strong in many of the core aspects of safety management.”<sup>35</sup> But there were also weaknesses. Some 46 percent of crew members surveyed felt that some of the workforce feared reprisals for reporting unsafe situations, and 15 percent felt that there were not always enough people available to carry out work safely.<sup>36</sup> Some Transocean crews complained that the safety manual was “unstructured,” “hard to navigate,” and “not written with the end user in mind”; and that there is “poor distinction between what is required and how this should be achieved.”<sup>37</sup> According to the final survey report, Transocean’s crews “don’t always know what they don’t know. [F]ront line crews are potentially working with a mindset that they believe they are fully aware of all the hazards when it’s highly likely that they are not.”<sup>38</sup>

Halliburton, BP’s other major contractor for the Macondo well, is one of the world’s largest providers of products and services to the energy industry.<sup>39</sup> It has offices in 70 countries, and Halliburton-affiliated companies have participated in the majority of producing deepwater wells and contributed to most of the world’s deepwater well completions.<sup>40</sup> Yet notwithstanding its clear experience and expertise in cementing—a \$1.7 billion business for the company in 2009<sup>41</sup>—Halliburton prepared cement for the Macondo well that had repeatedly failed Halliburton’s own laboratory tests (see Chapter 4). And then, despite those test results, Halliburton managers onshore let its crew and those of Transocean and BP on the *Deepwater Horizon* continue with the cement job apparently without first ensuring good stability results.

Halliburton also was the cementer on a well that suffered a blowout in August 2009, in the Timor Sea off Australia. The *Montara* rig caught fire and a well leaked tens of thousands of barrels of oil over two and a half months before it was shut down.<sup>42</sup> The leak occurred because the cement seal failed, the government report into the accident found. However, the report said it would not be appropriate to criticize Halliburton, because the operator “exercised overall control over and responsibility for cementing operations.”<sup>43</sup> The inquiry concluded that “Halliburton was not required or expected to ‘value add’ by doing more than complying with [the operator’s] instructions.”<sup>44</sup> In this, *Montara* offers yet another example of a lack of communication between operators and service providers and of the gaps between the silos of expertise that exist in the deepwater oil and gas industry.

### **Absence of Adequate Safety Culture in the Offshore U.S. Oil and Gas Industry**

As noted, the offshore oil and gas industry is inherently risky, beginning with the initial exploratory activities and continuing through the transportation of oil and gas produced

from the wells. The drilling rigs are themselves dangerous places to work, dense with heavy equipment, hazardous chemicals, and flammable oil and gas—all surrounded by the open-sea environment far from shore, where weather and water conditions can change rapidly and dramatically. The seriousness of these risks to worker safety and the environment are underscored by the sheer number of accidents, large and small, that have occurred in oil and gas drilling activities in the Gulf, even in the absence of a major spill since the 1979 Ixtoc spill, until the Macondo blowout (see graphic).<sup>45</sup> No operator or lessee is immune from these safety challenges.

But the pervasive riskiness of exploring for and producing offshore oil and gas does not explain the extent to which approaches to safety differ among companies, nor why they differ within companies depending on where they are working. From 2004 to 2009, fatalities in the offshore oil and gas industry were more than four times higher per person-hours worked in U.S. waters than in European waters, even though many of the same companies work in both venues.<sup>46</sup> This striking statistical discrepancy reinforces the view that the problem is not an inherent trait of the business itself, but rather depends on the differing cultures and regulatory systems under which members of the industry operate.

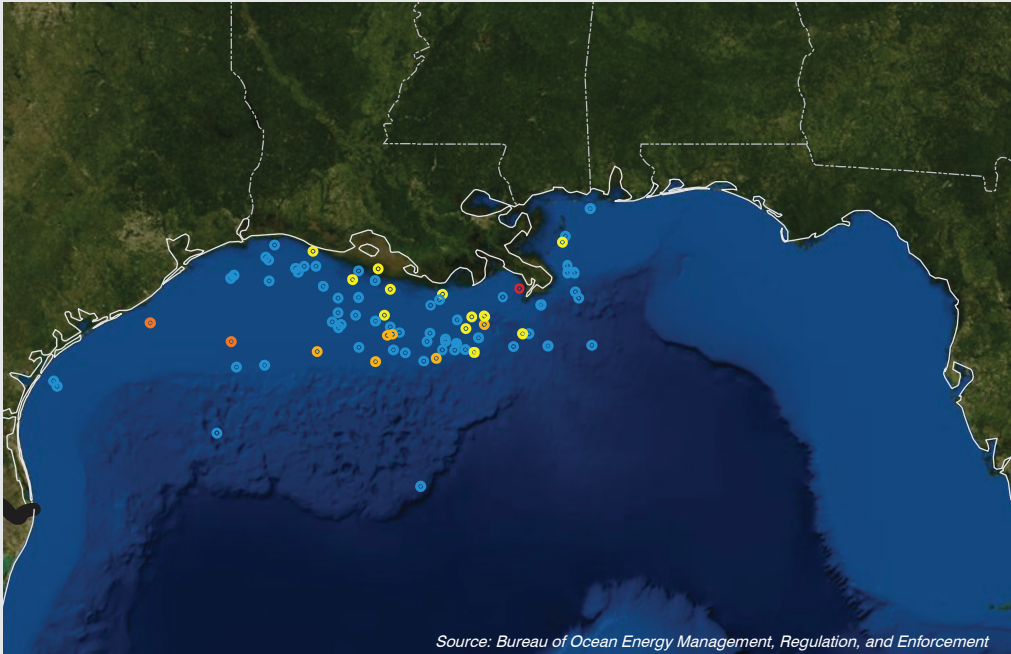
**The American Petroleum Institute: expert or advocate?** In the United States, the American Petroleum Institute (API) has played a dominant role in developing safety standards for the oil and gas industry.<sup>47</sup> And it clearly possesses significant, longstanding technical expertise. API produces standards, recommended practices, specifications, codes, technical publications, reports, and studies that cover the industry and are utilized around the world.<sup>48</sup> In conjunction with API's Quality Programs, many of these standards form the basis of API certification programs.<sup>49</sup> And the U.S. Department of the Interior has historically adopted those recommended practices and standards, developed by technical experts within API, as formal agency regulations.<sup>50</sup>

Based on this Commission's multiple meetings and discussions with leading members of the oil and gas industry, however, it is clear that API's ability to serve as a reliable standard-setter for drilling safety is compromised by its role as the industry's principal lobbyist and public policy advocate. Because they would make oil and gas industry operations potentially more costly, API regularly resists agency rulemakings that government regulators believe would make those operations safer, and API favors rulemaking that promotes industry autonomy from government oversight.<sup>51</sup>

According to statements made by industry officials to the Commission, API's proffered safety and technical standards were a major casualty of this conflicted role. As described by one representative, API-proposed safety standards have increasingly failed to reflect "best industry practices" and have instead expressed the "lowest common denominator"—in other words, a standard that almost all operators could readily achieve. Because, moreover, the Interior Department has in turn relied on API in developing its own regulatory safety standards, API's shortfalls have undermined the entire federal regulatory system.<sup>52</sup>

As described in Chapter 4, the inadequacies of the resulting federal standards are evident in the decisions that led to the Macondo well blowout. Federal authorities lacked regulations

**FIGURE 8.1: Loss of Well Control Accidents**



**Loss of Well Control Accidents and Resulting Consequences**

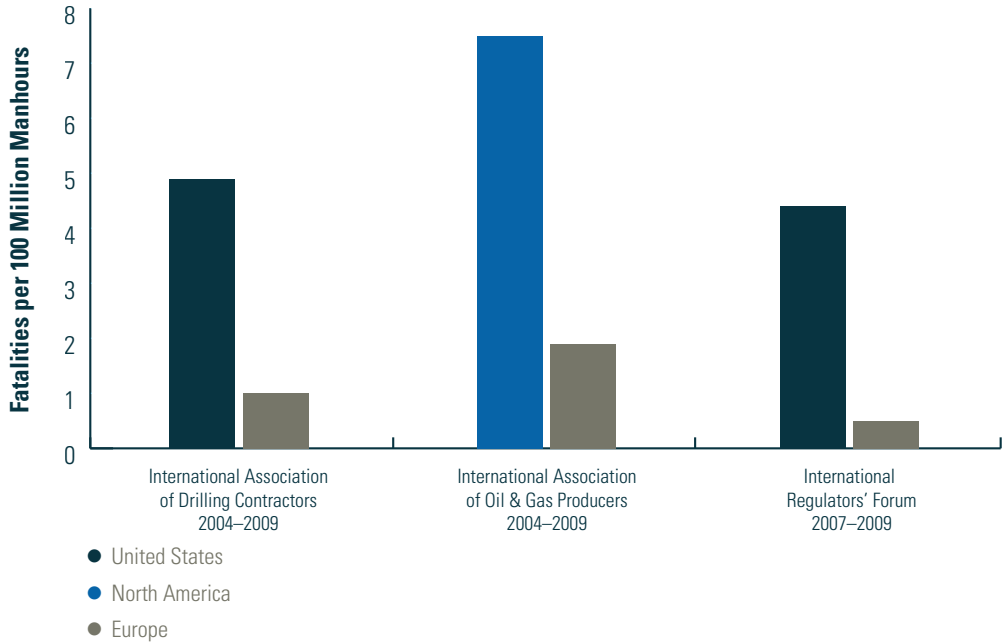
- Loss of Well Control
- Panel Investigation
- Fire or Explosion
- Fatalities
- Fire or Explosion with Fatalities or Injuries

Between 1996 and 2009, in the U.S. Gulf of Mexico, there were 79 reported loss of well control accidents—when hydrocarbons flowed uncontrolled either underground or at the surface.

The regulator considers the following three factors when determining whether or not an accident will undergo a panel investigation: the actual and potential severity of the incident; the complexity of the incident; and, the probability of similar incidents occurring.

Loss of Well Control Accidents & Consequences		
Date	Company	Consequence Code
01/24/96	Oryx Energy Company	
11/10/96	Norcen Explorer, Inc.	
11/27/96	Tana Oil and Gas Corporation	
12/03/96	Amoco Production Company	
01/10/97	BHP Petroleum, Inc.	
03/04/97	Shell Offshore, Inc.	
04/01/97	American Exploration Company	
05/31/97	Houston Exploration Company	
10/20/97	Freeport-McMoRan Resource Partners	
01/06/98	Hall-Houston Oil Company	
01/16/98	Chevron U.S.A., Inc.	
04/30/98	Vastar Resources Inc.	
07/08/98	Newfield Exploration Company	
11/22/98	Ocean Energy Inc.	
12/09/98	Petrobras America Inc.	
02/10/99	Union Pacific Resources Company	

08/11/99	Freeport McMoran Sulphur Inc.	
09/09/99	Newfield Exploration Company	
12/02/99	Apache Corporation	
12/05/99	Freeport McMoran Sulphur LLC	
01/02/00	Callon Petroleum Operating Company	
01/05/00	Apache Corporation	
01/12/00	Murphy Exploration & Production Company	
02/28/00	Murphy Exploration and Production Company	
03/22/00	Forcenergy Inc.	
04/07/00	Union Oil Company of California	
08/15/00	Houston Exploration Company	
11/18/00	Houston Exploration Company	
03/01/01	Forest Oil Corporation	
04/02/01	Newfield Exploration Company	
04/04/01	Matrix Oil & Gas, Inc.	
05/10/01	Devon Energy Production Company	
05/24/01	BHP Petroleum (Americas) Inc.	
07/06/01	Tri-Union Development Corporation	
07/13/01	William G. Helis Company	
10/24/01	Argo, L.L.C.	
11/21/01	BP Amoco Corporation	
01/12/02	BP Amoco Corporation	
08/08/02	BP Exploration & Oil Inc	
09/07/02	El Paso Production Oil & Gas Company	
10/03/02	Murphy Exploration & Production Co.	
11/14/02	BP Exploration & Production Inc.	
12/06/02	Kerr McGee Corporation	
03/08/03	Anadarko E&P Company	
04/12/03	Helis Oil & Gas Corporation	
04/22/03	ChevronTexaco Corporation	
09/02/03	Manti Operating Company	
12/04/03	Walter Oil & Gas Corporation	
02/09/04	Energy Partners, Ltd.	
02/17/04	Orca Energy (Dunhill), L.P.	
02/22/04	ATP Oil & Gas Corporation	
10/21/04	Amerada Hess Corporation	
03/08/05	Hunt Oil Company	
05/28/05	W & T Offshore, Inc.	
11/30/05	W & T Offshore, Inc.	
12/01/05	Chevron USA.	
02/20/06	Forest Oil Corporation	
11/18/06	Dominion Exploration & Production, Inc.	
01/23/07	Fairways Offshore Exploration, Inc.	
03/16/07	East Cameron Partners, LP	
06/24/07	Stone Energy Corporation	
08/22/07	Apache Corporation	
09/07/07	Eni US Operating Co. Inc.	
11/20/07	BP Corporation North America Inc.	
12/03/07	Rooster Petroleum, LLC	
02/14/08	Apache Corporation	
04/23/08	Apache Corporation	
04/26/08	LLOG Exploration Offshore, Inc.	
05/06/08	Mariner Energy, Inc.	
08/19/08	Energy Resource Technology GOM, Inc.	
10/31/08	Chevron U.S.A. Inc.	
11/01/08	Union Oil Company of California	
12/20/08	El Paso E&P Company, L.P.	
04/19/09	LLOG Exploration Offshore, Inc.	
04/23/09	Stone Energy Corporation	
05/27/09	Stone Energy Corporation	
08/26/09	Stone Energy Corporation	
12/22/09	Not Listed	
12/29/09	Murphy Exploration & Production Company	

**FIGURE 8.2: Fatalities from Offshore Oil and Gas Operations**

Note: Europe for the International Regulators' Forum Data Represents the United Kingdom, Norway, and the Netherlands  
 Source: IADC Incident Statistics Program, International Association of Drilling Contractors, <http://www.iadc.org/asp.htm>;  
 Safety Performance Indicators, International Association of Oil & Gas Producers, <http://www.ogp.org.uk/>;  
 IRF Country Performance Measures, International Regulators' Forum, <http://www.irfshoresafety.com/country/performance/>.

covering some of the most critical decisions made on the *Deepwater Horizon* that affected the safety of the Macondo well. For instance, notwithstanding the enormously important role cementing plays in well construction—especially in the high-pressure conditions often present in deepwater drilling—there were no meaningful regulations governing the requirements for cementing a well and testing the cement used. Nor were there regulations governing negative-pressure testing of the well's integrity—a fundamental check against dangerous hydrocarbon incursions into an underbalanced well. On many of these critical matters, the federal regulations either failed to account for the particular challenges of deepwater drilling or were silent altogether.

For years, API also led the effort to persuade the Minerals Management Service not to adopt a new regulatory approach—the Safety and Environmental Management System (SEMS)—and instead has favored relying on voluntary, recommended safety practices.<sup>53</sup> Safety and environmental management systems are used in similar forms in other parts of the world and many credit them with the better safety records achieved outside U.S. waters (see Chapter 3). Beginning early in the last decade, the trade organization steadfastly resisted MMS's efforts to require all companies to demonstrate that they have a complete safety and environmental management system<sup>54</sup> in addition to meeting more traditional, prescriptive regulations—despite the fact that this is the direction taken in other countries in response to the Piper Alpha rig explosion in the late 1980s.<sup>55</sup> Indeed, many operators in the Gulf were used to this safety-based approach on their rigs in the North Sea and Canada. It was not until this past September—after the Macondo blowout—that

the Department of the Interior was finally able to announce a new, mandatory Safety and Environmental Management System:<sup>56</sup> almost two decades after the approach was adopted in the United Kingdom, where it is called the “safety case.”<sup>57</sup> Moreover, API opposed revisions to the incident reporting rule that would have helped better identify safety risks.<sup>58</sup>

**Decreasing safety-related research and development.** Safely managing industrial hazards for oil and gas drilling requires experience and knowledge: knowing not only which actions to perform at various points on a checklist during a procedure, but also basic knowledge of the interactions of oil, gas, cement, drilling mud, sand, rock, and salt water that enables correct decisions when unexpected events occur. Yet such knowledge and experience within the industry may be decreasing.

The chair of the University of Texas’s Department of Petroleum and Geosystems Engineering, Tad Patzek, testified before Congress in 2010 that “the oil and gas industry has eliminated most of its research capabilities, which three decades ago allowed it to rapidly expand deepwater production.”<sup>59</sup> “Academic research has been important but small in scale and permanently starved of funding,” Patzek continued. “The depletion of industry research capabilities and the starvation of academia that educates the new industry leaders have resulted in a scarcity of experienced personnel that can grasp the complexity of offshore operations and make quick and correct decisions.”<sup>60</sup> Nor, Patzek stressed, could industry depend upon contractors to fill the safety gap: “The individual contractors have different cultures and management structures, leading easily to conflicts of interest, confusion, lack of coordination, and severely slowed decision-making.”<sup>61\*</sup>

### **Hazardous Industries Can Become Safer**

Even inherently risky businesses can be made much safer, given the right motivations and systems-safety management practices. Civil aviation and nuclear-fueled electric power are two good examples of industries that have had to manage the risk of catastrophic failures and losses. In the public sector, the United States Navy also faced the challenge of improving safety in its nuclear-power vessels—and did so.

The primary motivation for improving safety in each instance is that neither the public (as consumers and as voters) nor the government would allow such enterprises to operate if they suffered many accidents. People would not board planes if an unacceptable number crashed. The reaction to the contained partial core meltdown at the Three Mile Island power plant in 1979 has kept the industry from expanding in the United States for more than three decades.<sup>62</sup> And, nuclear submarines carry highly skilled crews and are enormously expensive to build (not to mention carrying a fuel source that would pose wide dangers in case of a leak)—all factors that compel the Navy to put a premium on safe practices.

\* According to Michael Bromwich, Director of the Interior Department’s Bureau of Ocean Energy Management, Regulation and Enforcement, the chairs of university departments of petroleum engineering whom he recently visited “expressed great concern about the level of R&D in the private sector into drilling and drilling safety.”



**Civil aviation.** The airline industry, for instance, is well aware that the industry as a whole suffers if the public lacks trust in the safety of any one company. The Federal Aviation Administration (FAA) is responsible for the safety of civil aviation,<sup>63</sup> and the airline industry lends resources to bolster government oversight.<sup>64</sup> The government enhances its oversight abilities by relying heavily on private Designated Engineering Representatives—either consultants or employees of aircraft manufacturers such as Boeing.<sup>65</sup> These engineers work for their employers and may approve, or recommend approval of, technical data provided to the FAA for the company.<sup>66</sup> It is a good example of industry and government “sharing” experts.<sup>67</sup>

Boeing itself has worked closely with the FAA to improve safety performance.<sup>68</sup> In the 1950s, only 20 percent of Americans were willing to fly, and there were 14 to 15 major accidents a year.<sup>69</sup> Boeing had a strong incentive to improve performance, and attitudes toward aviation, if it were to grow its commercial business. Despite an enormous increase (ten- to twentyfold) in airline flight operations between 1955 and 1991, the number of accidents fell to approximately four to five per year, one-fourth the annual rate in the 1950s.<sup>70</sup>

**The nuclear Navy.** Turning from the skies to the sea, between 1915 and 1963, the U.S. Navy lost about one submarine every three years to noncombat causes.<sup>71</sup> In 1963, when the nuclear-powered *USS Thresher* was lost during a deep test dive, 112 naval personnel and 17 civilians perished.<sup>72</sup> The Navy investigation found that a deficient silver-braze joint in a piping system had failed, flooding the engine room.<sup>73</sup> The investigation went far beyond immediate causes and “found deficient specifications, shipbuilding practices, and maintenance practices, along with inadequate documentation of construction and maintenance actions and deficient operational procedures.”<sup>74</sup> After the *Thresher* loss, Admiral Hyman Rickover, then head of the nuclear Navy, told his staff to establish a system to ensure that such an accident would never recur.<sup>75</sup> The new SUBSAFE system was established within 54 days of the loss of the *Thresher*, and no SUBSAFE-certified submarine has since been lost.<sup>76</sup>

SUBSAFE has two goals, both crucial for submarines: maintaining the watertight integrity of the hull, and maintaining operability and integrity of critical systems that allow control and recovery from a flooding hazard.<sup>77</sup> The system covers the administrative, organizational, technical, design, material-control, fabrication, testing, work-control, auditing, and certification aspects of submarine development and operations (see sidebar).<sup>78</sup> As important as procedures, SUBSAFE establishes a mindset—in this case, a questioning attitude and what the officers call *chronic uneasiness*, summarized in the saying, “Trust, but verify.”<sup>79</sup>

Another critical component of SUBSAFE is a separation of powers—no simple achievement in an organization as homogeneous and hierarchical as the Navy. In fact, there is always a dynamic tension among the Platform Program Managers (responsible for the costs, schedule, and quality of ships under their control), the Independent Technical Authority, and the Independent Safety and Quality Assurance Authority—the nuclear Navy’s “three-legged stool.”<sup>80</sup> The Platform Managers can select only from a set of acceptable design options, to ensure that safety is not traded off for performance.<sup>81</sup> The Technical Authority

approves these acceptable options.<sup>82</sup> The Safety Authority is responsible for administering SUBSAFE and enforcing compliance.<sup>83</sup>

#### Principles of the Naval “SUBSAFE” System

- Top management commitment to safety
- Clear and written safety requirements
- Education, not just training
- Regular rewriting of requirements
- Separation of powers and assignment of responsibilities
- Emphasis on rigor, technical compliance, and work discipline
- Documentation capturing what is done and why it is done
- Participatory audit approach, and requirements for objective quality evidence
- Program based on written procedures, not personality-driven
- Continual certification of a facility
- Accountability and accompanying responsibility
- Special efforts to be vigilant against complacency

SUBSAFE involves a great deal of certification (of design, materials, fabrication, and testing), and the overall SUBSAFE certification must be maintained through the life of the vessel.<sup>84</sup> Audits assure compliance, and the audits are treated not so much as exams by outsiders but as constructive learning experiences.<sup>85</sup> Continuous training and education of personnel are emphasized.<sup>86</sup> Many of the civilian contracting companies that service the nuclear Navy also service the offshore oil and gas industry and seem to cope well with the rigorous nature of the SUBSAFE system.<sup>87</sup>

#### Learning from Accidents: Exxon, Shell, and Bhopal

The Navy learned from the loss of the *USS Thresher* and set up an effective safety system. The American oil and gas industry must learn from the loss of the *Deepwater Horizon* and do the same today.

**The Exxon Valdez aftermath.** Among oil and gas companies, ExxonMobil’s wake-up call came in 1989, when its *Exxon Valdez* tanker struck a reef in Prince William Sound, Alaska, and spilled approximately 11 million gallons of crude oil.<sup>88</sup> Until the *Deepwater Horizon* disaster, this was the biggest spill in U.S. waters.<sup>89</sup> The spill covered thousands of miles of pristine waters and coastal areas, killing marine mammals, fish, and seabirds, and damaging the livelihoods of the people who lived and worked in the region.<sup>90</sup> A fatigued and overworked crew, inadequate safety escort vessels, and a single hulled tanker have been cited among the causes of the accident.<sup>91</sup> Exxon spent approximately \$2.1 billion in clean-up costs, and, pursuant to a settlement with the United States and Alaska, agreed to pay a criminal fine of \$150 million (\$125 million of which was forgiven in light of its cleanup efforts), \$100 million in criminal restitution, and \$900 million to settle civil claims, subject to a reopener provisions allowing for an additional \$100 million.<sup>92\*</sup>

\* A private civil lawsuit has been under way for the past two decades. A jury initially awarded the plaintiffs \$287 million in actual damages and \$5 billion in punitive damages, but the Supreme Court subsequently ruled that punitive damages could not exceed twice actual damages, or \$507.5 million. *Exxon Shipping Co. v. Baker*, 554 U.S. 471 (2008).

**Exxon Valdez Oil Spill**

The crippled tanker *Exxon Valdez* lies atop Bligh Reef off the coast of Alaska two days after running aground on March 24, 1989. More than a quarter-million barrels of oil leaked into Prince William Sound, wreaking environmental havoc and becoming the largest spill in U.S. waters until the *Deepwater Horizon* disaster.

*Natalie B. Fobes/National Geographic/Getty Images*

Following the spill, both government policy and industry practice changed dramatically. Congress enacted the Oil Pollution Act of 1990 and Exxon introduced its Operations Integrity Management System (OIMS) in 1992.<sup>93</sup> ExxonMobil CEO Rex Tillerson told the Commission's November 9 hearing that "OIMS is a rigorous 11-point set of elements designed to identify management and hazard risks. Its framework covers all aspects of safety, including management leadership and accountability; design, construction and maintenance of facilities; emergency preparedness; management of change; assessment of performance; and, of course, thorough inquiries into accidents and incidents."<sup>94</sup>

"OIMS guides the activities of each of ExxonMobil's more than 80,000 employees," he continued, "as well as our third-party contractors around the world. Over time it has become embedded into everyday work processes at all levels. Through OIMS, ExxonMobil monitors, benchmarks, and measures aspects of our safety performance. Its structure and standards are shared and communicated the world over."<sup>95</sup> "Safety is not proprietary," Tillerson added. "And for this reason ExxonMobil shares its best practices within our industry and across other industries. We seek to learn from others."<sup>96</sup> The reported improvements in the company's safety and environmental performance have been impressive. In 2009, the company reported that it had received a rating of 10 out of 10 from GovernanceMetrics International, placing it among the top one percent of companies

rated.<sup>97\*</sup> It also reported that it had had no spills from a marine vessel between 2006 and 2009, and that in 2009 it continued to lead the industry with combined employee and contractor workforce lost-time incident rates at best-ever levels.<sup>98</sup>

**Shell's safety response.** Shell, a long-time leader in Gulf of Mexico operations (before BP surpassed it, as described in Chapter 2), has had its own safety problems. Two men died in a gas leak on the company's Brent Bravo platform in 2003; former Shell senior manager Bill Campbell, who had earlier led a safety review, said after the accident that his 1999 warnings had been ignored by the company.<sup>99</sup> Shell denied that it operated at high levels of risk.<sup>100</sup>

Shell subsequently tightened and simplified its safety rules.<sup>101</sup> Shell also has promoted the use of the "safety case" worldwide (a risk-management approach to regulation described in Chapter 3).<sup>102</sup> It has adopted the safety-case approach even in the United States, where it is not required to do so, and has promoted it for the industry more broadly.<sup>103</sup> Marvin Odum, president of Shell Oil Company and director of Shell's Upstream Americas business, told the Commission's November 9 hearing that "the safety case in deepwater drilling shows how we identify and assess the hazards on a rig; how we establish the barriers to prevent and control those hazards; how we assign the critical activities needed to maintain the integrity of these barriers."<sup>104</sup>

Odum said that Shell also encourages workers to call for work to stop when they suspect that something is proceeding improperly, and gives awards to these "Goal Zero Heroes" (referring to the corporate goal of zero accidents).<sup>105</sup> He added that audits are key to system safety and that "in 2009, DuPont administered its safety and culture survey in our drilling organization, comparing us to the world's best across a range of industries. While we ranked world-class overall, improvement areas were identified."<sup>106</sup>

**Bhopal and Responsible Care.** The chemical industry's Responsible Care initiative was developed in Canada and launched in 1985 after the disastrous 1984 chemical leak in Bhopal, India.<sup>107</sup> It operates in 53 countries and describes itself as "the chemical industry's global voluntary initiative under which companies, through their national associations, work together to continuously improve their health, safety and environmental performance, and communicate with stakeholders about their products and processes in the manufacture and supply of safe and affordable goods that bring real benefits to society."<sup>108</sup> The American Chemistry Council can expel member firms for non-compliance with Responsible Care.<sup>109</sup> Subsequent analysis, however, suggests that the program's success has turned less on the availability of such formal sanctions and more on informal disciplinary mechanisms such as peer pressure and institutional norms of compliance: "Executives from leading firms pressure their non-compliant counterparts at industry meetings to adopt and adhere to the industrial codes."<sup>110</sup>

Of course, in drawing lessons from prior accidents, it is essential that they be projected beyond the particular circumstances of the accident at hand, to guide present and future

\* Governance Metrics International (GMI) is an independent governance research and ratings firm providing institutional investors an objective way of assessing corporate governance risk as well as governance leaders in their portfolios.

performance, lest government regulators and industry leaders make the classic mistake of “preparing to fight the last war.” As discussed in Chapters 3 and 5, despite the steps taken in the aftermath of *Exxon Valdez* to enhance transportation safety and oil spill response from a tanker spill, too little effort was made to take those lessons and apply them more broadly to the risks associated with the future of offshore drilling, in the deepwater of the Gulf.

### **Industry Self-Policing as a Supplement to Government Regulation**

One of the key responsibilities of government is to regulate—to direct the behavior of individuals and institutions according to rules. Many businesses and business groups are involved in internal standard-setting, evaluation, and other activities that constitute self-policing or self-regulation. Such oversight can be conducted by a private entity established and supported by an industry to ensure safe operations by individual members (among other purposes), often because industry leaders recognize that a misstep by any one member necessarily has significant repercussions for them all. But even in industries with strong self-policing, government also needs to be strongly present, providing oversight and/or additional regulatory control—responsibilities that cannot be abdicated if public safety, health, and welfare are to be protected.

**The logic of self-policing.** Industry-standard setting and self-policing organizations are widespread in the United States and in most industrialized nations—typically for operations marked by technical complexity, such as the chemical, nuclear power, civil aviation, and oil and gas industries, where government oversight is also present. These processes coexist where there are, as a practical matter, relatively limited numbers of people with the requisite expertise and experience, making it hard for government to be able to rely solely on its own personnel (especially when government cannot compete with private-sector salaries for those experts). Support for standard-setting and self-policing also arises in industries whose reputations depend on the performance of each company, and where significant revenues are at stake—witness both the airline industry’s private Designated Engineering Representatives (discussed above) and the Institute of Nuclear Power Operations (see below). Though the Navy is a government organization, SUBSAFE is also an example of self-policing to help assure the safety of its nuclear submarines.

**The limits of unregulated self-policing.** Industry self-policing is not a substitute for government but serves as an important supplement to government oversight. And the cost of forgetting that essential premise can be calamitous. In the financial sector, for example, the Securities and Exchange Commission’s Consolidated Supervised Entities Program had, in 2004, delegated regulatory risk assessment of global investment bank conglomerates to the banks themselves.<sup>111</sup> The program was designed to cover a regulatory gap left by Congress amid changes in global finance, but it was entirely voluntary.<sup>112</sup> Four years later, Securities and Exchange Commission Chairman Christopher Cox ended the program, declaring it a failure—indeed “fundamentally flawed”—after companies like Bear Stearns failed to adequately assess the risk of a sharp downturn in housing prices on their large, leveraged investments in mortgage-backed securities.<sup>113</sup>

A second cautionary tale involves an environmental disaster. When political opposition stymied federal and state regulation of toxic coal ash and other residues from power generation, the electric utilities that had opposed regulations deferred to the Utilities Solid Wastes Activities Group's voluntary "Action Plan" to manage such wastes.<sup>114</sup> The U.S. Environmental Protection Agency stepped back from regulating such hazards.<sup>115</sup> And, in 2008, an earthen dam containing coal ash gave way in eastern Tennessee, releasing more than a billion gallons of coal ash across a large portion of Roane County and polluting rivers that carried the hazardous wastes farther afield.<sup>116</sup>

### The Nuclear Model

The risk-management challenges presented by nuclear power are in some respects analogous to those presented by deepwater drilling: the dependence on highly sophisticated and complex technologies, the low probability/catastrophic consequences nature of the risks generated, and the related tendency for a culture of complacency to develop over time in the absence of major accidents. For the nuclear power industry, it took a crisis—the partial meltdown in 1979 of the radioactive core in Unit Two at the Three Mile Island Nuclear Generating Station—to prompt a transformation of its safety culture.<sup>117</sup> But that is what industry accomplished and reportedly with significant, positive results.<sup>118</sup> For that reason, the nuclear power industry's method of transforming business-as-usual practices offers a useful analogue as the oil and gas industry now seeks to do the same more than 30 years later.

The first recommendation of the President's Commission that investigated the root causes of the Three Mile Island accident was directed to industry, and made clear the extent to which the industry need to transform its safety culture:

[T]he nuclear industry must dramatically change its attitudes toward safety and regulations. The Commission has recommended that the new regulatory agency prescribe strict standards. At the same time . . . the industry must also set and police its own standards of excellence to ensure the effective management and safe operation of nuclear power plants.<sup>119</sup>

Two months later, in December 1979, the nuclear power industry created the Institute of Nuclear Power Operations (INPO), a nonprofit organization with the ambitious mission "to promote the highest levels of safety and reliability—to promote excellence—in the operation of commercial nuclear power plants."<sup>120</sup>

INPO's structure more closely resembles the utilities it "regulates" than it does the Nuclear Regulatory Commission (NRC), the federal regulatory agency whose work INPO is designed to complement. INPO's president answers to a board of directors, consisting of senior industry executives—mainly CEOs.<sup>121</sup> A few years after its founding, INPO established its own inspection process, based on its studies of what needed inspecting and how to do so.<sup>122</sup> Today, nuclear power plant inspections are thorough, but not adversarial. Because many INPO inspectors are nuclear employees drawn from other power plants, a great deal of cross-fertilization of knowledge occurs, and strong peer relationships are created.<sup>123</sup> INPO's normative system establishes a structured way of thinking about plant

operations by translating these matters into the language of responsibility as it spells out what it means to occupy a particular role and what it means to behave in a manner appropriate to that position.<sup>124</sup>

**Inspection teams and procedures.** INPO inspection teams usually number about 20 people: one-third are permanent, full-time inspectors; one-third are on loan from the industry for 18 to 24 months; and the remainder are peer evaluators on loan just for that particular inspection (but these cannot be from the utility being inspected).<sup>125</sup>

Each of the 66 nuclear sites (encompassing 104 reactors, operated by 26 utilities) is inspected every 24 months.<sup>126</sup> Inspectors rotate through assignments; each inspector averages 4 to 5 inspections per year. (Besides the major inspection of each site every two years, INPO performs a series of other evaluations and provides other safety-oriented services throughout the year. For example, utilities' training programs are evaluated and accredited every 24 months.)<sup>127</sup> Importantly, INPO is not the sole source of plant inspections, but instead serves as a significant supplement. Nuclear insurers, the Occupational Safety and Health Administration, and the NRC also conduct inspections; INPO coordinates with the NRC and other inspectors to avoid schedule conflicts.<sup>128</sup>

Nor is there anything casual about an INPO inspection. It is thorough and careful, extending for five to six weeks: two weeks of preparation and analysis of pre-delivered data from the site, two weeks on the site, a week of internal review and report writing by functional and cross-functional sub-teams, and perhaps another week reviewing with the INPO president.<sup>129</sup> Any lessons learned that are deemed valuable to the rest of the industry are posted on INPO's private online portal, but the name of the site is scrubbed from the text.<sup>130</sup> All plants respond to INPO's assessment reports by documenting actions planned to address any reported problems. A poorly performing plant will receive higher attention from INPO to see if the plant's responsive actions are on track. INPO will also work to give them help or coordinate help from other stations.<sup>131</sup> Furthermore, assessment results are never revealed to anyone other than the utility CEOs and site managers, but INPO formally meets with the NRC four times a year to discuss trends and information of "mutual interest." And if INPO has discovered serious problems associated with specific plants, it notifies the NRC.<sup>132</sup>

**The performance evaluation.** INPO considers at each plant such metrics as consistency of operations, safety-system performance, and workers' collective radiation exposure.<sup>133</sup> But its Plant Performance Assessments are the real backbone of its work. These exercises figuratively deconstruct and reconstruct the plants, looking into all aspects of operations, maintenance, and engineering. The inspection teams evaluate processes and behaviors that cross organizational boundaries such as safety culture, self-assessment, corrective action, operating experience, human performance, and training. The performance of operations and training personnel during simulator exercises is included in each evaluation. Where possible, observations of plant startups, shutdowns, and major planned changes are also included.<sup>134</sup>

INPO strongly discourages a rule-bound, compliance-oriented approach that would encourage a mentality of ticking boxes—and in fact its reports are not in checklist form.<sup>135</sup> Many of the risk factors that nuclear companies must deal with are beyond their control. One issue that is clearly within the industry's control is standardization: of design requirements, resulting advanced designs, and operations. The industry has devoted significant time and resources to this issue over the past few decades.<sup>136</sup> "Good practice" documents are written with an eye toward processes that are applicable across the industry.<sup>137</sup>

**From the control room to the CEO.** INPO directly connects those responsible for the day-to-day operations of nuclear plants with senior management.<sup>138</sup> Two INPO Industry Review Groups, which act in an advisory capacity to senior management, enable lower-level employees involved in plant operations to communicate with vice presidents and division directors.<sup>139</sup> Review groups also assess INPO programs and evaluate INPO's performance itself.<sup>140</sup> The existence of these groups reflects INPO's commitment to tie together senior management and lower-level, operational employees.

**INPO's influence.** In addition to its individual site evaluations, INPO hosts an industry "CEO Conference," usually each November, which includes numerous speakers from nuclear organizations and also some non-nuclear companies, with a focus on nuclear safety.<sup>141</sup> During this conference, the INPO president gathers only the 26 utility CEOs in a private room to reveal to all the executives the grades for each site, based on the assessments.<sup>142</sup> These grades range from one (most favorable) to five. Approximately 40 percent of the grades are INPO 1, 40 to 50 percent are INPO 2, and 10 to 15 percent are INPO 3 or 4. (The last time any site was given a grade of 5 was in the late 1980s.)<sup>143</sup> An INPO 5 indicates a site with significant operational problems, triggering a shutdown. And a grade of INPO 4 requires a verbal explanation by the affected CEO on the spot.<sup>144</sup> This meeting is not intended to shame or punish, but to put the facts on the table. CEOs with low-rated plants typically will describe to their peers what comprehensive actions they are undertaking to address the causes of the problems. All CEOs recognize that it is in everybody's interest to help lower performers operate better. At the larger dinner, with all conference attendees present, INPO announces and congratulates only the INPO 1 plants.<sup>145</sup> A former Chief Nuclear Officer of a major utility described INPO 1 as equivalent to receiving an Academy Award.<sup>146</sup>

Presentation of relative standings before the rest of the industry produces a high level of peer pressure; as one CEO put it, "You get the whole top level of the utility industry focused on the poor performer."<sup>147</sup> It also gives the industry the ability to "clean out" poor management. Because INPO's directors are industry peers, CEOs may become aware of a company taking too much risk and offer to loan people to help the "underperformer" come up to speed.<sup>148</sup>

**The impact on insurance premiums.** Although the Price-Anderson Act limits the liability of those who operate nuclear power plants in the case of an accident, owners of nuclear plants insure through Nuclear Electric Insurance Limited, an industry mutual insurance company, against losses associated with on-site problems such as power interruptions,



decontamination, and physical property damage.<sup>149</sup> Nuclear Electric Insurance Limited is allowed to visit INPO's office at least once a year to view the assessment ratings (but they are not provided with copies).<sup>150</sup> And, like any other insurance company, Nuclear Electric Insurance Limited sets insurance premiums based on its assessment of risk. Sites with top INPO ratings are charged lower premiums than stations with lower ratings.<sup>151</sup> NEIL requires that license holders be active members of INPO or that they notify NEIL formally and promptly if they stop being a member – and they must show NEIL how they will accomplish a level of oversight equivalent to what INPO provides. This has never occurred. In reality, NEIL's board would quickly discuss removal of insurance coverage should a member choose to drop out of INPO activities.<sup>152</sup> So utilities have a tremendous financial incentive to carry out INPO's recommendations.<sup>153</sup>

**Compensation competitive with industry.** INPO has about 400 employees, including about 60 on long-term loan from its member utilities. Of the total staff and management cadre, 250 are nuclear technical personnel.<sup>154</sup> INPO can do its job only if its employees possess technical expertise at least equal to that possessed by those in the industry INPO is charged with overseeing. To a certain extent, INPO achieves that standard by relying on experts on loan from industry for extended periods of time.<sup>155</sup> But to ensure that INPO's own full-time personnel possess the requisite qualifications, industry salaries are benchmarked, and INPO provides its employees comparable compensation.<sup>156</sup> INPO has therefore not suffered from the expertise gap too often evident with government inspectors (witness the issue raised at the founding of the Minerals Management Service, as discussed in Chapter 3). INPO can pay these higher salaries because it is not subject to the same budgetary constraints faced by a public agency. Each utility contributes to INPO's budget based on the number of reactors it owns. Budgets are approved by INPO's board each autumn. (INPO's fiscal year 2010 budget was \$99 million, with more than \$100 million budgeted for 2011.)<sup>157</sup>

**INPO "clout" and industry acceptance.** INPO's ability to achieve widespread acceptance within the nuclear power industry was not preordained. The new self-policing enterprise had to earn the necessary reputation for fairness and integrity over time.<sup>158</sup> A formative moment in gaining the necessary stature occurred in 1988, when INPO helped bring about the firing of a utility's corporate leadership following a plant shutdown.<sup>159</sup> Beginning in December 1984, INPO inspectors reported pervasive safety problems at Philadelphia Electric's Peach Bottom nuclear plant—including incidents of employees literally sleeping on the job. When INPO was dissatisfied with the plant's response to these concerns, it scheduled more inspections and meetings with Philadelphia Electric officials, and sent letters further detailing the depth of its concerns. These concerns prompted the NRC to order a shutdown of the plant, and when Philadelphia Electric submitted a recovery plan to the Commission to restart the plant, an INPO-convened industry panel sharply condemned the plan as seriously flawed. INPO and the NRC worked closely and cooperatively, with INPO so harshly criticizing Philadelphia Electric's management that several top executives ultimately lost their jobs. From then on, the message within the industry was clear: "INPO has a great deal of clout" and Peach Bottom became a symbol of INPO's new power.<sup>160</sup>

Although INPO has its detractors,\* it does appear to have helped the nuclear power industry improve and maintain performance and safety during the past three decades. INPO has helped the industry measure its progress in improving safety standards and has served as a vehicle for making advances in control-room design, plant and personnel performance, training and qualification, self-regulation, emergency response, maintenance, and radiation protection, among other areas.<sup>161</sup> During the past 30 years, the nuclear industry has improved plant efficiency, significantly reduced the number of automatic emergency reactor shutdowns per year, and reduced collective radiation accident rates by a factor of six compared to the 1980s.<sup>162</sup> The industry has achieved these milestones, in part, through INPO's role in promoting a strong nuclear safety culture and presenting performance objectives and criteria to help the industry strive for and surpass safety goals.<sup>163</sup>

### An INPO for Oil?

In the aftermath of the *Deepwater Horizon* spill, could the oil and gas industry similarly improve its safety culture by creating a self-policing entity like INPO as a supplement to government oversight? There are clear parallels that would strongly support such an effort, but also some equally clear differences between the oil and gas industry and the nuclear power industry that at least caution against wholesale adoption of the INPO model.

**Similarities: Need, incentive, and means.** The reason the INPO model holds promise is because the oil and gas industry, like the nuclear power industry after Three Mile Island, has both the substantial economic resources and the necessary economic incentive to make it happen. INPO was formed because doing so was in industry's self-interest.<sup>164</sup> As the *Deepwater Horizon* disaster made unambiguously clear, the entire industry's reputation, and perhaps its viability, ultimately turn on its lowest-performing members.<sup>†</sup> If any one company is involved in an accident with widespread and potentially enormous costs, like those that followed the Macondo blowout, everyone in the industry—companies and employees—suffers, as do regional economies and the nation as a whole. No one, in industry or in government, can afford a repeat of the Macondo explosion and spill. Also, as the enormous sums that BP was willing and able to expend to contain and respond to the Gulf spill make clear (see Chapter 5), the oil and gas industry possesses the financial means to fund a very healthy and effective self-policing organization akin to INPO.

A second fundamental parallel is that no one in the oil and gas industry has the unilateral right to engage in offshore drilling on the outer continental shelf any more than a utility has the right to construct and operate a nuclear power plant absent federal governmental approval. Indeed, the extent of governmental authority is even greater in the offshore context. The oil and gas industry does not own the valuable energy resources located on the outer continental shelf, which belong to the American people and are managed by the federal government on their behalf. As described in Chapter 3, the government accordingly

\* The Union of Concerned Scientists has on occasion faulted INPO (and the Nuclear Regulatory Commission) for not inspecting some plants with sufficient rigor and skepticism, and has pointedly raised the issue whether the fact that industry pays for INPO's services presents a conflict of interest that compromises its essential impartiality.

† This was also the case in the INPO context; in part, industry mobilized to unify "in reaction to a mutual internal threat, unsafe nuclear utilities." Joseph Rees, *Hostages of Each Other* (Chicago: The University of Chicago Press 1994), 44.

possesses sweeping authority to dictate the terms of private access to those resources in its lease agreements with private parties. And, in particular, government could decide to condition such access, either directly or indirectly, on participation with an industry safety institute.

A third clear parallel is the possibility in both contexts—offshore drilling and nuclear power—for industry self-policing to supplement government regulation.<sup>165</sup> As described in Chapter 3, government regulators need to improve their in-house technical expertise dramatically,<sup>166</sup> but they are unlikely ever to possess technical expertise truly commensurate with that of private industry. The salary differential, combined with the sheer depth of industry expertise on a wide variety of topics critical to understanding and managing offshore drilling operations, would make that goal illusory. Such expertise is, however, a prerequisite for the thorough, rigorous inspections required to ensure safe operation of dozens of deepwater exploration rigs and production platforms (the former operating in multiple locations and different geologies each year)<sup>167</sup>—a number that rises sharply if installations in shallower Gulf waters are included. By supplementing governmental oversight, with the kind of self-policing accomplished by INPO for nuclear power, that gap in expertise can be sharply narrowed. Government can never abdicate its ultimate responsibility to ensure drilling safety, but it can effectively take advantage of industry expertise to meet that objective.

**Differences that warrant modifying the INPO model.** But there are also clear differences between the two industries that would require a differently defined self-policing entity for offshore oil and gas. For instance, the U.S. nuclear power industry is based at a limited number of fixed sites, using a small number of known technological designs, and operated by an industry subject to comprehensive public regulation<sup>168</sup>—from permission to construct facilities through detailed oversight of design, operations, and maintenance. The oil and gas industry is structured much differently. As described by ExxonMobil’s Tillerson, his industry “is moving to different locations, different environments, evolving, all kinds of technologies being introduced.”<sup>169</sup> For this reason, he explained, while the oil and gas industry can “look at the principles around INPO in terms of how do you share best practices, how do you assess where the companies are operating at certain levels of competency?”<sup>170</sup>, he appeared to suggest there would be limits in the application of every aspect of the INPO model to offshore drilling for oil and gas.

The oil and gas industry is more fragmented and diversified in nature—from integrated global oil companies to independent exploration and drilling enterprises—and therefore less cohesive than the nuclear power operators who joined to establish INPO.\* As a result, it could be more challenging to create an INPO-like organization. And oil and gas executives would need assurances that any industry-wide efforts to promote better safety did not subsequently serve as the basis for claims that industry had violated antitrust laws. Finally, concerns about potential disclosure to business competitors of proprietary information might make it harder to establish an INPO-like entity in the oil and gas

\* Prior to the Three Mile Island accident, however, the nuclear power industry was reportedly far less cohesive than it became after that accident. See Rees, *Hostages of Each Other*, 42 (“when officials describe the pre-TMI nuclear industry, a collective portrait emerges in which each nuclear utility behaved like an ‘island unto itself’ or ‘independent barony.’ In short, the industry was *fragmented*.”) (emphasis in original).

industry. Technology and design apparently are more uniform in nuclear power than in offshore drilling. For this reason, Michael Bromwich, Director of the Bureau of Ocean Energy Management, Regulation, and Enforcement (the successor to MMS), cautioned that an INPO-like approach might run into problems if companies perceived the potential for inspections of offshore facilities to reveal “technical and proprietary and confidential information that companies may be reluctant to share with one another.”<sup>171</sup>

### **Essential Features of a Self-Policing Safety Organization for the Oil and Gas Industry**

Like the nuclear power industry in 1979—in the immediate aftermath of the Three Mile Island accident—the nation’s oil and gas industry needs now to embrace the potential for an industry safety institute to supplement government oversight of industry operations. Akin to INPO, such a new safety institute can provide the nation with the assurances of safety necessary to allow the oil and gas industry access to the nation’s energy resources on the outer continental shelf. To be sure, the significant differences between the two types of industries warrant significant differences in the precise structure and operation of their respective industry safety institutes. But, as elaborated below, the basic, successful principles upon which the INPO model is premised can serve as the touchstones for the oil and gas industry in establishing its own.

**Credibility.** To be credible, any industry-created safety institute would need to have complete command of technical expertise available through industry sources—and complete freedom from any suggestion that its operations are compromised by multiple other interests and agendas. As a consensus-based organization, the American Petroleum Institute (API) is culturally ill-suited to drive a safety revolution in the industry. For this reason, it is essential that the safety enterprise operate apart from the API. As described above and in Chapter 3, API’s longstanding role as an industry lobbyist and policy advocate—with an established record of opposing reform and modernization of safety regulations—renders it inappropriate to serve a self-policing function. In the aftermath of the *Deepwater Horizon* tragedy, the Commission strongly believes that the oil and gas industry cannot persuade the American public that it is changing business-as-usual practices if it attempts to fend off more effective public oversight by chartering a self-policing function under the control of an advocacy organization.

**An industry-wide commitment to rigorous auditing and continuous improvement.** The INPO experience makes clear that any successful oil and gas industry safety institute would require in the first instance strong board-level support from CEOs and boards of directors of member companies for a rigorous inspection and auditing function. Such audits would need to be aimed at assessing companies’ safety cultures (from design, training, and operations through incident investigation and management of improvements) and encouraging learning about and implementation of enhanced practices. As at INPO, the inspection and auditing function would need to be conducted by safety institute staff, complemented by experts seconded from industry companies, able to analyze the full range of technologies and practices, and designed to promote cross-company learning and shared responsibility while protecting proprietary information.

There would also need to be a commitment to share findings about safety records and best practices within the industry, aggregate data, and analyze performance trends, shortcomings, and needs for further research and development. Accountability could be enhanced by a requirement that companies report their audit scores to their boards of directors and insurance companies.

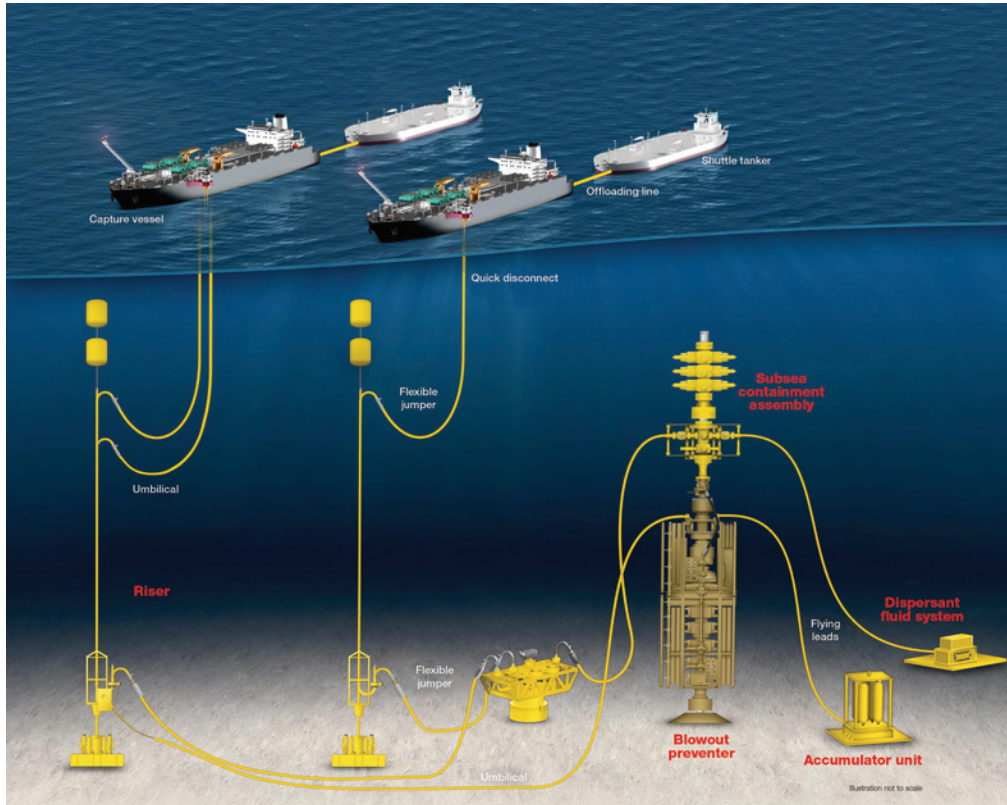
The main goal is to drive continuous improvement in every company's standards and performance, measured against global benchmarks. The means, to that end, include the safety auditor's reviews; insurer evaluations of risk; and management recognition of and incentives for effective behavior. Senior leadership would be accountable to the company's board of directors, who in turn would be accountable to investors.

In a broader sense, the industry's safety institute could facilitate a smooth transition to a regulatory regime based on systems safety engineering and improved coordination among operators and contractors—the principles of the U.K.'s "safety case" that shifts responsibility for maintaining safe operations at all times to the operators themselves. It should drive continuous improvement in standards and practices by incorporating the highest standards achieved globally, including (but not exclusively) those set by the API.

**An initial set of standards and scope of operation.** The industry needs to benchmark safety and environmental practice rules against recognized global best practices. The Safety and Environmental Management Program Recommended Practice 75 (API RP 75) developed in 1993 by the API and incorporated by reference in the Department of the Interior's new workplace safety rules, adopted in October 2010, is a reasonable starting point.<sup>172</sup> Updates to those safety rules are needed immediately, but a new industry safety institution could make a credible start by requiring members to adopt all safety standards promptly—and mandating that the companies, in turn, require that their contractors and service providers comply with the new safety rules.

Because the number of offshore drilling operations subject to potential inspection is much greater than the number of nuclear sites INPO must review (although the number of exploratory rigs on the outer continental shelf is comparable to the number of nuclear plant sites), any new oil and gas industry safety institution will likely need, as a practical matter, to phase in its inspections over time. Accordingly, the safety institute will need to identify those operations that present the greatest risks because of the type of drilling (for example, deepwater or ultra-deepwater), the challenges of drilling in a particular kind of or less-well-known geologic formation, or the location of the operation in a remote frontier area where containment and response resources may be fewer.\* Over time, the safety institute might move to cover more offshore operations to reduce the risk of accidents that can lead to loss of life or property, or environmental damage.

\* Given the speed with which companies are moving into ever deeper, less well understood geologic formations, the institute will have to move quickly.

**FIGURE 8.3: Schematic of the Marine Well Containment System**

Courtesy of the Marine Well Containment Company LLC

### Industry Responsibilities for Containment and Response

Industry's responsibilities do not end with efforts to prevent blowouts like that at the Macondo well. They extend to efforts to contain any such incidents as quickly as possible and to mitigate the harm caused by spills through effective response efforts. As described in Chapter 5, once a spill occurs, the government must be capable of taking charge of those efforts. But government depends upon the resources and expertise of private industry to contain a blown-out well and to respond to a massive subsea oil spill. Chapter 5 also explains how woefully unprepared both government and industry were to contain or respond to a deepwater well blowout like that at Macondo. All parties lacked adequate contingency planning, and neither government nor industry had invested sufficiently in research, development, and demonstration to improve containment or response technology. Notwithstanding its promises in the aftermath of *Exxon Valdez* that industry would commit significant funds to support more research and development in response technology—through the “Marine Spill Response Corporation,” for example—those commitments were soon forgotten as memories dimmed.<sup>173</sup>

From now on, the oil and gas industry needs to combine its commitment to transform its safety culture with adequate resources for containment and response. Large-scale rescue, response, and containment capabilities need to be developed and demonstrated—including

equipment, procedures, and logistics—and enabled by extensive training, including full-scale field exercises and international cooperation.

To that end, at least two industry spill containment initiatives have emerged that build on ideas and equipment that were deployed in response to the Macondo blowout and spill. The nonprofit Marine Well Containment Company, created in July 2010 by four of the five major, integrated oil and gas companies (with BP subsequently announcing its intention to join), is a significant step toward improving well containment capability in the Gulf of Mexico.<sup>174</sup> The four founding companies have committed \$1 billion for startup costs to develop the Marine Well Containment Company's rapid-response system, which includes modular containment equipment that can be used to collect oil flowing from a blown-out deepwater well. The system is designed to mobilize within 24 hours and be operational within weeks, ready to contain spills 10,000 feet below the surface, at volumes up to 100,000 barrels per day.<sup>175</sup> Although many of the details surrounding the company's governance and membership structure have not yet been finalized, membership is open to all oil and gas operators in the Gulf of Mexico. Nonmembers will be able to gain access through service contracts.<sup>176</sup>

The second spill containment initiative is being coordinated by Helix Energy Solutions Group, which played a major role in the Macondo well containment efforts. Helix is seeking industry participation to make permanent modifications to the equipment it used in responding to the Macondo blowout and spill. It offers more modest containment capacity than the Marine Well Containment Company—less than the 100,000 barrels per day without additional investment—but at a lower cost. Although Helix maintains that it is not in competition with the Marine Well Containment Company,<sup>177</sup> its system appears to be attracting the interest of many of the independent oil and gas producers in the Gulf, who have expressed concerns about cost of and access to the Marine Well Containment Company.<sup>178</sup>

The Marine Well Containment Company and Helix spill containment proposals are promising, but they have at least two fundamental limitations. First, the systems are not designed to contain all possible catastrophic failures, only the next *Deepwater Horizon*-type spill. For instance, while both systems are designed to contain quickly the kind of blowout that happened at Macondo, they would not be able to contain a spill of the type that occurred in the Gulf of Mexico in 1979 during the Ixtoc oil spill, where the rig collapsed on top of the well. In addition, neither the Marine Well Containment Company's planned capabilities nor Helix's go past 10,000 feet despite the fact that current drilling technology extends beyond this depth.

Second, and perhaps most important, it seems that neither the Marine Well Containment Company nor the Helix system is structured to ensure the long-term ability to innovate and adapt over time to the next frontiers and technologies. What resources, if any, either initiative will dedicate to research and development going forward are unclear. The Marine Well Containment Company, in particular, could become another Marine Spill Response Corporation (as described in Chapter 5)—an industry nonprofit initiative created in response to a major oil spill that becomes underfunded and fails to innovate over time—if

it does not implement specific policies and procedures to monitor and guarantee its long-term readiness as well as funding and investment levels.

The primary long-term goal of a spill containment company or consortia should be to ensure that an appropriate containment system is readily available to contain quickly spills in the Gulf of Mexico with the best available technology. Any spill containment company or consortia should ensure that it remains focused on this goal, even when doing so potentially conflicts with the short-term interests of its founding companies, in the case of Marine Well Containment Company, or the parent company, in the case of Helix. An independent advisory board, with representatives from industry, the federal government, state and local governments, and environmental groups could help keep any spill containment initiative focused on innovative, adaptive, effective spill response over the long term.

As next-generation equipment is developed, industry must ensure that its containment technology is compatible with its wells. For instance, it may be useful to consider design modifications to blowout preventer stacks that would allow for more expeditious hook-ups of injection and evacuation networks and hoses, reducing the capital costs and increasing the flexibility of the spill containment companies or consortia. Capping and containment options should also be developed in advance to contain blowouts from platform wells.

### Managing Liability

The market has a financial mechanism for encouraging risk-managing behaviors: the cost of insurance. In the wake of *Deepwater Horizon* oil spill, early reports indicated that insurance premiums rose by as much as 15 to 25 percent in shallow waters and up to 50 percent for deepwater rigs.<sup>179</sup> An energy underwriter predicted that premiums for deepwater operations would rise 25–30 percent and by 100 percent for deepwater drilling.<sup>180</sup> Companies insure for many perils, and a major reinsurer has represented to the Commission that there is ample additional coverage for most risks. The significant exception is third-party liability, about which there remains considerable uncertainty.<sup>181</sup>

**The liability cap.** Under the Oil Pollution Act of 1990 (the Act), responsible parties, including the lessees of offshore facilities, are strictly liable for removal costs and certain damages resulting from a spill.<sup>182</sup> Compensable damages are defined in the Act.<sup>183</sup> Removal costs themselves are unlimited, but there is a cap on liability for damages: for offshore facilities, \$75 million.<sup>184</sup> The cap does not apply in cases of gross negligence, violation of an applicable regulation, or acts of war, and does not limit the amount of civil or criminal fines that might be imposed for violations of federal law, such as the Clean Water Act, nor does it limit damages under state law.<sup>185</sup>

As it became apparent that the damages from the *Deepwater Horizon* oil spill were likely to be orders of magnitude greater than the existing cap, Congress began to consider raising that cap significantly (to as much as \$10 billion) or even eliminating it altogether.<sup>186</sup> The arguments in favor of such a change are straightforward. The amount of potential damage caused by a major spill clearly exceeds the existing caps, and one cannot fairly assume



that the responsible party causing a future spill will, like BP, have sufficient resources to fully compensate for that damage. Nor should the spill's victims or federal taxpayers have to pay the bill for industry's shortcomings. Increasing liability limits would also serve as a powerful incentive for companies to pay closer attention to safety, including investing more in technology that promotes safer operations.

Notwithstanding these arguments in favor of at least raising the liability cap, legislative efforts quickly stalled when members of Congress learned more about the potential impact on the structure of the oil and gas industry. A substantial portion of the offshore industry in the Gulf is made up of smaller, independent operators who fear that they would be unable to afford the dramatically higher insurance premiums that would result from a significant raising or elimination of the cap.<sup>187</sup> The concern is that lifting the liability cap immediately could have a harmful, anticompetitive impact on the independents and their thousands of employees and other commercial interests. Both large and small firms argue that the result would be detrimental, among other reasons, because the independent producers develop many smaller and end-of-life oil fields that the larger firms find uneconomic.

Apart from the handful of major companies, like BP, none in the oil and gas industry have the ability to self-insure against a major accident. But under current law, no company operating in the Gulf has had to demonstrate financial capacity to cover liabilities amounting to anything close to the cost of the BP spill—extending into the tens of billions of dollars.<sup>188</sup> Analysts have suggested that the insurance industry could adjust over time to the demand for capacity.<sup>189</sup> In fact, Munich Re announced on September 12, 2010, that it has developed a new concept for insuring offshore oil drilling, which has the potential to create coverage on the order of \$10–20 billion per drilling operation.<sup>190</sup> Other proposals include mutual insurance funds that would pool risks.<sup>191</sup> The effectiveness of such mechanisms is currently unknown.<sup>192</sup> Congress and industry are considering a series of more nuanced measures that, while raising the cap, also seek to anticipate and mitigate the potentially adverse impact on the smaller, independent operators in the Gulf without distorting incentives to avoid accidents to begin with, or to be adequately prepared to respond to and contain spills that do occur. None of these proposals had been enacted by the end of 2010.

### The Challenge of Change

Changing institutional culture and behavior is rarely easy. Business interests naturally prefer stable laws and market conditions that allow planning and investments (which can run into the billions of dollars for extensive deepwater operations in the Gulf) based on a clear understanding of what the future holds. But in the aftermath of the *Deepwater Horizon* spill, the operating environment and legal regime have been in constant flux. Beginning with a drilling moratorium, the industry has been struggling since the spring to recover from the nation's loss of trust in the safety of its operations, especially in the deepwater Gulf.

The oil and gas industry needs now to regain that trust, but doing so will require it to take bold action to make clear that business will no longer be conducted as usual in the Gulf. Industry must seize the opportunity to demonstrate that it is fully committed to subjecting its own internal operations to fundamental change and not merely because it is being forced to do so. Underscoring the sincerity and depth of their commitment to embracing a new safety culture, company leaders will need to lead the effort to guarantee that risk management improves throughout the industry to ensure that the mistakes made at the Macondo well are not repeated. And those leaders must also demonstrate an equal commitment to ensuring adequate containment and response technology and resources in case another spill happens. Only then will the oil and gas industry truly demonstrate that it is ready, willing, and able to engage in the kind of responsible offshore drilling practices upon which the nation's basic energy supplies depend.