

Offshore Oil and Gas Industry Safety Culture

Implications for Commercial Transportation Safety Regulation

STEPHEN R. GODWIN

The author is Director, TRB Studies and Special Programs, Washington, D.C.

Fire boat response crews battle the blazing remnants of the offshore oil rig *Deepwater Horizon*, April 21, 2010.

The Macondo Well–*Deepwater Horizon* blow-out, explosion, and oil spill of 2010 provides a case example of organizational failures that affected complex sociotechnical systems to produce a catastrophic accident. The multiple studies evaluating the causes of this catastrophe, including one by the National Academies of Sciences, Engineering, and Medicine, faulted the weak safety cultures of the companies involved (1).

A follow-up report, Transportation Research Board (TRB) Special Report 321, *Strengthening the Safety Culture of the Offshore Oil and Gas Industry*, defines safety culture, describes ways to improve

safety culture among offshore oil and gas companies, indicates ways to assess safety culture, and summarizes ways to address and overcome the challenges to strengthening safety culture industrywide (2).

Studying safety regulation and the role of safety culture in another industry provides an opportunity to reflect on lessons that could apply to the safety regulation of commercial transportation carriers that also are at risk for catastrophic accidents. For example, how can a regulatory regime enhance and reinforce organizational safety culture? What are lessons from the regulatory experience offshore that may apply to the regulation of commercial transportation?



PHOTO: FLORIDA SEA GRANT/FLECK



Many offshore oil and gas companies have established safety culture programs—such as Shell’s Goal Zero—to cultivate a workforce and processes that perform without harm or mishap across all operations.

Being Before Doing

Organizational culture is complex and multidimensional and involves deeply held assumptions and values. The committee that prepared Special Report 321 relied on the work of Edgar Schein,¹ a leading theorist of organizational culture:

Schein’s...influential model of culture asserts that there are surface features of culture that can be seen and heard, including visible artifacts and communicated values and beliefs, whereas the essence of culture, comprising underlying assumptions, is “deeper” and difficult even for cultural insiders to perceive and articulate. (2, p. 143)

Safety culture may be defined as an organization’s attitudes and values about protecting life and limb in the pursuit of the organization’s principal goals, which usually are not safety itself. The distinction is between “doing” and “being”—certain actions define what organizations do about safety; safe outcomes, however, result from an organization’s most basic motivations—what it is—recognizing, of course, that cultures may vary within organizations.

Safety Culture Journeys

Organizations with a strong safety culture naturally will choose to behave in ways that are safe. Achieving a strong safety culture, however, is a journey, not a destination. The achievement requires years of commitment. Special Report 321 points to an analysis of the way that the international oil and gas company Shell dramatically drove down accidents and injuries through a multiyear process of organizational

¹ Schein, E. H. *Organizational Culture and Leadership*, 4th ed. John Wiley, Hoboken, N.J., 2010.

learning and a deep commitment to safety organizationwide (3).

A commitment to safety, therefore, goes beyond simple compliance with a set of required actions—such as those mandated by regulations. Exemplary organizations’ deep commitments to safety are to be celebrated, but individual companies may not represent the industry as a whole. The challenge for regulators is to determine how to foster the development of strong safety culture industrywide through regulatory and nonregulatory approaches.

Evolving Regulatory Regime

In 2013, the U.S. Department of the Interior’s Bureau of Safety and Environmental Enforcement (BSEE), which regulates offshore safety, published a list of the characteristics of organizations that have developed strong safety cultures. The intent was to begin a dialogue about safety culture with the offshore industry.

BSEE drew from the experience of the nuclear power industry, which became deeply committed to improving its safety culture after a catastrophic accident. Chapter 2 of Special Report 321 describes the following characteristics of safety culture in detail:

- ◆ Leadership commitment to safety values and actions,
- ◆ Respectful work environment,
- ◆ Environment for raising concerns,
- ◆ Effective safety and environmental communication,
- ◆ Personal accountability,
- ◆ Inquiring attitude,
- ◆ Hazard identification and risk management,
- ◆ Safe work processes, and
- ◆ Continuous improvement.

The Macondo Well–*Deepwater Horizon* accident prompted many important changes in offshore regulatory approaches and industry activities, modeled on the experience of the nuclear power and chemical processing industries (2). BSEE now requires offshore oil and gas companies to employ safety management systems (SMSs) and to submit extensive reports on near misses and incidents to be shared industrywide to facilitate learning. The offshore industry has created an independent organization dedicated to safety, emulating the nuclear power industry, whose leadership has developed an industrywide commitment to safety culture.

Safety Management Systems

SMSs have been in wide use in industrial safety for decades. SMSs vary across industries but share common elements for safe operations, including

requirements for specific, written plans for operating practices, hazards analysis, safe work practices, training, mechanical integrity, emergency response, incident reporting, and ongoing, independent audits of performance (4). SMSs are suited to industries involved in high-risk endeavors and emphasize risk assessment to avoid catastrophic failures.

In the 1990s, the Minerals Management Service—a predecessor of BSEE—prompted the offshore industry to develop a voluntary standard, American Petroleum Institute (API) Recommended Practice (RP) 75. As a result of the Macondo Well blowout, RP 75 became mandatory through regulation in 2013, with additional refinements.

SMSs have multiple parallels with safety culture, particularly an emphasis on hazards analysis—such as an inquiring attitude and risk management; on incident reporting—such as creating an environment for raising concerns and encouraging effective safety communication; and on safe work practices and processes. The SMS emphasis on processes, however, focuses on what organizations *do*—the processes they follow—to enhance safety.

RP 75 was developed, in part, to compensate for the long-standing SMS dependence on physical inspections of offshore facilities, which focus on the integrity of mechanical systems and on compliance with standards, not on organizational performance. The designers of the offshore industry's SMSs were interested in shifting away from simple compliance to an emphasis on safety performance (4).²

Relying on compliance with standards and on the physical inspection of facilities is a common regulatory approach to industrial safety, including commercial transportation safety. For the offshore industry, however, this approach risked creating a culture of compliance with minimum standards for equipment and work practices instead of a strong organizational culture committed to safety (4). Because of the many parallels with safety culture principles, SMSs can reinforce a strong safety culture, but only if a company truly values safety and does not simply comply with SMS requirements in a “check the box” fashion (4).

Safety Incident Reporting

Another important element of the regulatory regime for high-risk industries is a system for reporting near misses and incidents (5). Many companies in regulated industries have these systems, but the systems are internal, because the companies want to avoid

² TRB has a study under way examining the pros and cons of performance-based safety regulation, such as SMSs, and the contexts in which these approaches work most effectively. The report is expected later this year.



PHOTO: SHELL/FLICKR

exposure to legal liability if data about possible failures are shared.

Successful internal reporting systems depend on a culture that supports employees for reporting mistakes without punishing them for making the mistakes. Industry incident reporting systems complement and depend on the safety culture principles of personal accountability, an inquiring attitude, an environment for raising concerns, and methods of hazard identification and risk management. Nevertheless, reports of near misses need to be shared across the industry, so that other companies can learn from them.

One way to overcome corporate aversion to sharing is through independent reporting systems, which protect reporters who have not exercised criminal negligence. These systems typically provide informa-

Engineers monitor oil equipment from remote control centers. Offshore oil companies are finding ways to create a safety culture that goes beyond minimum standards compliance.

In Shell's oil spill response training, employees are encouraged to share concerns and incidents.



PHOTO: SHELL/FLICKR



NASA's Aviation Safety Reporting System provides a confidential venue for pilots, ground personnel, mechanics, flight attendants, air traffic controllers, and others involved in aviation operations to share information about unsafe situations they have encountered or observed.

tion to third parties that make the data anonymous and share the lessons learned with the industry and regulators.

Transportation safety professionals are familiar with NASA's Aviation Safety Reporting System, which by law protects reporters from retribution. The authorizing legislation for the Bureau of Transportation Statistics (BTS) allows for the protection of information in similar fashion. BSEE has made use of BTS's capabilities by establishing a near-miss reporting system for the offshore industry.³

³ <https://near-miss.bts.gov/>.

Industry Leadership

Reformers of the offshore industry safety regime looked to the leaders of the nuclear power and chemical processing industries for models of independent, industry-led organizations dedicated to improving safety. Admiral James Ellis, the former head of the Institute of Nuclear Power Operators (INPO)—one of the model organizations—briefed the study committee that authored Special Report 321. Ellis explained that the top executives of nuclear power companies exerted strong peer pressure on each other to achieve the highest standards of safe performance.

Leadership, a key safety culture principle, is fundamentally important in the creation and function of these organizations. After the Macondo Well disaster, the offshore industry created the Center for Offshore Safety (COS) to serve as the industry's version of INPO.

In contrast to the more homogeneous nuclear power industry, which has a relatively small number of operators, the offshore industry is fragmented and diverse, with dozens of large operators and independent drillers served by hundreds of smaller companies with specialized expertise and services. Although the Special Report 321 committee noted the substantial achievements of the COS in just a few years, the committee also noted that a relatively modest share of the offshore industry is actively participating. Many of the current members of the COS are companies that already were committed to improving their safety performance.

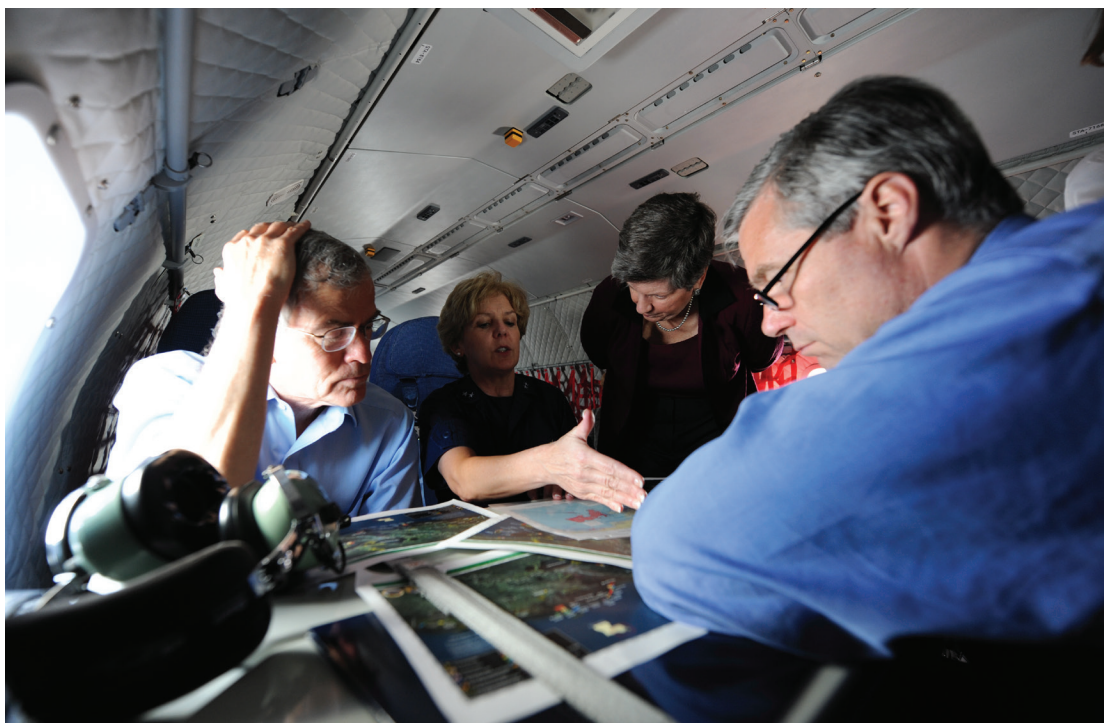


PHOTO: DEEPWATER HORIZON RESPONSE/LT. CAPT. ROB WYMAN

Government agency officials work with on-scene coordinators during the 2010 oil spill. The Macondo Well disaster instigated new safety reforms, including the creation of the Center for Offshore Safety.

Regulators' Challenge

Companies strengthen their safety cultures through leadership and deep organizational commitment. These actions are based on choices and values that are difficult, if not impossible, to require through rules. Regulations, such as required SMSs, can impose process requirements but can be truly effective only if embraced by companies.

Regulators can foster companies' commitment to the safety culture journey by providing flexibility and, possibly, incentives. Exemplary companies can serve as role models for the industry as a whole, but in a large, heterogeneous industry, the necessary commitment from all companies is not guaranteed.

This implies that regulators who want to foster safety through a stronger organizational safety culture need flexibility to reward the good performers but to maintain a vigorous enforcement capability for companies that merely comply with the regulations. To some extent, this same concern arises with the regulation of safety in the transportation sector.

Applicability to Modal Safety

The regulation of commercial transportation safety has a long and varied history—more than a century in the case of railroads. As with the offshore industry, transportation safety regulation across all modes relies heavily on equipment and operating specifications, on enforcement through government inspections, and on limits to the hours that employees can work to manage fatigue. These regulations are necessary but may not mitigate the risks of organizational failures.

Commercial transportation safety regulation has some of the elements of the evolving industrial safety regulatory model. Variations on SMSs, regulated and voluntary, appear in most modes, and may serve as mechanisms through which regulators can influence organizational safety culture.⁴

As noted, aviation has an exemplary incident reporting system industrywide, but other modes do not follow this model. Although the aviation industry has illustrated strong leadership in improving safety and safety culture, aviation and other modes have no organization comparable to INPO.

The literature on transportation organizational safety culture, which dates back more than two

⁴ Studies of SMSs in transportation appear to be more extensive in Europe than in the United States. For a survey of the European experience, see Lappalainen, J. *Overcoming Obstacles to Implementing SMS*. Draft discussion paper prepared for the Roundtable on Safety Management Systems, International Transport Forum, Paris, January 2017. <http://www.itf-oecd.org/sites/default/files/docs/overcoming-obstacles-implementing-sms.pdf>.



PHOTO: ROBERT COUSE-BAKER/Flickr

decades, is growing and reflects the importance of safety culture in all transportation modes. Literature searches indicate, however, that most of the research has occurred in the aviation and maritime modes, and most of the citations come from outside the United States. Lacking are case studies evaluating organizational performance over time and analyzing the role of safety culture at the industry level—even in aviation, which views safety culture as a widespread commitment across carriers.

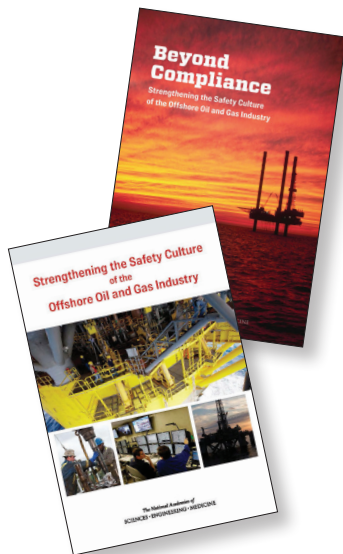
Pilot Projects' Success

A series of modest-scaled pilot projects and evaluations addressing specific elements of safety culture in the U.S. railroad industry, however, offer an important counterexample. Conducted jointly by the Federal Railroad Administration and industry, the projects have led to measured safety improvements and to changes in organizational culture.⁵ As in the offshore industry, exemplary companies in commercial transportation are committed to strengthening their safety cultures (6), but the level of industrywide commitment to safety culture seen in the nuclear power industry is not evident.

Regulators perhaps can foster stronger safety cultures in commercial transportation through SMS

⁵ For an overview of these FRA projects and evaluations, see Ranney, J. M., M. K. Zuschlag, J. Morrell, M. K. Coplen, J. Multer, and T. G. Raslear. *Evaluations of Demonstration Pilots Produce Change: Fourteen Years of Safety Culture Improvement Efforts by the Federal Railroad Administration*. *TR News*, No. 286, May–June 2013, pp 28–36.

Commercial transportation safety relies on safe equipment and operation, including managing employee fatigue by limiting workable hours.



TRB Special Report 321, *Strengthening the Safety Culture of the Offshore Oil and Gas Industry*, is available from the TRB online bookstore, <https://www.mytrb.org/Store/Product.aspx?ID=8295>; to view the book online, go to <http://www.trb.org/Publications/Blurbs/174395.aspx>. A summary version of the report, *Beyond Compliance*, is available from the TRB online bookstore at <https://www.mytrb.org/Store/Product.aspx?ID=8316> and can be viewed online at <http://www.trb.org/Main/Blurbs/175037.aspx>.

regulations. They can support incident reporting by providing systems that protect those who make reports—as BSEE has done for the offshore industry. Regulators may be unable to cause companies and industries as a whole to embrace safety culture improvements but may be able to incentivize company leadership by rewarding good safety performance with less direct or less frequent government oversight.

Key Questions

Research and policy analysis could demonstrate the potential benefits of a stronger safety culture in transportation industries—and of regulatory approaches to fostering this change. Some key questions include the following:

- ◆ Policies for enhancing organizational safety culture may have a strong intuitive appeal, but can evidence be developed to show that emphasizing safety culture enhances safety at either the company or the industry level?
- ◆ What are the components of a regulatory regime that can assist industry safety culture in mitigating the organizational failures that can lead to catastrophic accidents? Is the evolving regulatory model complete? If so, are the components essential, reinforcing, and effective in fostering stronger industry safety cultures?
- ◆ Which transportation modes, based on organizational and industry structure and on risk of catastrophic failures, are amenable to a regulatory approach built on strengthening safety culture?

◆ Can a mix of strict enforcement of rules on poorly performing organizations coexist with reliance on a performance- and incentives-based approach through SMSs, incident reporting, and industry leadership and self-regulation?

All of the modal administrations of the U.S. Department of Transportation that regulate commercial transportation have regulatory programs and research and technology programs. These programs can partner to explore the questions above, following the FRA model for evaluating the safety culture pilot projects in the railroad industry.

References

1. *Macondo Well—Deepwater Horizon Blowout and Explosion: Lessons for Improving Offshore Drilling Safety*. National Academy of Engineering and National Research Council of the National Academies, Washington, D.C., 2012.
2. *Strengthening the Safety Culture of the Offshore Oil and Gas Industry*. Transportation Research Board Special Report 321, National Academies of Sciences, Engineering, and Medicine, Washington, D.C., 2016.
3. Hudson, P. Implementing Safety Culture in a Major Multi-National. *Safety Science*, Vol. 45, pp. 697–722, 2007.
4. *Special Report 309: Evaluating the Effectiveness of Safety and Environmental Management Systems*. Transportation Research Board of the National Academies, Washington, D.C., 2012.
5. Barach, P., and S. D. Small. Reporting and Preventing Medical Mishaps: Lessons from Near-Miss Reporting Systems. *British Medical Journal*, Vol. 320, No. 7237, pp. 759–763, March 18, 2000.
6. Short, J., L. Boyle, S. Shackelford, B. Inderbitzen, and G. Bergoffen. *Commercial Truck and Bus Safety Synthesis 14: The Role of Safety Culture in Preventing Commercial Motor Vehicle Crashes*. Transportation Research Board of the National Academies, Washington, D.C., 2007.



PHOTO: JOHN TURNER/FILICOR

The U.S. railroad industry has implemented pilot projects that have led to measurable safety improvements and a heightened safety culture.