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PANEL: DECISION MAKING, ETHICS, AND PROFESSIONALISM

In New Horizons and At New Depths: Where are the Ethical Boundaries and Potential Liabilities Facing the Offshore Energy Industry?

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Abstract

As organizations point the way to a safer and pollution wary maritime industry and demand going beyond simple compliance with government rules and regulations, the offshore energy industry should now further examine the evolving decision making, ethics and professionalism boundaries and potential liabilities surrounding current and future activities in the offshore energy industry. The contour of these boundaries may have a substantial impact on the profitability and direction of the progression of the offshore energy industry. This session will focus on how regulators, certification organizations and companies define the boundaries and potential liabilities via mindful decision making, ethical behavior and professionalism in the offshore energy industry. The panel will discuss this topic based on the regulatory environment, case studies and potential developments facing the new depths and new horizons in the industry.

INTRODUCTION

Individuals and companies in the offshore energy industry face many challenges. These challenges may seem to rest only on technical questions, but often the decision making process also includes concerns that center on ethics, professionalism and liability. An examination of these concerns demonstrates that ethics, professionalism and liability each provide different technical challenges in the offshore energy industry.

CODES OF ETHICS: PROFESSIONAL SOCIETIES

American Association of Petroleum Geologists

The American Association of Petroleum Geologists (AAPG) requires its members to follow a code of ethics. This code of ethics includes obligations to the public, employers, clients, other members of the association and to the American Association of Petroleum Geologists. However, the following three general principles are at the core of AAPG's code of ethics:

- Geology is a profession, and the privilege of professional practice requires professional morality and professional responsibility.
- Honesty, integrity, loyalty, fairness, impartiality, candor, fidelity to trust, and inviolability of confidence are incumbent upon every member as professional obligations.
- Each member shall be guided by high standards of business ethics, personal honor, and professional conduct....

Association of Environmental and Engineering Geologists

The Association of Environmental and Engineering Geologists (AEG) is an international, non-profit, scientific and technical association whose members include geoscientists specializing in engineering geology, environmental geology, and ground-water geology as well as other professionals in affiliated fields such as civil and mining engineering, land-use planning, public policy and education.

AEG promotes the value and importance of geologic practice in: (1) detecting, containing, and remediating contaminated soil and ground water; (2) recognizing and mitigating hazardous geologic processes to promote public safety and welfare, and (3) planning, designing, constructing and maintaining engineered works.

The mission of AEG is to provide leadership in the development and application of geologic principles and knowledge to serve engineering, environmental, and public needs. The goals of this association is to advance engineering geology and to promote public safety and welfare and public understanding and acceptance of the field of geology.

National Society of Professional Engineers

Most engineering societies have adopted a code of ethics. The National Society of Professional Engineers (NSPE) has a code of ethics that is often used as the basis for

licensing of professional engineers by the states. One of the fundamental canons of ethics by the NSPE states: "Engineers shall hold paramount the safety, health, and welfare of the public." Under this guideline, if the engineer's judgment is "overruled under circumstances that endanger life or property, the engineer should notify their employer or client and other such authority as appropriate." In addition, engineers having knowledge of any alleged violation of this code should report it to the appropriate professional body and, when relevant, also to public authorities.

American Institute of Chemical Engineers

Similarly, the American Institute of Chemical Engineers (AIChE) has adopted a code of ethics where its members shall uphold and advance the integrity, honor and dignity of the engineering profession by: (1) being honest and impartial and serving with fidelity their employers, their clients, and the public; (2) striving to increase the competence and prestige of the engineering profession; and (3) using their knowledge and skill for the enhancement of human welfare. AIChE members are encouraged to hold "paramount the safety, health and welfare of the public and protect the environment in performance of their professional duties." Similar to code promulgated by the NSPE, the AIChE code of ethics also states that members should "formally advise their employers or clients (and consider further disclosure, if warranted) if they perceive that a consequence of their duties will adversely affect the present or future health or safety of their colleagues or the public."

Institute of Electrical and Electronic Engineers

The code of ethics for the Institute of Electrical and Electronic Engineers (IEEE) is particularly relevant to electrical engineers who are not licensed professional engineers, a situation that applies to many engineers who work in either development of new products or applied research.

American Society of Mechanical Engineers

Likewise, the American Society of Mechanical Engineers (ASME) has established the Center for Professional Development, Practice & Ethics (CPDPE) to assist the society in meeting the professional, ethical, and developmental needs of its members.

American Society of Civil Engineers

Since 1914, the American Society of Civil Engineers (ASCE) has had a code of ethics. In the aftermath of the Hurricane Katrina, this society is working with affiliated societies to determine the needs of the local professional community as efforts to rebuild the infrastructure of New Orleans continues. The ASCE created the Geo-Institute (G-I) in October 1996. G-I is an organization of scientists, engineers, and technologists and who are interested in the technical advancements in soil, rock, and the fluids they contain. G-I members share a common goal of improving of the environment, the mitigation of natural hazards, and the economical construction of engineered facilities. The G-I serves as the United States of America member society of the

International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE).

Society of Petroleum Engineers

Similarly, the Society of Petroleum Engineers (SPE) has a guide to professional conduct which contains twelve canons of professional conduct, rooted in the fundamental principle that:

[t]he engineer as a professional is dedicated to improving competence, service, fairness, and the exercise of well-founded judgment in the ethical practice of engineering for all who use engineering services with fundamental concern for protecting the environment and safeguarding the health, safety and well-being of the public in the pursuit of this practice.

STATE ADMINISTRATIVE RULES AND REGULATIONS

Texas Engineers

The code of ethics for the Professional Engineer (PE) is regulated at the state level and often via state legislation and administrative rules. For example, Texas has adopted the Texas Engineering and Practice Act and Rules. Under the Texas rules, the engineers are mandated to protect the public in the practice of their profession. Engineers shall not perform any engineering function which, when measured by generally accepted engineering standards or procedures is reasonably likely to result in the endangerment of lives, health safety, property or welfare of the public. Any act or conduct which constitutes incompetence or gross negligence, or a criminal violation of law, constitutes misconduct and shall be censurable by the Board.

Under the Texas rules, engineers should strive to adequately examine the environmental impact of their actions and projects, including the prudent use and conservation of resources and energy, in order to make informed recommendations and decisions. Also, engineers are required to strive to make affected parties aware of the engineers' professional concerns regarding particular actions or projects, and of the consequences of engineering decisions or judgments that are overruled or disregarded.

Moreover, as set out in Section 137.63 of the Texas Engineering Practice Act and Rules, engineers have a mandated responsibility to their profession as follows:

- (a) Engineers shall engage in professional and business activities in an honest and ethical manner. Engineers should strive to promote responsibility, commitment, and ethics both in the education and practice phases of engineering. They should attempt to enhance society's awareness of engineers' responsibilities to the public and encourage the communication of these principles of ethical conduct among engineers.

- (b) The engineer shall:
- (1) endeavor to meet all of the applicable professional practice requirements of federal, state and local statutes, codes, regulations, rules or ordinances in the performance of engineering services;
 - (2) exercise reasonable care or diligence to prevent the engineer's partners, associates, and employees from engaging in conduct which, if done by the engineer, would violate any provision of the Texas Engineering Practice Act, general Board rule, or any of the professional practice requirements of federal, state and local statutes, codes, regulations, rules or ordinances in the performance of engineering services; and
 - (3) exercise reasonable care to prevent the association of the engineer's name, professional identification, seal, firm or business name in connection with any venture or enterprise which the engineer knows, or should have known, is engaging in trade, business or professional practices of a fraudulent, deceitful, or dishonest nature, or any action which violates any provision of the Texas Engineering Practice Act or Board rules;
 - (4) act as faithful agent for their employers or clients; and
 - (5) conduct engineering and related business affairs in a manner that is respectful of the client, involved parties, and employees. Inappropriate behaviors or patterns of inappropriate behaviors may include, but are not limited to, misrepresentation in billing; unprofessional correspondence or language; sale and/or performance of unnecessary work; or conduct that harasses or intimidates another party.
- (c) The engineer shall not:
- (1) aid or abet, directly or indirectly, any unlicensed person or business entity in the unlawful practice of engineering;
 - (2) maliciously injure or attempt to injure or damage the personal or professional reputation of another by any means. This does not preclude an engineer from giving a frank but private appraisal of engineers or other persons or firms when requested by a client or prospective employer;
 - (3) retaliate against a person who provides reference material for an application for a license or who in good faith attempts to bring forward an allegation of wrongdoing;
 - (4) give, offer or promise to pay or deliver, directly or indirectly, any commission, gift, favor, gratuity, benefit, or reward as an inducement to secure any specific engineering work or assignment;
 - (5) accept compensation or benefits from more than one party for services pertaining to the same project or assignment; or
 - (6) solicit professional employment in any false or misleading advertising.

Even when working in other jurisdictions, the Texas engineer is required not to violate the laws regulating the practice of the profession in that jurisdiction. A finding of illegal practice by a Texas engineer in another jurisdiction is misconduct in Texas and will subject the engineer to disciplinary action in Texas. Any disciplinary actions taken by another jurisdiction on a matter that constitutes a violation of the Texas Engineering Practice Act or Board rules shall be sufficient cause for disciplinary action by the Texas Board.

Texas Geoscientists

Similarly, the Texas Geoscience Practice Act was enacted by the 77th Texas Legislature. The Act was developed by a coalition of Texas geoscientists working in the petroleum, environmental groundwater resources, engineering and mining practice areas. In Texas, any individual practicing geoscience or holding themselves out to be a geoscientist before the public must be licensed if their service involves work for the State of Texas.

Florida

In other states, such as Florida, the code of ethics and the enforcement of these and other professional rules have shifted from the government to nonprofit organizations. For example, in the late 1990s, legislation was passed to privatize certain functions previously monitored by the Florida state government in an effort to encourage greater operational and economic efficiency and better benefit the regulated persons and public. Under Section 471.038 of the Florida Statutes, administrative, investigative, and prosecutorial services are provided to the Florida Board of Professional Engineers by the Florida Engineers Management Corporation (FEMC). The FEMC is a non-profit, single purpose corporation that operates through a contract with the Department of Business and Professional Regulation. The FEMC Board of Directors is composed of members appointed by the Florida Board of Professional Engineers and those appointed by the Florida Secretary of the Department of Business and Professional Regulation.

Delaware

Similarly, since 1972, the Delaware Association of Professional Engineers (DAPE) has regulated the practice of engineering in Delaware. DAPE was created by a statute enacted by the Delaware legislature (Delaware Professional Engineers' Act, Delaware Code, Title 24, Chapter 28). Professional engineers licensed under the laws of Delaware, and residing or having a place of business in the state, are "Members" of the DAPE. Professional engineers not residing or having a place of business in this state are referred to as "Associate Members" of DAPE and are not entitled to vote.

Delaware statute also created a "Council" that serves as the DAPE governing board. The Council is comprised of representatives from civil, chemical, electrical, mechanical, and other engineering disciplines. In addition to serving as the governing board of the DAPE, the powers of the DAPE Council include the authority to subpoena witnesses and compel their attendance, and may also require the production of books, papers, and documents in a matter involving an

application for registration, the revocation of registration or practicing or offering to practice engineering without registration.

FEDERAL REGULATIONS

There are several titles in the Code of Federal Regulations that govern, refer to and/or require the signature of a professional engineer. Below are a few examples of the regulations that require sign off by a certified professional engineer.

Deepwater Ports

Title 33 of the Code of Federal Regulations, Part 149 governs the design, construction and equipment for deepwater ports. Under these regulations, each drawing, specification and revision must bear the seal or a facsimile imprint of the seal of the registered professional engineer responsible for the accuracy and adequacy of the material.

Vessels

A registered professional engineer or other recognized classification society (under 46 CFR part 8) must certify the fire detection systems installed on the vessel used to detect engine room fires. Also, the engineering analysis used to inspect and certify tank vessels midbodies (more than 30 years old) which carry oil cargo must be signed by a registered profession engineer. The boiler to be installed and certain pressure vessels must also be certified by a professional engineer as meeting the design requirements under the Code of Federal Regulations and in section I of the ASME Code. Industrial systems and component on mobile offshore drilling units (MODU) must be analyzed by a registered professional engineer to certify that the system has been designed in accordance with applicable standards.

Hazardous Materials

Section 1910.111 of Title 29 of the Code of Federal Regulations applies to the design, construction, location, installation and operation of anhydrous ammonia systems including refrigerated ammonia storage system. Such systems are custom-designed and custom-built where no nationally recognized testing laboratory or federal, state municipal or local authority is responsible for the storage, transportation and use of anhydrous ammonia. Therefore, the design of such systems must be signed by a registered professional engineer or other person having special training or experience sufficient to permit him to form an opinion as to the safety of the unit involved. In signing off on the design, the test basis, test data and results together with the qualifications of the certifying person must be provided.

Similarly, Section 1917.43 applies to every type of powered industrial truck used for material or equipment handling within a marine terminal, but does not apply to over-the-road trucks. Any modifications that might affect a vehicle's capacity or safety shall not be performed without either the manufacturer's prior written approval or the written approval of a professional engineer experienced with the equipment who has consulted with the manufacturer, if available.

Title 40 of the Code of Federal Regulations, Part 260, requires that the corrosion expert qualified to engage in the practice of corrosion control on buried or submerged metal piping systems and metal tanks be certified as qualified by the National Association of Corrosion Engineers (NACE) or be a registered professional engineer who has certification or licensing that includes education and experience in corrosion control on buried or submerged metal piping and tanks.

Professional Geologist

Certain titles of the Code of Federal Regulations also require that a professional geologist certify maps and plans, and siltation structures, impounds, banks, dams and embankments.

GRADUAL VERSUS SUDDEN CHANGE IN THE REGULATORY ENVIRONMENT

Traditionally the focus on changing the regulatory environment occurs when events generate concerns in the minds of the public, government officials and industry. These events often are dramatic in nature. Such events are dramatic because of the effects on the public, the effects on the industry or even individual companies. Sometimes pressures are enough to propel changes in industry practices even before potential tragedies occur. This preventive approach has substantially increased the offshore energy industry's record of safe performance over time.

Civil Liability of Engineers and Geologists

As with other professionals, there is a steady increase in the number of malpractice suits being filed against engineers and geologists. Increased exposure to liability is naturally followed by an increase in the premiums for malpractice liability coverage and a subsequent decrease in the number of insurance companies willing to offer such policies. Certain types of engineers (i.e., those who deal with hazardous materials) are often held to a higher duty of care and standard of performance. As a result, these individuals find it even more difficult and costly to maintain professional malpractice insurance coverage.

Hence, while issues related to ethics for engineers and geologists shall continue to evolve in our ever increasing technical society, an understanding of how the courts construe and apply the provisions of malpractice and indemnity insurance policies is essential to successfully implementing new technologies in the offshore energy industry. Furthermore, a need exists for an understanding of the legal and equitable subrogation in these matters.

Legal Liability of the Engineer and Geologist

Legal liability for services rendered by any professional (doctor, lawyer, accountant, engineer, and geologist) turns on a legal duty to exercise care. Generally, to establish a cause of action for professional negligence, the professional must have breached his legal duty to carry out professional services in accordance with the accepted standards for his profession. It is the negligent breach of this duty of care that gives rise to a cause of action in tort.

To support a cause of action for professional negligence, the following elements must be proven: (1) a duty on the part of the professional to use the degree of care that a reasonably prudent member of the profession would use under like circumstances; (2) a breach of that duty; (3) actual loss or damage to the plaintiff; and (4) a proximate causal connection between the professional's negligence (breach of duty) and the resulting damages or injury to the plaintiff.

Engineers and geologists are professionals whose activities are subject to legal liability. The engineer and geologist are specially trained and experienced in the planning, design, construction, or management of roads, buildings, bridges, and the like. They also possess certain scientific expertise in the various engineering fields and related disciplines. Because of their skill and experience, engineers and geologists have a duty to perform their professional services in accordance with generally accepted practices.

As noted above, the practice of engineering is commonly regulated by state statute. In such cases, the term "engineering" is often broadly defined to include any service or creative work, the adequate performance of which requires education, training, and experience in the application of special knowledge of the mathematical, physical, and engineering sciences. The services rendered can be for the public or provided in the private domain and include consultations, investigations, evaluations, planning, and design of a wide variety of engineering works and systems. Unless a more specific standard has been mandated by statute or in a contract, the engineer is duty-bound to exercise the degree of knowledge, skill, and care that is usually possessed and exercised by other members of the profession acting under similar circumstances.

Because certain engineering services, such as construction management and construction inspection, are often difficult to define, activities that might appear to be professional in nature may be excluded by law or by definition in the professional services statutes. Therefore, an individual may be allowed to engage in them without qualifying as a design or other engineering professional. The mere fact that an engineering professional provides a service does not necessarily make that service "professional" by definition. On the other hand, in certain jurisdictions, whether the defendant's status as a licensed engineer may affect the plaintiff's ability to enforce a professional services contract, or to prosecute a professional liability lawsuit. Moreover, in many jurisdictions, courts have great latitude in construing whether particular activities fall within the definition of "professional engineering." Therefore, a threshold question in many lawsuits related to professional malpractice is whether the acts in question would constitute the practice of engineering within the meaning of the pertinent statutes.

Furthermore, the existence and scope of a professional's duty of care can depend on whether the defendant expressly or impliedly agreed to render professional services, and whether the law (in a tort action for negligence) or the agreement (in a contract action) under which a duty arises precludes or limits that duty. However, a contract to pay the engineer for the services in question is not essential to

the creation of a professional duty of care. Such duties can arise even when an engineer voluntarily performs or agrees to perform professional services without payment.

Basically, engineers and geologists have an obligation to exercise a reasonable degree of care, skill and ability in their service. What is reasonable is based on the degree of care, skill and ability employed by other engineering professionals under similar conditions and circumstances. This standard is not "the level of the highly skilled," nor is it "the skill of the average practitioner." The engineer or geologist must have sufficient skill and ability to perform the required professional services, at least ordinarily well as others in his profession. However, a satisfactory result does not have to be implied or warranted. Errors in judgment are recognized by the courts as different from a lack of care or skill.

While the standard of conduct is usually that of an engineering professional performing similar professional services in similar communities, the standard may be increased by a promise to perform services "in accordance with the highest standards of the profession," or that the services will be provided by a "specialist." The standard of conduct may also be heightened by the engineer's express guarantee that higher-than-normal standards will be met during the design and/or construction project.

When an engineer or geologist is employed to work on a project, his responsibilities are usual set out in a written services contract. Hence, it may seem that the only retribution for a breach of these services would be a lawsuit brought under the laws of contract. However, while the services were rendered as a result of the contract, a tort action for negligence may be founded on the fact that the engineer breached his duty of properly rendering his services as a result of his negligence.

Under a traditional tort theory, courts do not recognize an action for economic damages or other injuries in the absence of privity of contract between the parties. Privity of contract is the relationship that exists between the contracting parties. However, in an increasing number of jurisdictions, the courts refuse to accept the absence of privity of contract as a defense to negligent conduct by the engineering professional unless the plaintiff is beyond the foreseeable scope of harm resulting from negligent performance of the activities. While privity was essential in the past, this theory has now been expanded by many courts to include the rights of third parties both third party beneficiaries and even the public in general. Notwithstanding, whether the cause of action is in tort or contract, the engineer has the duty to exercise reasonable care and skill in the performance of his professional duties, and the central issue becomes whether the proper degree of care and skill were met.

The scope of duty of care and skill may also be limited or expanded by a state, local or federal statute. Many state boards of engineers have adopted professional standards of competence and specified many acts or omissions that are grounds both for tort liability and for possible disciplinary proceedings and sanctions.

For example, Florida statute authorizes the state Board of Engineers to impose penalties on an engineer who is found guilty of negligence in the practice of engineering. Negligence is defined as "the failure by a professional

engineer to utilize due care in performing in an engineering capacity or failing to have due regard for acceptable standards of engineering principles." In Florida, professional engineers "shall approve and seal only those documents that conform to acceptable engineering standards and safeguard the life, health, property, and welfare of the public." The Florida statute also authorizes regulatory action against an engineer for incompetence in the practice of engineering. Monetary damages, however, are not always required for finding of negligence against an engineer in the administrative proceeding.

With respect to professional engineers, depending on the state, the statute may be specific about minimum competencies, qualifications for practice, examination prerequisites, licensure, prohibitions and penalties, and disciplinary proceedings. At the state level, negligence statutes and/or evidence codes might also identify the standard of care or professional duty to be met by engineers. If an engineer fails to meet the standard, the engineer is then exposed to liability in tort.

HISTORICAL PERSPECTIVE ON ETHICAL AND PROFESSIONALISM CONCERNS

Offshore Events that Caught the Offshore Energy Industry's Attention

Professionals, like everyone, make mistakes. We chose the examples below because these stories made the news in a significant way, and provide an example of what we do in the offshore energy industry affects more than just the people we directly interact with on a daily basis.

BP Thunder Horse

Headline: "BP's Thunder Horse cursed by bad design"

At one point in time, BP changed the name of the platform from Crazy Horse to Thunder Horse due to concerns raised by descendants of Chief Crazy Horse and his curse. Now, after the Thunder Horse platform "came close to being lost," engineers realize that the curse has nothing to do with the name of the platform or even Hurricane Dennis. Rather, for BP, the curse is the lesson of the huge economic loss of an improper design. Even Chief Executive Lord Browne is quoted as saying "It was not storm related but was caused by design weakness in the ballast system which has been corrected offshore." This mistake will affect BP's bottom line. Production targets will not be met for 2006 since production cannot begin on Thunder Horse until the second half of 2006, and, the cost of the repairs would be in excess of £140 million.

What happened and the Lesson Learned

In July 2005, Hurricane Dennis blasted through the Gulf of Mexico. In its aftermath, BP found the Thunder Horse Offshore Drilling Platform was listing around 20 degrees. Months later, BP finally got to the bottom of the problem: a design fault. The interaction between the fire water system and ballast system of Thunder Horse left valves open when the platform was shutdown. Fortunately, the hull had been

designed to naturally float even in a bad list. The total cost of repairs is estimated to exceed 250 million dollars.

While BP has taken the lesson learned from Thunder Horse into it Atlantis project, the projected downtime and lost profits from a year of repair of Thunder Horse and other problems as a result of the 2005 hurricane season shaved off nearly \$700 million from BP's pre-tax earnings in the third quarter of 2005 alone.

Facility design criteria and mooring of Mobile Offshore Drilling Units (MODUs) in major storm events

Headline: "Operators begin clean-up repair from Katrina Rita: Cost set at twice that of Sept. 11 attack"

This headline appeared in the October 1, 2005 edition of Offshore magazine. Along with the many details in the article concerning storm related damage, the authors noted that several MODUs were adrift several miles from where the MODUs broke lose from their moorings. Several speakers from the Minerals Management Service have highlighted their concerns regarding the industry's need to find a solution to this problem. In fact, the Secretary of the Department of Interior met with companies on November 17, 2005 to find a possible solution to this problem.

Events that Highlight Public Safety Concerns

The following examples are not specifically tied to the offshore energy industry, but they do provide insight into how professionals in the offshore energy industry need to deal with ethical, professional and liability concerns especially in regard to safety.

The Kansas City Hyatt Regency Walkway Collapse

On July 17, 1981, the Hyatt Regency Hotel in Kansas City, Missouri, held a videotaped tea-dance party in their atrium lobby. With people standing and dancing on suspended walkways, the connections supporting the ceiling rods failed and two walkways collapsed onto the crowd below. The rods were designed to hold up the second and fourth-floor walkways crossing the first floor atrium. The fourth floor walkway fell on the second floor walkway, while the third floor walkway offset from the other two remained in tact. 114 people died and in excess of 200 injured in what has come to be known as the most devastating structural failure in the US. Millions of dollars in costs resulted from the collapse as well as thousands of lives adversely affected.

While the hotel had only been in operation for about a year, an investigation later revealed that the fabricator of hanger rod connections changed the design from a one-rod to two-rod system to simplify the assembly task. This change doubled the load on the connector and ultimately resulted in the walkways collapse. The testimony over whether the general contractor had approved such change was conflicting. However, while the same hotel was under construction, more than 2700 square feet of the roof collapsed because one of the roof connections failed. Here, the general contractor blamed the owner because they requested on-site project representation during the construction phase. Reportedly, even as originally designed, the walkways were barely capable

of holding up the expected load and would have failed to meet the requirements of the Kansas City Building Code.

While a number of principals lost their engineering licenses, firms went bankrupt and many expensive legal suits were settled out of court, this case serves as an example of the importance of meeting professional responsibilities and what the consequences are for professionals who fail to meet those responsibilities.

Space Shuttle Accidents (Challenger and Columbia) The Challenger Disaster

Of all the disasters in recent history, the Space Shuttle Challenger Disaster clearly highlights a multitude of issues associated with engineering disasters including accountability, professional responsibility and ethical conduct. At the forefront of a large number of events that lead to this disaster is the off-line telecom caucus by Morton Thiokol management that ultimately produced the decision to launch.

In short, joint seal problems were identified and specific events happened that should have signaled either a flight postponement or a change in launch commitment criteria. Low ambient temperature (under 53°F) prior to launch was shown to be responsible for combustion gases to be blown out by the primary seal on two field joints. O-ring resiliency, that is, the ability to restore itself to a round cross sectional shape after the squeeze on the seal is removed, together with evidence that the primary seal had not sealed during the full two minutes of an earlier booster flight was postulated by engineers and later ignored by senior management. Many opportunities were available for corrective action, but none were allowed to interfere with the production and shipping boosters, and ultimately the launch.

Specifically, engineers presented data and graphs showing the post history of O-ring damage on the solid rocket motor. Based upon an engineering presentation made the evening of January 27, 1986, the management at Morton Thiokol did not recommend launching to NASA. NASA told Morton Thiokol that they would not launch over the contractor's objection. Shortly afterwards, Morton Thiokol reconsidered the engineer's presentation and made a statement that the data was inconclusive. During a closed-door management session (where the engineers were excluded), a vote had been taken by four senior executives at Morton Thiokol to launch. The teleconference then resumed, having launch support rationale read from a handwritten list by management. NASA promptly accepted the launch recommendation without any discussion or any probing question as they had done previously. NASA then asked for a signed copy of the launch rationale chart.

Trying to protect the shuttle program and themselves, a little over two weeks later and before the Presidential Commission, both NASA officials and Morton Thiokol management did not tell the whole story. But, prior to the President Commission's report issuing, two Morton Thiokol engineers were requested to submit comments and testimony disputing the report findings that were biased toward the attempt to downplay the effect of low temperature on the joint failure by trying first to focus blame on such things as assembly problems and other factors.

As it turned out, everyone involved with the decision to launch Challenger was either transferred or took normal or early retirement without any penalty for his actions. Reportedly, Morton Thiokol did not pay a 10 million dollar penalty provided in their contract for supplying the hardware responsible for the disaster, loss of seven lives and/or the destruction of over 2 billion dollars in hardware. As further reported, because of an agreement between Morton Thiokol and NASA, Morton Thiokol received only 10 million less in profits when their production contract resumed.

The Columbia Disaster

A reporter for National Public Radio branded the Challenger accident as the result of a "cultural problem" at NASA. As reported, the culture at NASA tended to accept abnormal events as normal. As engineers, geologists and scientists, we accept a certain level of risk in order to advance technology. However, certain opinions have identified NASA's "culture" as the ultimate cause leading up to the Columbia accident. Regarding Columbia and according to reports, NASA had previously noted that insulation kept falling from the external fuel tank, but since nothing bad ever happened, NASA management accepted the event as normal. It was falling insulation that ultimately led to the 2003 Columbia disaster where all the Columbia astronauts died during reentry.

New Orleans' Levee Design and Construction

The massive failures of the levees in New Orleans during and after Hurricane Katrina resulted in a flooded city and caused the deaths of hundreds of people. According to preliminary findings, the levee failures resulted from errors at almost every level of engineering: conception, design, construction and maintenance of the flood control system. Levees were built with inadequate safety margins. Indeed, the overall architect of the city's flood control system (certain aspects dating back 100 years) created unnecessary vulnerabilities well before Katrina came ashore. For example, some say that the drainage canals that extend into New Orleans from Lake Pontchartrain were "inviting the enemy."

Maintenance practices were lax. Indeed, the rapid sinking of the Louisiana coast might have lowered the New Orleans' levees and contributed to their failure. According to reports, these levees and storm walls may be up to two feet lower than originally designed because the elevation data was outdated when levees were built (in some cases decades ago) and the land has continued to sink. Indeed, subsidence (sinkage) is one of several problems under scrutiny by the experts seeking to understand why three levees failed on August 29, leaving 80 percent of the city under water and hundreds dead.

Also, under scrutiny are certain earthen levees that were merely topped with concrete walls in an effort to strengthen against a hurricane. This approach may have been economical but may have left the walls weaker than intended. Hence, the New Orleans' levee design failed to use modern technology, had almost no redundancy in place, and was further undermined by weak clay soils in the New Orleans area. The US Army Corps of Engineers together with other

agencies apparently failed to grasp warning signs over the last decade that the levees were not as strong as expected, and/or simply did nothing about it.

As reported, the defects in the design and construction might have been offset had the corps of engineers used higher safety margins. Public safety structures are now designed to last an estimated 10,000 years without failure. By contrast, the New Orleans levees were reportedly designed to withstand only 50 or 100 years of natural forces. In designing the levees, the Army Corps of Engineers applied a 30 percent higher than maximum load that a hurricane could impose on the levees and walls. Such margin is far below the level engineers typically set for highway bridges and dams, offshore oil platforms and other public structure. A more typical approach is to double the wall strength over the maximum expected loads. In basic terms, the walls were weak and unsafe.

Even railroad companies failed to shore up gaps in storm walls where tracks pass through. These gaps are unprotected and were supposed to be plugged with sandbags during a hurricane. The preliminary evidence suggests that the gaps were left open.

The industrial canal breaches occurred first at about 9 am on the day Katrina made landfall. The second breach occurred at the 17th Street Canal about 4 pm. The London Avenue levee failed around midnight. The storm surge swept over the top of the industrial canal and eroded its foundation. But the water was more than two feet below the tops of the walls on the 17th Street and London Avenue canals. As a result, the loads were well within the wall's design.

However, reflecting a cultural mind-set that does not pay enough attention to public safety, no governmental agency moved to overcome the warnings (lasting for over a decade) that these levees were not as strong as expected and/or needed. One problem has been identified: along a single levee in one section of New Orleans, seven different government agencies and private authorities including road agencies, levee boards, railroads and the corps of engineers were involved. Such confusion only fueled poor design.

Notwithstanding, there were plenty of warning signs that New Orleans' level system was inadequate. For example, in the case of the soil defects, at least two contractors previously warned that soil conditions were weaker than realized by the Corps. But officials failed to heed the warning signs, similar to the philosophy blamed on NASA over the Columbia Space Shuttle explosion. Many now believe the normalized deviation was simply accepted.

A New Framework for Planning the Future of Coastal Louisiana after the Hurricanes of 2005

A report entitled *A New Framework for Post-Hurricane Planning for the Future of Louisiana Coast* was published on January 26, 2006 by a self organized working group of natural and social scientists and engineers who came together in late 2005 to assess the failure of the levees and walls. Over a six week period, the group exchanged ideas on how to incorporate coastal ecosystem restoration with planning for improved storm protection and future navigational infrastructure. One of the interesting results of

this report dealt with the proposals for Decision Support which include:

- Support for Adaptive Management
- System-Scale Plan Formation and Evaluation
- Participatory Decision Making and Modeling
- Decision Making Under Risk and Uncertainty
 - o Scenario Analysis
 - o Probability Analysis
- Performance and Evaluation Measures
 - o Physical and Ecological Measures
 - o Economic Performance Measures

These decisions support techniques and demonstrate the useful decision making tools with regard to the future development of coastal Louisiana. Overall, professionals in the offshore energy industry should increase their expertise in similar decision making techniques that include a variety of parameters including the concerns for safety and environmental protection. Such steps would help industry professionals manage ethical, professional and liability concerns.

ROLES FOR THE PROFESSIONAL SOCIETIES, REGULATORS AND MEMBERS OF THE OFFSHORE ENERGY INDUSTRY

Role of Professional Societies

One of the main purposes of this panel is to focus on how individuals, companies and regulators in offshore energy development have handled the challenges in balancing ethical obligations, professional responsibility and liability concerns. One of the traditional advocates raising these concerns has been the professional societies, especially in encouraging their members to follow codes of ethics, sponsoring continuing education and working with regulators on behalf of their members. These professional societies have a broad range of experience in a variety of disciplines that are critical to the offshore energy industry. As regulators have increasingly required licensure for individuals and companies that have greater impact on public safety, environmental quality and market integrity, these professional societies have continued to play a crucial role in enabling their members' ability to maintain the professional standards their member need to meet and exceed the regulatory requirements governing their professions.

Role of Regulators

Regulators have the role of representing the general public in ensuring that actions by individuals and companies in the offshore energy industry do not threaten the public interest. This role includes both a proactive and responsive rules. The role is proactive in the sense that regulators establish standards pursuant to applicable law and work to assess whether individuals and companies meet the established regulatory standards. As a result, this process enables regulators to minimize risk to the general public. Similarly, regulators have a responsive role to assess any liability a party might have regarding violations of established regulatory

standards. Likewise, regulators must work with lawmakers to assess the effectiveness and cost of any changes in the established regulatory standards or the establishment of new regulatory standards pursuant to the enactment of the new laws that affect the offshore energy industry.

Another critical role that regulators play in both their proactive and responsive roles is in the capacity of a fact finding role that helps establish for the general public, lawmakers and the individuals and companies what are the facts as can be best determined based on the information available and what impact any changes in the current regulatory environment might have on the public interest, individuals and companies.

Role of Individuals and Companies

Individuals and companies also have important roles in this exercise of balancing their ethical, professional and liability concerns. Individuals and companies must first evaluate whether they have the competency to undertake specific tasks in the offshore energy industry. If an individual or company discovers a deficiency, then the individual or company has the obligation to either not undertake the task or ensure that the deficiency is remedied. Second, individuals and companies have an obligation to deal in a good faith with their other professionals, regulators and the general public. Integrity is an asset that a company and an individual can lose and, once lost, is very difficult to regain. Finally, individuals and companies must continually seek to add to their professional competency and actively encourage others within their organization and industry to do the same. If individuals and companies actively pursue these goals, the ethical, professional and liability balancing act will be much easier to manage.

FUTURE CHANGES

Now we should evaluate how we can improve the actions of people and companies in the industry, regulators, professional societies so that we can generate confidence within the general public that the offshore energy industry is adhering to the proper balance in the decision making process. This proper balance includes an emphasis on ethics, professionalism and a recognition of potential liability if we fail to consider the resulting effects. As we have seen through a historical view, when we fail to adhere to the basic principles of ethics and professionalism, we likewise fail to appreciate the potential liability that the general public and regulators will seek to modify industry behavior.

We have a choice. Individuals, organizations, associations and companies within the offshore energy industry can be proactive and act with the utmost ethical behavior and respect for the rights of others. Professionals can demand high standards of care, particularly from each other. Or, we can watch the disasters and suffer personal and economic loss brought via a tragedy.

Within this industry, we often work in a location and/or environment that seems isolated from the rest of our profession or even the general public. However, the decisions we make have very broad implications on public safety and the environment. As we have seen in more recent years, even

the financial markets and the broader global economy are affected.

As geologists, engineers and scientists, individually and collectively, we all want recognition as professionals. We seek to excel in some of the most challenging technical environments. However, we still have an obligation to adhere to ethical and professional principles and must recognize the potential hardship and liabilities that may result from the damage and injuries that occur when we fail to strive for ethical excellence as well as technical excellence in our profession at these new depths and in new horizons.

CONCLUSION

Modern business and governments operate in very competitive markets. However, there is an increasing awareness of wider social issues that require both corporations and government to exceed the basic ethical, legal, and commercial obligations. There is a new public expectation that society has brought upon both the public and private sectors. Emerging is the need for social responsibility by governments and business. Such responsibility may require new policies, practices and programs that are integrated within the business or governance of a city, state or federal government and considered in the decision-making process. No longer is it good enough to talk about ethical responsibilities. Behavior must be linked with such proclamations.

Businesses, both service and manufacturing, must demonstrate its commitment to customers, employees, shareholders, investors, regulators, legislators and the public at large to act in concern for the overall public safety and welfare. New products, new proposals and designs should be examined in the context of the larger community in which it operates and beyond. One of our goals needs to be improvement for the good of the overall community, not just a single organization or individual. We should not apply a one dimensional approach at the possible expense of the other. But rather, we need to create options having multidimensional advancements. Indeed, corporate practices should make the most of overall growth by making decisions and instituting plans to reduce risk to the general public while winning loyal customers, and creating new markets and opportunities for all.

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