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The Safety and Environmental Management System Rule

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Abstract

In October 2011 the United States Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) introduced its Safety and Environmental Management System (SEMS) rule. It became effective November 15th 2010; companies operating on the Outer Continental Shelf (OCS) under the jurisdiction of BOEMRE must be in compliance with its requirements by November 15th 2011. The rule is based on the Safety and Environmental Program (SEMP), which is part of the API (American Petroleum Institute) Recommended Practice (RP) 75 (API 2004). RP 75 was first published in 1994; the most recent edition is from the year 2004.

The SEMS rule is lengthy and its requirements are demanding. Not only has BOEMRE incorporated SEMP into law, the agency has added many additional requirements, some of which are quite substantial. (Hence, the statement “SEMS is SEMP” is somewhat misleading — there is a lot more in SEMS than there is in SEMP.) The timing of the rule is particularly demanding — particularly for those companies and facilities that do not currently have an up to date SEMP in place.

The manner in which the new rule will be enforced is also important. It is likely that BOEMRE will be considerably more assertive in enforcing rules and standards than was its predecessor, the Minerals Management Service (MMS). For example, although the moratorium over new deepwater drilling that was put in place following the *Deepwater Horizon* event has been lifted, the agency has continued to make it very difficult for companies to actually obtain permits.

This paper provides a brief historical background as to how SEMS came to be. It goes on to discuss the requirements of the rule, and then provides some guidance as to how its requirements can be addressed in an expedient and defensible manner, particularly by those companies who do not already have a complete SEMP in place.

Finally, it should be noted that, when the original Abstract for this paper was being written, the SEMS rule had not been promulgated. Some of the assumptions made at that time — such as a requirement for Production Safety Cases — did not materialize. It is likely that the SEMS rule, along with some of its associated standards, will change some more over the course of 2011 and 2012. Therefore, it is very important that anyone who is implementing or running a SEMS program check to see if the rule has been updated, or if any material changes have been made to the pertinent API standards.

Historical Background

The development of Formal Safety Management systems for offshore facilities can be said to have started with the Piper Alpha catastrophe that occurred in 1988. Of course, companies working offshore had had safety programs before that time, but Piper Alpha is often viewed as being the starting point for the development of formal Safety Management Systems for offshore operations — world wide. This development is illustrated in Figure 1.

Figure 1
Development of Safety Management Systems

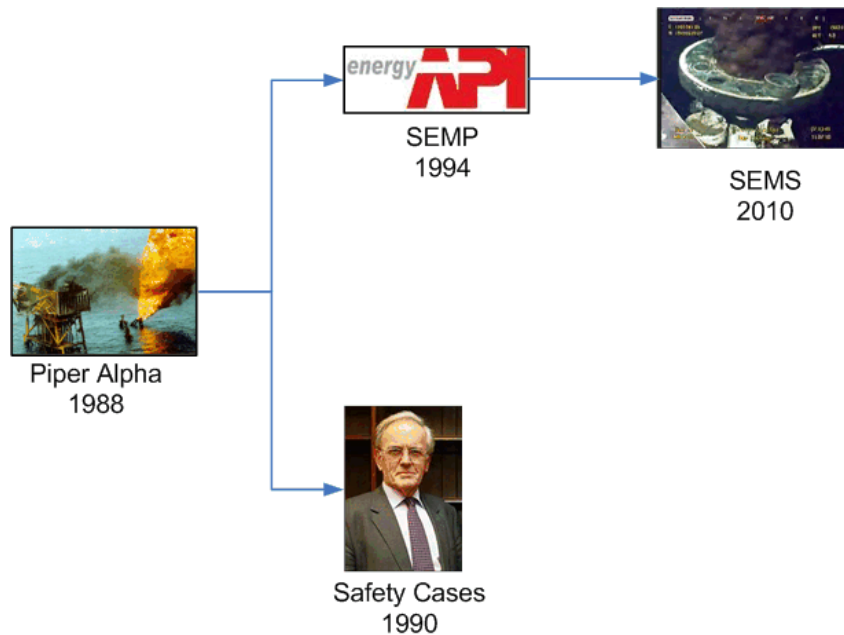


Figure 2 shows that, two years after the event, a committee led by Lord Cullen wrote a report usually simply referred to as “The Cullen Report”. The report made strong recommendations regarding improvements to the development and application of Safety Cases in for oil and gas operations in U.K. waters. (The same system was later adopted in other areas of the world, including Australasia and Southeast Asia.)

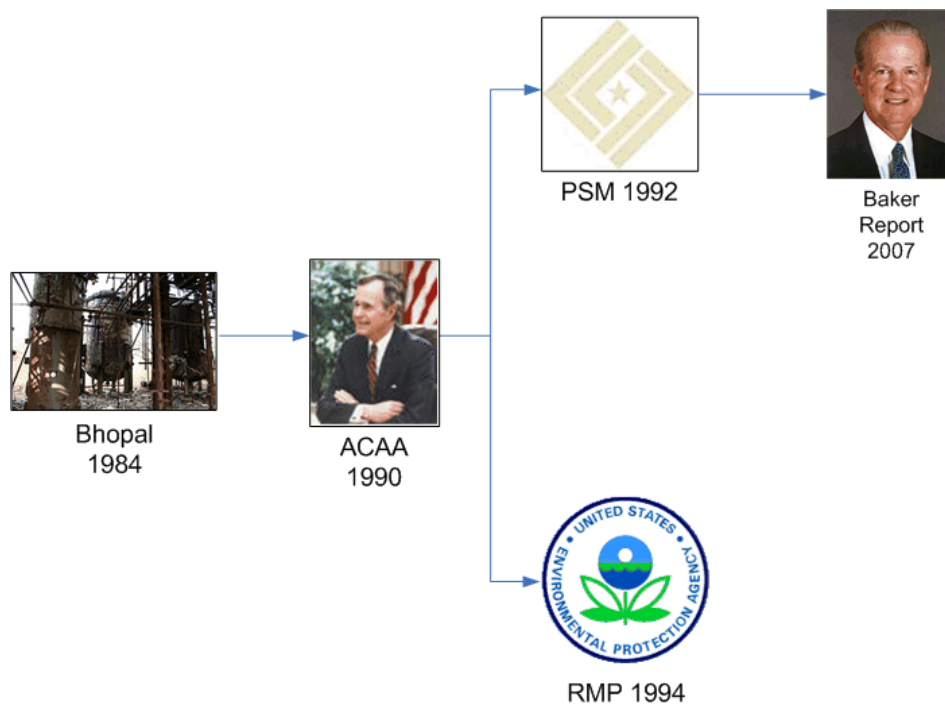
In the United States there was an equally vigorous response to Piper Alpha (the top line in Figure 2). However, the circumstances on the Outer Continental Shelf (OCS), principally the Gulf of Mexico (GoM) are different from the North Sea. For example, there are far more platforms, but many of these platforms are quite simple and very similar to one another. Given this background, the approach taken by the American Petroleum Institute (API) was to issue Recommended Practice 75, which calls for companies to prepare and follow a SEMP (Safety and Environmental Management Program). A SEMP contains twelve technical elements; they are discussed below. Although a SEMP is a performance-based system, the RP 75 approach is generally perceived to be more prescriptive than Safety Cases, not least because it references many other standards, particularly the API RP 14 “family”. These standards are often prescriptive in nature.

Figure 1 shows that the SEMS rule was issued in 2010. Although the MMS had issued the first draft in 2006, it was the *Deepwater Horizon* event that led to the quick issuance of the final rule, and to its increased scope.

In spite of the different approaches to offshore safety management that were taken, there are many similarities between SEMS and Safety Cases (and onshore Process Safety Management programs). Fundamentally, they all result in the development of a risk-based Safety Management System, and they all make extensive reference to prescriptive industry standards. Hence a complete and detailed SEMS document is very similar to a Safety Case, and achieves many of the same goals.

It is noteworthy that the onshore process industries (*i.e.*, chemical plants and refineries) in the United States faced an analogous set of circumstances at about the same time as Piper Alpha, and experienced a roughly similar sequence of events in the succeeding years, as illustrated in Figure 2.

Figure 2
Onshore Safety Programs



In the mid-1980s a series of serious incidents had occurred in chemical plants throughout the world. The Bhopal catastrophe was the worst in terms of human life, but there were many others. Consequently, various nations enacted process safety type legislation such as the Seveso Initiative in Europe. In the United States, the Amendments to the Clean Air Act, which was signed by President H.W. Bush just before he left office, required (among its many provisions) that OSHA and EPA to put in place Process Safety Management (PSM) and Risk Management Program (RMP) regulations. The Act was written such that the technical sections of the respective regulations are very similar to one another, thus minimizing duplication of work and effort. The first of these programs — OSHA’s Process Safety Management (PSM) standard — was issued in 1992.

However, just as *Deepwater Horizon* showed that sufficient progress had not been made with regard to offshore safety (or that performance standards had slipped) so the Texas City refinery explosion in of 2005 demonstrated that much work needed to be done with regard to PSM. The Baker Report (2007), written in the wake of that disaster, make a clear distinction between occupational safety (in which the refinery was doing well) and process safety. The following is a representative quotation from the report.

BP has emphasized personal safety in recent years and has achieved significant improvement in personal safety performance, but BP did not emphasize process safety. BP mistakenly interpreted improving personal injury rates as an indication of acceptable process safety performance . . . reliance on this data, combined with an inadequate process safety understanding, created a false sense of confidence that BP was properly addressing process safety risks.

Just as the Baker report analyzed and critiqued management systems, so, following the *Deepwater Horizon* event, the National Commission report to President Obama, published in January 2011, offered insights to do with offshore management and regulatory systems. (Some of the conclusions of that report are discussed in a later section of this paper.)

SEMP

API RP 75 - *Development of a Safety and Environmental Management Program for Offshore Operations and Facilities* - calls upon companies to prepare a SEMP. The 2004 edition of the standard states, “The objective of this recommended practice is to form the basis for a Safety and Environmental Management Program (SEMP)”. It goes on to say, “Management (owner and operator) should require that the program elements . . . are properly documented and available at field and/or office locations, as appropriate for each program element”.

The program elements are:

1. General
2. Safety and Environmental Information
3. Hazards Analysis
4. Management of Change
5. Operating Procedures
6. Safe Work Practices
7. Training
8. Assurance of Quality and Mechanical Integrity of Critical Equipment
9. Pre-Startup Review
10. Emergency Response and Control
11. Investigation of Incidents
12. Audit of Safety and Environmental Management Program Elements
13. Records and Documentation

Appendix A	Contractor Selection Criteria
Appendix B	Industry Codes, Practices and Standards
Appendix C	References
Appendix D	Definitions
Appendix E	Performance Measures

Because it is basically a performance-based and non-prescriptive standard, API RP 75 does not provide much detail to do with the implementation of the elements listed above. To pick one of the elements at random — Operating Procedures — RP 75's requirements for that element consists of just 468 words. Details regarding the actual writing of procedures must come from a company's own management processes, and from industry guidance such as that provided by Sutton (2010) and the wide range of publications from the Center for Chemical Process Safety (CCPS). Also, as already noted, RP 75 does reference a large number of other standards (39 to be precise). Most of these are from the API itself but some are from other professional organizations such as the ASME (American Society of Mechanical Engineers).

Although RP 75 is a voluntary practice, over the years a number of the referenced standards, such as RP 14C — Analysis, Design, Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms — have been incorporated into law by being referenced by the MMS.

Process Safety Management

Figure 2 showed that Process Safety Management (PSM) standards were being developed for onshore facilities at about the same time as the offshore industries were introducing SEMP and Safety Cases. There is a high degree of similarity between the elements of SEMP and PSM, as shown below.

OSHA's PSM	SEMP
1. Employee Participation	1. Safety and Environmental Information
2. Process Safety Information	2. Hazards Analysis
3. Process Hazards Analysis	3. Operating Procedures
4. Operating Procedures	4. Training
5. Training	5. Pre-Startup Review
6. Contractors	6. Assurance of Quality and Mechanical Integrity of Equipment
7. Prestartup Safety Review	7. Safe Work Practices
8. Mechanical Integrity	8. Management of Change
9. Hot Work	9. Investigation of Incidents
10. Management of Change	10. Emergency Response and Control
11. Incident Investigation	11. Audit of Safety and Environmental Management Program Elements
12. Emergency Planning and Response	12. Records and Documentation
13. Compliance Audits	
14. Trade Secrets	

Probably the most important difference is that the topic of Employee Participation is not included SEMP, although some of the requirements under the General Provisions of SEMP could be considered as being Employee Participation. The success

of the Employee Participation element is absolutely crucial to any safety management program. Neither SEMP nor PSM are programs to be developed and run by a team of specialists. Instead they involve everyone on the facility, including full-time employees, contract workers and senior management. And this element is about *participation*, not just *communication*. (At the time of writing there has been some discussion that Employee Participation will be incorporated into SEMS, thus further aligning it with Process Safety Management.)

OSHA’s PSM standard has Trade Secrets as the last of its elements. The reason for this is that some onshore chemical plants use or manufacture chemical compounds that are proprietary. This element provides those companies with a means to protect those secrets, while at the same time ensuring that the chemicals in question are properly managed. Since offshore platforms do not generally handle proprietary chemicals, this topic is not included in the SEMP list.

SEMS

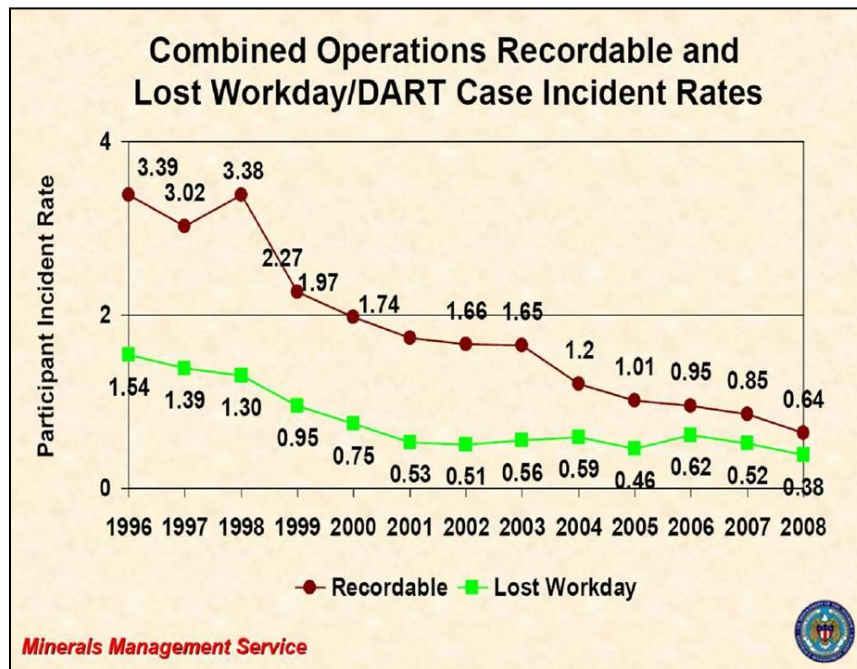
In the year 2006 the Minerals Management Service (MMS) — the precursor to the current Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) — proposed a new regulation called the Safety and Environmental Management System (SEMS). The proposed rule adopted just four of the twelve technical elements of SEMP. They were:

- Mechanical Integrity
- Operating Procedures;
- Hazards Analysis; and
- Management of Change.

The MMS chose these four elements because their research had suggested that failures in these areas contributed to the majority of incidents. (The order in which the elements are shown is significant, *i.e.*, Mechanical Integrity was the most important, Manatgement of Change the least.)

A public hearing to do with the proposed SEMS rule was held in New Orleans in September 2009. At that hearing representatives from industry (Parker 2009) questioned the need for the new rule on the grounds that the MMS’s own data showed that there had been considerable improvement in safety in the prior twelve years, as shown in Figure 3. The trend shown in Figure 1 is impressive (similar results were also reported for environmental discharges) and served as a justification for not requiring new regulation.

Figure 3
Safety Trends - United States Coastal Waters



No further information as to the new rule was provided by the MMS between the time of the 2009 hearing and the Deepwater Horizon event (April 2010). Soon after the occurrence of that event, the Department of the Interior renamed the

MMS as BOEMRE and underwent a major reorganization. The rebadged agency appointed a new director, Secretary Michael Bromwich.

In October 2010, BOEMRE published an updated version of the SEMS rule (there were no public hearings). Key parts to the new rule were:

- All twelve of the technical elements of SEMP were incorporated;
- Additional requirements were included for each of those elements;
- The effective date of the rule was November 15th 2010; and
- Companies have until November 15th 2011 to be in full compliance.

There had been discussion in the months leading up to the publication of the SEMS rule that companies would be required to prepare a formal Safety Case (they already do so for drilling). That requirement did not materialize.

SEMS covers all types of operation

. . . facilities include all types of offshore structures permanently or temporarily attached to the seabed (i.e., mobile offshore drilling units; floating production systems; floating production, storage and offloading facilities; tension-leg platforms; and spars) used for exploration, development, production, and transportation activities for oil, gas, or sulphur from areas leased in the OCS . . . Facilities also include DOI regulated pipelines.

The key change to do with SEMS is that what had been just guidance and recommended practice has now become a legal requirement. Specifically, the SEMS rule means that companies working offshore must have a SEMP in place.

BOEMRE is incorporating by reference, and making mandatory, the American Petroleum Institute's Recommended Practice for Development of a Safety and Environmental Management Program for Offshore Operations and Facilities (API RP 75), Third Edition, May 2004, reaffirmed May 2008. This recommended practice, including its appendices, constitutes a complete Safety and Environmental Management System (SEMS) program.

BOEMRE (2010)

BOEMRE has done more than merely incorporate SEMP into law, however. Using the example of Operating Procedures once more, it has added six paragraphs of instructions in response to their own question,

§ 250.1913 What criteria for operating procedures must my SEMS program meet?

Each paragraph contains the word “must”, not “should”.

The first paragraph states the following:

(a) You must develop and implement written operating procedures that provide instructions for conducting safe and environmentally sound activities involved in each operation addressed in your SEMS program. These procedures must include the job title and reporting relationship of the person or persons responsible for each of the facility’s operating areas and address the following:

- (1) Initial startup;*
- (2) Normal operations;*
- (3) All emergency operations (including but not limited to medical evacuations, weather-related evacuations and emergency shutdown operations);*
- (4) Normal shutdown;*
- (5) Startup following a turnaround, or after an emergency shutdown;*
- (6) Bypassing and flagging out-of service equipment;*
- (7) Safety and environmental consequences of deviating from your equipment operating limits and steps required to correct or avoid this deviation;*
- (8) Properties of, and hazards presented by, the chemicals used in the operations;*
- (9) Precautions you will take to prevent the exposure of chemicals used in your operations to personnel and the environment. The precautions must include control technology, personal protective equipment, and measures to be taken if physical contact or airborne exposure occurs;*
- (10) Raw materials used in your operations and the quality control procedures you used in purchasing these raw materials;*
- (11) Control of hazardous chemical inventory; and*
- (12) Impacts to the human and marine environment identified through your hazards analysis.*

Clearly the SEMS rule is considerably more detailed than SEMP,

In addition to the expanded technical elements, the SEMS rule requires that offshore operators carry out Job Safety Analyses (JSAs).

Timing of SEMS

The SEMS rule became effective November 15th 2010 and companies have to be in compliance by November 15th 2011. The degree to which the target date is achievable depends largely on the extent to which companies and facilities already have a complete SEMP in place. For those companies that do have such a program a year is not a long time, but it should be sufficient. (Those companies that have their own Safety Management System will have to spend time and effort “mapping” their processes to correspond with the requirements of SEMS.)

Unfortunately, according to BOEMRE’s own data, many mid-size companies, and most small companies do not have a complete SEMP in place. In the rule BOEMRE divides oil and gas operators into three broad categories: High, Moderate and Low. The division depends on the thousands of barrels of oil equivalent (MMBOE) produced. BOEMRE reviewed data that had been submitted by many of the operators, and came up with the conclusions shown below.

Size	Annual Production Rate	Number of Operators	Percentage with SEMP
High:	>- 10 MMBOE	13	100
Moderate	1 MMBOE < 10 MMBOE	41	71
Low	< 1MMBOE	76	37

In other words, only slightly more than 50% of the companies on the OCS have a complete SEMP in place. Those companies that do not have an existing SEMP program, or that have a program that is far from completion, are in an invidious position. The effort needed to meet the deadline is likely to be very substantial.

In order to determine how much time might be needed to develop a full SEMS, two historical precedents can be referred to. The first is from OSHA’s Process Safety Management (PSM) standard. As shown above, there are strong similarities

between PSM and SEMS. Therefore the time that companies needed to implement PSM probably provides good guidance for the same activity with SEMS. In 1992 OSHA told companies that they had to have most of the elements in place immediately. However, they gave a five year implementation period for certain key activities such as the completion of P&IDs and hazards analyses. Consequently, PSM became — unofficially — a five year standard. And, in general, that was about the right amount of time that committed companies found that they needed for a comfortable implementation period.

Another relevant benchmark comes from a public hearing that the Chemical Safety Board held September 15th 2010. Authorities on the implementation of Safety Cases in both the United Kingdom and Norway said that it took about five years to develop Safety Cases in their jurisdictions.

It is important to recognize that the above comments about taking five years to complete a program do not constitute a reason for not making every effort to achieve compliance inside one year. However, some activities cannot be compressed into a shorter time frame. This dilemma is expressed in Brook's Law, which was written about software projects: "adding manpower to a late software project makes it later" (Brooks 1995).

For those companies that cannot get the necessary work done in one year, some guidance as to how a SEMS program can be implemented is provided in the final section of this paper.

Auditing

All of the elements of a SEMP/SEMS program are important. Indeed, one of the philosophical underpinnings of such a program is that the elements all depend on one another, and that they are all "equally important". For example, it could be argued that most accidents result from unintended change, so Management of Change (MOC) is the "most important" element. But accidents all result from hazards, so Hazards Analysis is the "most important". But both MOC and Hazards Analyses depend on the existence of timely and accurate technical information, so Safety and Environmental Information is the "most important element". The point is, of course, that all the elements are important and they all are interlinked with one another.

However, it is likely that Auditing element will receive particular attention in the coming months. As already noted, it is anticipated that BOEMRE will have a more assertive attitude than its predecessor, the MMS, so inspections of all kinds are likely to be more rigorous, and maybe more confrontational, than was the case in the past. Therefore it is particularly important that a company carefully checks its SEMP/SEMS program to make sure that there are no gaps between "what is" and "what should be".

A problem faced by government inspectors in general is that they can have trouble recruiting personnel who are fully qualified, and have sufficient industrial experience. This is a particularly severe problem in the industries such as deepwater drilling and production. In recognition of this difficulty, BOEMRE is permitting an "independent third-party or your designated and qualified personnel" to carry out audits. However, BOEMRE reserves the right to accept or reject the credentials of any proposed auditor.

Plan

The discussions in the previous sections make it clear that the implementation of a SEMS program can be time-consuming, demanding of resources (particularly key personnel) and expensive (which is not to say that SEMS is not a good investment in pure financial terms). Many operators have a lot of work to do to make sure that they are in compliance by November 15th 2011.

Those companies that already have a complete SEMP program will spend most of their time conducting audits and gap analyses. They will want to make sure that they really are complete and that they won't be snagged during an outside audit. If their Safety Management System follows a different structure from that of SEMS (true of many of the larger oil companies) then they will need to conduct a mapping process which links the elements of their program to the elements of SEMS.

Those companies that do not have a complete SEMP program in place are in an unenviable position. If it is accepted that meeting all of the SEMS requirements inside one year or less is not practicable for the reasons that are discussed above, then a 'Plan B' is needed. It is suggested that such a plan could contain be organized as follows:

1. *Develop a plan.* If a detailed SEMS-compliance plan is in place, and *if the company can show that they have been following it*, then they have a defense should they be audited by an external agency (or even worse, have to take part in an investigation following a serious incident). This defense may or may not be adequate, but it does show, at least, that the company was aware of SEMS, was committed to meeting its requirements, and was working systematically to complete a plan.
2. *Organize the plan with a risk assessment.* In addition to having a plan, it is important that activities and programs are risk ranked. This can be done through use of a Major Hazards Analysis (MHA). If it is found, for example, that the risks associated with hydrogen sulfide are greater than those to do with hydrocarbon gases, then the training program and other activities can be prioritized correspondingly.
3. *Start with Safety and Environmental Information and Management of Change.* In a previous section of this paper it was stated that all elements of SEMS are of equal priority with one another. While this is true, when starting such a program it is particularly important to make sure that the Safety and Environmental Information (SEI) and the Management of Change (MOC) programs are in place. SEI is foundational to virtually all other activities, and must be complete and correct — otherwise a lot of time will be wasted conducting hazards analyses on the wrong equipment and writing procedures for operations that do not exist, and so on. MOC is important in the first phases of a SEMS project because the SEI is constantly changing, and it is vital that those changes are carried out in an orderly and timely manner.

Developments

The *Deepwater Horizon* event was so serious that it is unlikely that changes to the manner in which safety is managed offshore will stop with the current version of SEMS. Indeed, the National Commission report to President Obama (2011) states,

... regulatory oversight of leasing, energy exploration, and production require reforms even beyond those significant reforms already initiated since the Deepwater Horizon disaster. Fundamental reform will be needed in both the structure of those in charge of regulatory oversight and their internal decisionmaking process to ensure their political autonomy, technical expertise, and their full consideration of environmental protection concerns.

This paragraph seems to be suggesting that the development of a SEMS program is not sufficient. After all, SEMS is not really new — it is built on the well-established SEMP. New ideas and management processes are needed. The same report states, “... reforms even beyond those already initiated ... will be needed.”

No one knows the scope and nature of reforms and changes to SEMS that will come up. But, those working in the area of SEMP and SEMS can be assured that they are going to have plenty to do in the coming years.

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