SEMS successes, challenges and recommendations based on analysis of 3rd round SEMS audit results and SEMS corrective actions

Executive Summary

The Safety and Environmental Management Systems (SEMS) regulations issued by BSEE require that audits of each operator's SEMS be conducted regularly, most typically every 3 years. This report assesses the third cycle of SEMS audits since the SEMS regulation was promulgated, summarizing findings from audits conducted mid-2017 to mid-2020. In general, these audits reveal that operators with older facilities located nearer to shore in water depths under 200 meters, record more SEMS deficiencies than operators predominantly producing oil and gas from newer, more productive, deep water leases. Half (approximately 50%) of the deficiencies during this audit cycle derives from inconsistent or incomplete implementation of a documented policy, work procedure, or practice. Comparing this to findings from the 2015 to 2017 audit cycle when the most common deficiency involved the design and establishment of a SEMS element, there appears to be a general movement on the SEMS maturity path away from the need to design and establish SEMS policies and procedures toward improving operational discipline and ensuring more consistent adherence to those policies and procedures.

This report also includes a review of operator corrective action activity. BSEE regulation requires that, following the completion of their SEMS audit, the operator submit for BSEE review their Corrective Action Plan (CAP) to resolve all reported deficiencies. CAPs associated with the 3rd round SEMS audits were analyzed to categorize the mitigation actions proposed by operators to address their SEMS deficiencies. Between 35 and 55% of the mitigation actions (depending on the SEM element being addressed) sought to improve the level of implementation of their SEMS elements. More notable were the 5 to 20% of corrective action steps that sought to address systemic root causes for the identified deficiencies such as by improving decision making processes, modifying organizational workflow and oversight practices, and accounting for other human factors. Approximately 40% of the corrective actions could be considered simple corrections, i.e. immediate actions to at least partially resolve the deficiency such as moving chemicals into secondary containment or adding missing references, descriptions of tasks, or check boxes to SEMS documents.

Our analysis also identifies several opportunities for BSEE to improve its oversight practices to promote higher levels of operator SEMS effectiveness via the audit and CAP follow-up. These include:

- BSEE should work with industry, the Accreditation Body (AB) for the Audit Service Providers (ASPs), and the ASPs themselves to refocus future audits of Operators who have a complete and well documented SEMS program so that more auditor time is spent assessing whether key SEMS elements are applied effectively to operator-specific risk management practices and less on SEMS design.
- BSEE should also seek to ensure that all CAPs submitted in response to SEMS deficiencies contain steps for the operator to self-identify the root causes for their incomplete SEMS implementation or safety practices, and that more actions be taken to improve operational consistency and resilience, and self-validate that their actions have addressed the issues.

Regulatory History – SEMS and the SEMS audit process

Management System Establishment, Implementation and Maintenance

The Mineral Management Service (MMS) (BSEE's predecessor) first issued an Advanced Notice of Proposed Rulemaking (ANPRM) to establish a SEMS in 2006. This ANPRM explored options for requiring that Outer Continental Shelf (OCS) Oil and Gas (O&G) operators adopt management system approaches such as described in the American Petroleum Institute (API) Recommended Practice (RP) 75. MMS then issued a Notice of Proposed Rulemaking (NPRM) in 2009 indicating an intent to require that OCS O&G operators adopt and implement four of API RP 75's thirteen elements, specifically Hazard Analysis, Management of Change, Operating Procedures and Mechanical Integrity. The reason the NPRM focused only on a subset of the API RP 75 elements was that MMS analysis of OCS incident reports indicated that OCS incidents were often characterized by inadequate risk awareness and poor discipline. Enhanced practices based on these chosen four elements were expected to address those deficits.

The Deepwater Horizon incident occurred in April 2010. In order to increase focus on major incident prevention, the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), the immediate successor to MMS, issued the first SEMS regulation in October 2010. This regulation, now referred to as SEMS I, required that all thirteen elements of API RP 75 be adopted by OCS operators. BSEE was established in October 2011 and BSEE issued the SEMS II regulation in April 2013. SEMS II defined four additional management system elements and established additional requirements such as the need for SEMS audits to be conducted by accredited Audit Service Providers (ASPs).

The entirety of the SEMS regulation is published as 30 CFR 250 Subpart S. The need to follow API RP 75 and the four additional BSEE-established elements is important, but the overarching, primary requirement of Subpart S for lessees and designated operators on O&G leases is that they **establish, implement and maintain** a systematic approach for risk management (§250.1900) throughout the life cycle of their operation on the OCS (§250.1901). The 17 elements that are required to be incorporated into each operator's SEMS systemic approach are as follows:

1. General requirements
2. Safety and Environmental Information
3. Hazards Analysis
4. Management of Change
5. Operating Procedures
6. Safe Work Practices
7. Training
8. Mechanical Integrity (Critical Equipment)
9. Pre-startup Review
10. Emergency Response and Control
11. Investigation of Incidents
12. Auditing
13. Recordkeeping
14. Stop Work Authority
15. Ultimate Work Authority
16. Employee Participation Plan
17. Reporting Unsafe Working Conditions

These 17 elements alone are not the SEMS, but rather provide a framework of practices that must be considered and integrated into each O&G operator's internal policies, procedures, processes, and management culture to guide their safety and environmental risk management, i.e. each operator is expected to explicitly and clearly define how it will develop, implement, monitor, and manage risk for its organization utilizing each of these elements.

The design of BSEE's SEMS requirements, especially the "establish, implement and maintain" requirement of §250.1900, mirrors the "Plan→Do→Check→Act" (PDCA) cycle embedded in every other internationally recognized Quality Management System (QMS), e.g. ISO 9001 (*Quality management systems – Requirements*), ISO 14001 (*Environmental management systems – Requirements with guidance for use*) and ISO 45001 (*Occupational health and safety management systems – Requirements with guidance for use*)[1]. PDCA is an iterative four-step management method used in business for the control and continuous improvement of processes and products. The purpose of PDCA and BSEE's SEMS regulation is to focus attention on how work is done and engrain in the organization performing the work a learning attitude so that the quality of its outputs can continually improve. Within this context:

- the "**establish**" requirement of SEMS expects each oil and gas operator to design and promulgate policies and procedures that incorporate the 17 elements listed above to manage operational risks to the safety of personnel and the environment;
- the "**implement**" requirement expects operators to roll out these policies and procedures in an organized fashion, to promote that they be carried out as designed to the extent practicable, and when any specific policy or procedure cannot be followed as designed or needs to be changed for any other reason, to introduce revisions in a similarly organized fashion;
- the "**maintain**" requirement expects operators to **monitor** performance regularly and **improve / revise** policies and procedures as needed – to continually improve the effectiveness of each SEMS-related policy and procedure in managing risks to personnel and the environment.

Evaluating the success of a SEMS therefore means assessing movement on the continual improvement path. The audits performed during the 3rd SEMS Audit cycle provide evidence of such movement, especially when compared to results of audits performed in the first two cycles. The benefits of a SEMS investment (e.g. better safety and environmental performance) will become clearer as companies increase efforts on implementation and maintenance stages, for that is where increased awareness and creation of a learning culture begin to change human and organizational behaviors.

Management System Auditing

BSEE regulations currently require audits of each operator's SEMS using accredited Audit Service Providers (ASPs) at a prescribed frequency[2] and in response to a BSEE Directed Audit order (refer to 30 CFR 250.1920 and 250.1925 for more details). Note that the requirement to use an accredited ASP became effective in June 2015.

Since SEMS II was promulgated in 2012, nearly 200 audit reports have been submitted to BSEE per regulatory requirements:

[1] ISO (International Organization for Standardization) is an independent, non-governmental international organization with a membership of 165 national standards bodies and a mission to develop "high quality voluntary International Standards which facilitate international exchange of goods and services, support sustainable and equitable economic growth, promote innovation and protect health, safety and the environment."

[2] An audit must start within 2 years after initial implementation of an operator's SEMS and every 3 years thereafter. For drilling on the Arctic OCS, an audit must be performed every year that drilling is conducted.

- **Cycle 1**: 2012 to mid-2014 – 87 audit reports from 96% of the companies operating on the OCS in mid-2014, demonstrated that a SEMS was beginning to be established by the OCS oil and gas operators; however, a lack of report content standardization made it difficult to extract more intelligence on the effectiveness of the initial SEMS plans (Appendix 1).
- **Cycle 2**: 2014 to mid-2017 – 60 audit reports were received representing 100% of the companies still operating on the OCS by mid-2017[3]. Most were generated by accredited ASPs and all provided details that confirmed many companies were utilizing their SEMS; however, gaps still existed in the establishment and implementation of several key SEMS elements (Appendix 2).
- **Cycle 3**: 2017 to mid-2020 – 52 audit reports were submitted, again representing 100% of the companies with operations on the OCS by mid-2020. For many companies currently operating on the OCS, this period covered their 3rd SEMS audit overall. Audits during this cycle demonstrated additional movement on the PDCA curve revealing that most SEMS deficiencies were in the implementation of their established procedures. This report provides a more in-depth analysis of those audit results.

Facility Coverage

During each audit the establishment, implementation, and maintenance of SEMS is reviewed in the operators' offices; the SEMS regulation further requires that the ASP visit 15% of each operator's production and well operation assets to verify via interviews and observations that the SEMS procedures and programs referenced in their SEMS plan are in place and providing the anticipated performance results. For unstaffed facilities that are included in the offshore verification sample, the audit team can combine physical visits with interviews of maintenance personnel and review of documentation and photos to assess the safety and environmental adequacy of the operator's oversight practices.

Table 1a highlights the number and percentage of drill ships and related well operation vessels that have been visited during SEMS audits since the beginning of the program. While 47 of such vessels were visited to-date in SEMS audits, only 22 of these were active on the US OCS as of June 2020. This is because drill ships are hired for a limited period and then move offsite when the work is completed; also rig counts always rise and fall with oil commodity pricing, and 2020 is a period with depressed pricing. Still, 26% of the rigs still active on the US OCS have been included so far in the SEMS audits.

Table 1a. Drilling Rig Coverage in SEMS Audits, All Regions (2012 to mid-2020)		
# Rigs and related well operation vessels visited during all SEMS audits to-date:		47
# still active on the US OCS as of June 2020	22	
# that had left the US OCS as of June 2020	25	
# Rigs active on the OCS as of June 2020:		86
Percent of currently active rigs sampled in a SEMS audit (= 22 ÷ 86):		**26%**

[3] There has been a reduction in the number of audit reports received by BSEE over the 8-year period since SEMS was first established as a result of consolidation in the number of active COS operators, not a reduction in OCS drilling, production and decommissioning activity.

Table 1b highlights the number and percentage of staffed and unstaffed production facilities that have been sampled during SEMS audits since the beginning of the program. These data indicate that priority has been given to sampling SEMS on staffed, deeper water facilities rather than on unstaffed assets. For example, close to 50% of all production facilities in waters exceeding 200-meter depth have been visited during the SEMS audits to-date. And while significantly more unstaffed vs staffed facilities have been assessed during the SEMS audits to-date (432 vs 281), those represent only 25% of the June 2020 inventory of unstaffed structures on the OCS.

Table 1b. Production Facility Coverage in SEMS Audits, All Regions (2012 to mid-2020)			
Total # production complexes on the OCS on December 31, 2012 (SEMS audits began):			2841
Total # production complexes on the OCS as of December 31, 2019:			1811
# staffed production complexes on OCS visited during all SEMS audits to date:			281
Gulf of Mexico Region	Less than 200 meters depth (657 feet):	232	
	200 – 1000 meters depth:	18	
	Greater than 1000 meters depth:	16	
Pacific Region:		14	
Alaska Region (not counting Spy Island):		1	
Estimated % of existing staffed complexes visited during these SEMS audits:			**39%**
Gulf of Mexico Region	Less than 200 meters depth (657 feet):	37%	
	200 – 1000 meters depth:	**49%**	
	Greater than 1000 meters depth:	**48%**	
Pacific Region:		**61%**	
Alaska Region (not counting Spy Island):		**100%**	
# un-staffed production complexes / manifolds visited during all SEMS audits to date:			432
Estimated % of existing un-staffed complexes sampled during these SEMS audits:			**25%**

A 36% decrease between 2012 and 2019 in the number of OCS facilities has further reduced the assets inventory that can be included in future SEMS audit. This is a result of removal from the OCS of aging and unneeded structures as well as industry's growing reliance on larger, higher-producing deep water production facilities.

Analysis of 3rd Round Audit Findings

"Findings" are the product of SEMS audits. Findings are classified as either Good Practices, Deficiencies, or Opportunities for Improvement.

Good Practices

Good practices (or in many cases, notably effective or compliant practices) were identified in 40 of the 52 audit reports reviewed; they accounted for one third of the overall findings reported during the 3rd round audits. The few cases where audit reports did not call out any positive SEMS attributes typically involved operators with many SEMS deficiencies across multiple SEMS elements. In other words, a large deficit existed in SEMS-related practices by that operator, and the elements where auditors identified conformance with the SEMS requirements did not provide a robust enough base upon which to expand their SEMS practices.

Half of the identified good / notable compliant practices identified in the audit reports were associated with the following four SEMS elements— General (organization and leadership), Safe Work Practices, Operating Procedures, and Mechanical Integrity.

General

This SEMS element deals primarily with the general organization of a company's SEMS policies and procedures, the involvement of company leadership, and the quality of communications regarding risks and SEMS controls throughout the organization. The General element provides indicators of SEMS integration into a company's culture. Most good / notable practices highlighted under this element involved:

- the positive commitment and high visibility of company leadership,
- the transparency of communications throughout the organization,
- the growth of a culture of safety especially since the last audit, and
- the formality and clarity of the defined SEMS processes and requirements.

Good practices that were mentioned less frequently but which are more forward thinking include:

- engagement by operators with their business partners to ensure buy-in and increase breadth and effectiveness of their SEMS,
- actively addressing developing risks (e.g. cyber-security) within their SEMS scope, and
- the expansion of their OCS SEMS approaches to other aspects of company operations not on the OCS – thus engraining SEMS into the corporate culture, not just a compliance requirement.

Safe Work Practices and Operating Procedures:

These two SEMS elements are similar in that they both involve the description of how work is to be carried out, which parts of the workforce need to be involved, and how work is expected to be reviewed, approved, and monitored. Also included under the Safe Work Practices element are requirements for contractor management. Good / notable practices for these elements as identified by the auditors included the following:

- Many of the safe work practices and operating procedures were found to be scalable; standardized and simplified; easily accessible. In these cases, they were able to be applied successfully to operations of varying complexity and risks.
- Contractor management programs were often robust and effective; regular contractor performance reviews increased attention to implementation of safe practices and led to better safety performance.
- Focused initiatives to maintain, improve, and communicate practices, procedures, and the diligent documentation of permit-associated work impressed several auditors.
- Establishment and promotion of safety improvement goals contributed to improved safety performance.

The following are good and notable safe work practices identified by the auditors that represent leading edge activities and which may represent a current best practice.

- Applying behavior-based principles in the design of safe work practices appeared to improve their effectiveness.
- A robust bridging document process that highlighted and analyzed gaps between expectations for the contractor work force and work-as-performed helped close the gaps.
- Human factors analysis improved the effectiveness of certain operating procedures.
- Robust SEMS operational and other controls were designed and successfully implemented for specific, high risk operations (e.g. Managed Pressure Drilling (MPD)).

Mechanical Integrity

This SEMS element largely involves the maintenance of equipment and facilities, with a focus on operator-identified "critical equipment". Auditors identified the following as good / notable practices in the design, implementation and maintenance of this element:

- Diligent corrosion/erosion control and QA measures; an organized workflow process;
- Utilizing qualified personnel and a risk-based approach to carry out the program; and
- High level ownership and execution of maintenance responsibilities by first line personnel.

Deficiencies

Deficiencies include both non-conformances with specific SEMS requirements, and areas of concern where failure to address the finding could lead to a non-conformance. Both non-conformances and areas of concern should be considered equivalent deficiencies since BSEE regulations require that both be addressed in a Corrective Action Plan (CAP)[4].

Over 60% of the documented deficiencies were associated with five SEMS elements: Safe Work Practices, Mechanical Integrity, Hazard Analysis, Operating Procedures, and Management of Change. The deficiencies were further analyzed to determine whether they reflected a gap in the establish, implement, and/or maintain requirement of SEMS. Following are examples of the most common deficiencies identified in each of these five elements.

Safe Work Practice (SWP) deficiencies

Most SWP deficiencies derived from inconsistencies between the SEMS program expectations and field observations, e.g. gaps in SEMS implementation. This can be summarized as a lack of operational discipline. These findings came from observations on one or more of the operator's facilities (not the totality of an operator's facilities) visited by the auditors, potentially reflecting localized vs. company-wide implementation gaps. Most common SWP implementation deficiencies included:

- Inconsistent Implementation: Safe Work Practices such as Lock Out Tag Out (LOTO), Hot Work, Confined Space, Hydrogen Sulfide risk management, and Working from Heights, were not being followed "as designed" in all instances

[4] See BSEE's regulatory interpretation at https://www.bsee.gov/guidance-and-regulations/regulations/regulatory-interpretations#sems

- Incomplete Documentation: Job Safety Analyses (JSAs) and Permit to Work packages did not always document the required use of various Safe Work Practices or contain acknowledgement such as names and signatures that all involved workers were aware of the hazards
- Undisciplined Chemical Management practices: Unlabeled chemical containers; storing flammable materials outside of flammable storage cabinets; inadequate secondary containment for chemicals; discrepancies between Safety Data Sheet books, chemical logs, and chemicals on the facilities
- Poor housekeeping: Including existence of tripping and falling hazards and use of deteriorated equipment such as heavily corroded cranes.

Mechanical Integrity deficiencies

Most deficiencies identified by the auditors concerned the "establish" requirement; these were focused on a lack of written mechanical integrity procedures:

- for contractor equipment;
- for quality assurance of critical monitors;
- for preventive maintenance; and
- for verification that critical equipment has been maintained or remained fit for purpose.

Further, the scope of some Mechanical Integrity processes did not appear to cover every high-risk concern (such as general facility corrosion). Almost as frequent in the Mechanical Integrity element were findings of implementation and maintenance deficiencies, including:

- Hoses in poor condition were not removed and broken gauges on equipment were not repaired;
- Platform safety inspections and checklists were not conducted or documented consistently;
- Casing pressure tests were being conducted at lower than the required pressure ratings;
- Calibrated gauges were not used for some required integrity tests; and
- Corrective actions were not defined or carried out to address mechanical integrity deficiencies.

Hazard Analysis deficiencies

Most operators had established hazard analysis and JSA processes, but the ASP's identified deficiencies in how they were implemented and maintained. Examples include:

- Facility and Process Hazard Analyses (HA's) were not completed at several operator locations;
- HA's were at times being completed by potentially less-than-qualified persons;
- Follow-up actions from several HA's were not implemented or closed out;
- The scope of the HA's did not cover all expected hazards, e.g. lightning strikes, H_2S, facility incident and non-compliance history;
- Facility leadership were not always aware of the results of their facility's HA;
- JSA's for similar activities contained discrepancies in their descriptions of the tasks and the risks;
- JSA's were not always available for what were labeled routine operations; and
- Signatures of the workers and facility leaders missing from several JSA's.

Operating Procedure deficiencies

The largest number of deficiencies identified by the auditors focused largely on the lack of evidence that the operating procedures were being reviewed and updated either regularly or in response to changes on the facility, which is largely a concern of inadequate maintenance of their Operating Procedures. But there were also several implementation and establishment deficiencies, such as:

- Inadequate control to prevent or minimize oil/chemical intrusion to the deck drain sumps, such as from pigging operations;
- No formal mechanism in place to ensure the correct flare functioning;
- Written operating procedures were not used in day to day operations; and
- Lack of awareness as to facility lease stipulations.

Management of Change (MOC) deficiencies

Most operators had established their MOC processes, but in many cases a review of the documentation indicated that the process was not being implemented consistently or thoroughly. Examples include:

- Some MOCs existed in the operator's tracking system with no apparent review, approval, or action for months at a time;
- Documentation maintained in the MOC tracking system by the operator did not always reflect the actions taken to implement and close out the change request;
- In some cases, the MOC closure documentation did not include the signoffs and evidence called for by the operator's MOC process;
- The triggers for implementing the MOC process were not always being followed, such as the acquisition of new facilities, the change in staffing levels or leadership on a facility, and changing facility equipment (e.g. generators, firefighting systems, pumps); and
- Training those who have been impacted by facility changes or modifications to other aspects of the SEMS such as Operating Procedures, did not always occur.

Relationship between deficiencies and SEMS maturity

The existence of deficiencies such as identified above rarely means that a SEMS element was entirely ineffective. Auditors often revealed both good and deficient practices in each SEMS element; in fact half of the operators audited had this occur. The existence of both good and deficient practices in a company is to be expected as their experience with SEMS matures. Table 2 and the discussion that follows is presented to generally demonstrate this.

Table 2. Relative prevalence of deficiencies in top 5 SEMS elements

SEMS Element	% of total Deficiencies identified during 3rd Audit Cycle	% of 3rd cycle audits where one or more Deficiency is identified for this element	% of 3rd cycle audits where one or more Good Practice is identified for this element
Safe Work Practices	17%	63%	48%
Mechanical Integrity	14%	56%	33%
Hazard Analysis	12%	56%	19%
Operating Procedures	10%	50%	35%
Management of Change	9%	58%	31%

- The first column lists the elements most often associated with a deficiency.
- The second column shows the percent of all 3rd cycle deficiencies associated with that element.
- The third column shows the percent of 3rd cycle audit reports that listed at least one deficiency in that same SEMS element.
- The fourth column shows the percent of 3rd cycle audit reports that also listed at least one good practice in that element.

Specific examples of auditor findings where both good practices and deficiencies were noted in the same SEMS element for the same operator, follow.

- The safety performance and the controls that were in place were exemplary, but the documentation associated with some operations was not as complete as the operator's own SEMS definitions required them to be (an example of effective but partial implementation).
- The communication level and details between an operator and its contractors were observed to be excellent, but follow-up monitoring of contractor performance was inconsistent (an example of good implementation but inadequate SEMS maintenance).
- Diligent QA measures and materials procurement processes were in place, but there was an inadequate fixed equipment maintenance program for vessels and piping per API579 requirements (an example of good but incomplete establishment of SEMS procedures).
- The Production Operations MOC process was enhanced, effectively rolled out, and monitored, but the operator's Well Operations MOC program had gaps, e.g. whether it would be utilized effectively when there were business pressures on things like drilling schedule (an issue of good implementation in one operation, but potentially inadequate implementation in another).

These examples demonstrate how SEMS maturation occurs... operators will work to get one aspect of SEMS design or implementation right, and then will work on the other aspects that were not yet at the same level of robustness. Ideally, operators learn from their successes and apply those learnings to resolve more recently discovered gaps; in the process organizational culture change occurs. Such changes take time and dedicated effort, but changes that create a learning culture within a company also have the potential to improve safety performance in the most sustainable fashion.

To further explore the concept of growth in SEMS maturity sector-wide, we looked at all deficiencies independent of the SEMS element they were identified under. In the 3rd audit cycle, 50% of all deficiencies involved inadequate or inconsistent implementation of the established SEMS policies and procedures. Table 3 compares this to a similar analysis performed for the 2nd cycle audit report (see Appendix 2); the results further indicate that there is industry-wide movement on the maturity path from the initial challenges of designing and documenting SEMS to implementing SEMS.

Table 3. Comparison of 3 Audit Cycles and the SEMS Establish, Implement and Maintain expectations					
Audit Cycle	Time Frame	General Comment	Identified Deficiencies in SEMS…		
			Establishment	Implementation	Maintenance
1	2012-2104	Companies were beginning to establish their SEMS	No standard reporting format; strict adherence to COS Checklist; fear of reporting details and receiving INCs		
2	2015-2017	Requirement for Accredited auditors began in June 2015	41%	39%	20%
3	2018-2020	Findings indicate movement on maturity path	26%	50%	24%

Discussion regarding implementation gaps

A recurring audit review results theme or finding involves the challenges faced in consistent and sustained SEMS procedures implementation and closing the gap between "work as planned or imagined versus work as actually performed or executed." This phrase describes the underlying challenge that all operators face when work is planned primarily by persons with in-depth understanding of risk but executed in the field by those who may have competing priorities, an innate comfort and familiarity with alternative work procedures, or operating experience that conflicts with the newer guidance.

BSEE and industry continue to search for possible solutions to close the gap between work as planned and work as performed.

Opportunities for Improvement

Opportunities for Improvement (OFIs) are the third type of finding included in many SEMS audit reports. OFIs are identified when an element appears to be established, implemented, and maintained, but levels of efficiency or sustainability could potentially be improved. Five SEMS elements were responsible for more than half of the OFIs during the 3rd Audit Cycle: Management of Change, Training, Mechanical Integrity, Emergency Response and Control, and Hazards Analysis.

In reviewing some OFI descriptions, they read similarly as those that could be interpreted as deficiencies. However, our discussions with the ASPs indicate that they take extra effort to ensure that any OFI identification is not reflective of a systemic deficiency and that OFI designation is made via an audit team consensus process. In other words, the element for which an OFI is issued either meets the operator performance expectation, or the finding reflects normal, non-critical variation that is to be expected in any system; e.g. the absence of a signature or a detailed description of a risk on a Job Safety Analysis form, and is not the same as the workforce being unaware of their risks and their responsibilities to manage them.

Examples of auditor reported OFIs are described below.

Management of Change (MOC) OFIs

The auditors noted that the MOC process is occasionally hampered by a lack of deadlines to "push" MOCs to closure, a gap in defined processes on how and when to modify "required action" dates, a lack of clarity around MOC communication requirements, and not specifying the documentation that would be needed to support different MOC requests. Auditors also reference good practices seen elsewhere when writing these OFIs. For example, some thought that providing additional clarity for what should trigger the MOC process and utilizing stage gate or other formal approaches to ensure each MOC step is fully completed, could improve the efficiency and sustainability of the MOC implementation.

Training OFIs

The 3rd cycle auditors suggested that some training requirements would benefit from additional clarity, especially related to those requiring training, establishing training standards and frequency, and improving oversight through effective completion certificate tracking and associated expiration dates.

Mechanical Integrity (MI) OFIs

The auditors suggested MI process definitions be strengthened in multiple ways: provide details on how to authorize changes in test procedures; supplement the procedures with details to match current practices; incorporate Key Performance Indicators (or other mechanisms) to track the health of the MI process; make it easier to prioritize equipment for maintenance or removal; formalize expectations for ensuring rental equipment MI; and take additional steps to verify information that is used to ensure MI is an accurate reflection of actions that were taken or gauge readings that were recorded.

Emergency Response and Control OFIs

The auditors suggested that documentation and critiques of Emergency Response drills could contain more details; more accurately reflect leadership and participants in drills; utilize the most current required company forms; and reconcile the number of drills conducted in practice with programmatic design expectations.

Hazard Analysis (HA) OFIs

The auditors noted that operators did not always: completely document action items from HA analysis close outs; identify the qualifications of HA participating personnel; include adequate detail around corrosion / erosion impacts of hazard levels; or lead to field signage to warn others of the identified hazards. Regarding the element's Job Safety Analysis (JSA) requirements, the auditors suggested that additional clarity could help operators identify when JSAs are required vs other types of safety reviews; identify who is authorized to approve the work described in the JSAs, and ensure that the JSAs are completed with names of individuals responsible for each task.

Differentiation of Operators based on Audit Findings

The above analysis provides an overview of findings (good practices, deficiencies and opportunities for improvement) that characterize the overall OCS O&G industry. However, there are large differences among operating companies in how effectively they establish, implement and maintain their SEMS.

For this analysis, we chose average water depth of production operations as a differentiator, largely because most OCS O&G production in 2020 comes from "deep water" Gulf of Mexico operations, yet

most of the facilities that SEMS apply to (see Table 1b) are in "shallow water". As shown in Table 4, auditors reported that deep water companies (those operating in > 200 meters water depth on average) versus those operating older closer to shore assets had fewer SEMS deficiencies covering fewer SEMS elements; these deficiencies were also much more likely to be in the implementation and maintenance aspects of their SEMS rather than in its establishment, perhaps indicating more experience, maturity, or comfort by operators in deep water with the use of SEMS tools to manage risks.

Table 4. Comparison of Third Cycle Audit Results for Deepwater vs Other Operators					
	Required SEMS improvement focus			**Prevalence of SEMS Deficiencies**	
	Establish	**Implement**	**Maintain**	**Average Number of Deficiencies per report**	**SEMS Elements with >50% likelihood of having a deficiency**
Deepwater Operators	12%	58%	30%	5	1. MOC 2. Safe Work Practices 3. Operating Procedures
Other Operators	29%	48%	23%	11	1. Safe Work Practices 2. Mechanical Integrity 3. Hazard Analysis 4. Operating Procedures 5. Safety and Environ. Info. 6. MOC 7. General 8. Emergency Response 9. Training
Deficiencies vs. Good Practices					
	Percentage of 3rd Cycle Audit…				
	Reports	**Deficiencies**	**Good Practices**	**Average Number of cited Good Practices per report**	**SEMS Elements with >50% likelihood of having a cited Good Practice**
Deepwater Operators	27%	13%	41%	9	1. Safe Work Practices 2. Mechanical Integrity 3. Hazard Analysis 4. Operating Procedures 5. Safety and Environ, Info. 6. MOC 7. General 8. Emergency Response 9. Training
Other Operators	77%	87%	59%	5	1. General 2. Safe Work Practices

Tracking and analysis of associated corrective actions

BSEE requires that deficiencies identified in a SEMS audit be addressed by the operator through developing, implementing, and closing out a Corrective Action Plan (CAP). Each CAP must include "the name and job title of the personnel responsible for correcting the identified deficiency(ies)", as well as steps to "effectively address the audit findings" (see 30 CFR 250.1920(d)). BSEE is also authorized to verify the corrective actions are in place and validate that the actions effectively address the audit

findings (30 CFR 250.1920(e)). Accordingly, BSEE requests that each CAP be updated quarterly and resubmitted to BSEE until all identified actions are complete. As many corrective actions involve implementing a procedure or driving a change in safety culture, BSEE recognizes that some corrective actions may take longer periods of completion time. In that case, the progress of the activities taken to implement the change(s) should be included in the CAP updates submitted quarterly to BSEE.

Corrective Actions by SEMS Element

Actions taken to address SEMS deficiencies can take one of three forms; they can:

- change what was observed by the auditor (update a document; fix something in the field)
- revise a procedure and/or focus attention on doing the procedure the way it is/was designed
- investigate and revise aspects of the system that allowed the deficiency to exist (e.g. implement the Check→Act portions of the continual improvement PDCA loop)

Table 5 provides an assessment of the frequency in which these three types of corrective action tasks have been proposed to BSEE to address deficiencies. This analysis only examines the five elements with the most proposed corrective actions; these are the same five elements with the most identified deficiencies. This analysis reflects a judgement as to the scope of the proposed corrective action.

Table 5. Corrective Actions proposed to correct SEMS deficiencies during 2018-2020 Audit Cycle

SEMS Element	Percent of all corrective actions	Types of corrective actions		
		Document and field quick fixes	Improve implementation of SEMS elements	Perform Check→Act Continuous Improvement
Safe Work Practices	19%	45%	35%	20%
Mechanical Integrity	10%	48%	34%	18%
Hazards Analysis	10%	38%	58%	4%
Management of Change	9%	38%	54%	8%
Operating Procedures	9%	44%	45%	11%

Corrective Action tracking – common types of actions

Examples of corrective actions that qualified as “document and field quick fixes” follow:

- Revise confined space policy to (a) reflect current OSHA standards, (b) OSHA 1910 146b definitions;
- Add a place for auditor to sign off on the completion of the evaluation form;
- Review the procedure to specify critical equipment inspection and maintenance frequencies;
- Operator has completed the work order to install grating to walking / working surfaces to prevent injury to personnel;

- Revise SEMS program documents to reflect that Lead Operators will review and approve all new or revised procedures and MOCs; and
- During the audit, the chemical was removed and then stored in a proper container.

Examples of corrective actions that were counted in the "Improve implementation" category follow. Many times, these also involved procedure document updating or reworking. As primary actions were focused on field implementation and improved risk identification, not just document changes, they were included in this category:

- HSE Reps will audit all LOTO logs and ensure the Safe Work Practices (SWPs) are being adhered to; additionally, operators will be further trained in LOTO procedures contained in the SWP;
- MOCs, INCs, actual spills and releases are now evaluated during the Hazards Analysis process;
- Identify and/or develop a system of records to track MOC documents;
- Review operating procedures, determine what emergency evacuation procedures are necessary, update the procedures, issue them, ensure they can be implemented;
- Revise the Mechanical Integrity checklist to help focus on points presenting operations risk; and
- Develop a tracking system within each platform's SEMS tracker to monitor calibrated gauges

Finally, following are examples of how some operators "perform Check→Act continuous improvement" within their CAPs. A big difference between this category and the "improve implementation" category is the recognition that the original system requirements were insufficient to provide needed performance; sometimes a root cause analysis was employed that guided the operator how to address the gap:

- Monthly interval for rigging inspections was found to be insufficient in ability to identify hazards, therefore revise Safe Work Practice to inspect rigging pre-use during each JSA process;
- Use technology enhancement by adding monthly task within compliance management software, specifically to ensure integrity of devices located on the facility including calibration activities and physical equipment inspection; this increases awareness of need to perform certain tasks on a regular basis and hold staff accountable to perform those tasks;
- Update operating procedures to meet the latest Human Performance standards and ensure they include equipment-specific updates to reduce risk of human error;
- Training on the revised processes will be performed, including verification of effectiveness through a combination of examination, practical application, and field observation;
- Develop and utilize risk-based methodology to redefine and drive periodic review processes for both individual consultants employed and contractor organizations; and
- Incorporate / enhance a risk assessment method within the MOC process to aid in prioritizing follow-up actions.

Discussion and Next Steps

The audit reports and CAPs analyzed for this report provide BSEE valuable insights. The purpose of this report is to share those insights with the regulated industry and to guide future discussions on how to further unleash the power of SEMS to drive safety and environmental performance.

SEMS adoption by operators

- Every operator with audit reports were included in this review has developed (and to some extent implemented) their own SEMS version. However, not every company has a robust SEMS approach based on the number and type of audit report findings. Auditors have provided actionable insights to all operators for improving the effectiveness of their individualized SEMS approaches.
- Deepwater operators typically operating larger, newer, and higher production facilities than their nearer-to-shore competitors, appear to have a more robust SEMS approach based on the fewer, more focused audit report findings.
- The biggest challenge for all operators, independent of their operating water depth, appears to be in ensuring consistent SEMS procedures implementation.

SEMS audit processes

The quality of the SEMS audit reports improved significantly during the 3rd audit cycle compared to the prior cycles. However, opportunities exist to improve the SEMS audit process and impacts.

- SEMS audits have been focused on assessing conformance with a 1993 defined management system standard (close to 30 years ago) and a 10-year-old regulation. Accredited auditors are required to review the 17 management system elements defined in these documents and utilize an auditor's checklist included as a reference in early SEMS documents. For the audits to help guide increased effectiveness of SEMS, BSEE and the regulated industry should consider the following changes either via rule-making or voluntary requests.
    - Evaluate (through research and public comment) the applicability and desirability of using updated performance-based management system definitions, requirements, and audit practices, including the 4th edition of API RP 75 (issued in 2019), and adopt updated COS guidance documents that refocus audits on system performance rather than the prescriptive requirements for documents found in the SEMS regulation.
    - Update requirements for SEMS Audit Plans so more attention is paid to performance gaps analysis based on incident history, the development and tracking of leading and lagging indicators by operators, and the sampling by the auditors by risk operation type, especially as their portfolio of operating assets changes.
    - To bring the SEMS audit process closer in practice to other international safety and environmental management system processes, promote that surveillance audits (by the operator, ASP or other independent assessor) be performed as part of the CAP close out process (including an assessment whether the actions that were completed, effectively and systematically addressed the gap originally identified by the auditors).

Corrective action processes

Most CAPs examined during this audit cycle contained potentially impactful action steps; however, the overall corrective action planning and implementation process could be improved by also modifying BSEE's published expectations for CAPs, either by rule-making or voluntary action.

- Recently, the Center for Offshore Safety (COS) issued a guidance document (COS-1-07[5]) to help operators develop and implement CAPs that combine corrections, better implementation, and system improvements addressing root causes for both SEMS deficiencies and performance deficits. Reliance on COS-2-07 could improve the quality of every CAP.
    - The challenge for many operators with numerous deficiencies will be to examine their internal communication and decision-making practices and evaluate if revitalization needs to occur to improve the overall SEMS approach effectiveness; changes to those underlying processes could and should be described as CAP tasks.
    - Operators viewing their SEMS and the audits as compliance mandates and paperwork exercises will have the most difficulty benefitting from their SEMS; BSEE's response to CAP proposals is one way to challenge such operators to view their SEMS more holistically as continual improvement vehicles.
    - Should surveillance audits become routine SEMS practice, they can begin by focusing on operator corrective actions undertaken in response to their SEMS audit.

[5] COS-1-07 Guidance for Developing a SEMS Corrective Action Plan

Appendix 1: Review of 1st Cycle SEMS Audit Reports

ISSUE MEMORANDUM

TO: Brian Salerno, Director July 23, 2014

FROM: Doug Morris, Chief, Office of Offshore Regulatory Programs

SUBJECT: SEMS Program Summary—First Audit Cycle (2011-2013)

I. Introduction

It has been approximately four years since BSEE first promulgated regulations that required regulated parties on the OCS to develop and implement Safety and Environmental Management Systems (SEMS). This performance-based program, the cornerstone in BSEE's move toward a hybrid regulatory approach, is designed to help drive the safety and environmental performance of OCS oil and gas operators and contractors beyond attaining full compliance to BSEE regulations. The BSEE SEMS program, which is modeled after international programs for quality, safety, and environmental management systems, incorporates the elements of API RP 75 to focus both industry's and BSEE's attention, resources, and initiatives on recognizing and managing the impacts of human behavior, organizational structure, leadership, standards, processes and procedures, as well as, an underlying safety culture to promote continuous improvements in safety and environmental performance.

November 15, 2013, marked the end of the first SEMS Audit Cycle. Of the regulated operators, 86% were able to successfully demonstrate through a formal audit that the required SEMS program was in place and being implemented. Only 3 operators, representing approximately 4% of the OCS operators, are still out of compliance. These companies remain under enforcement orders.

The primary objective of our first two years was to establish and drive the implementation of BSEE's SEMS expectations within the regulated community. This was accomplished by requiring the operators to perform audits of their SEMS programs. BSEE used the audits to 1) determine whether the operators had in fact developed (and implemented) a SEMS and 2) to set a baseline for measuring progress, demonstrating a central theme of a management system: continuous improvement.

The SEMS audits were intended to go beyond the traditional facility inspection and issuance of Incidents of Non-Compliance (INCs), as performed in standard BSEE inspections. The SEMS regulations required the audits to review program documents and procedures, and determine whether the programs were implemented.

As the BSEE SEMS regulations represent a shift toward more of a performance-based regulatory model versus the traditional focus on strict compliance, both BSEE and industry had to modify their expectations and approaches around how to demonstrate and verify that the BSEE SEMS

regulations had been implemented. Therefore, our findings and lessons learned from the first cycle of SEMS audits relate to both specific SEMS-related observations and observations of the auditing processes used to verify compliance with the requirements of 30 CFR 250.

II. SEMS-Related Observations

The overall finding of the first cycle of SEMS audits is that OCS operators have implemented a SEMS. However, the current compliance rate of 96%[1] tells only a small part of the story. **The system maturity and level of SEMS awareness and understanding amongst operators vary significantly.** For companies that have long-standing, established internal safety and environmental management systems as part of their corporate culture, the response to the BSEE SEMS regulations generally consisted of mapping their internal program elements to the requirements of 30 CFR 250 Subpart S. More importantly, the requirement to submit a report of their SEMS audit to BSEE gave many companies the opportunity to evaluate their internal programs and processes against a government standard, and reinforce the importance of and commitment to their SEMS program within their workforce. For those organizations where 30 CFR 250 triggered a first effort to develop and implement a formal SEMS, the focus was more on fulfilling the requirements of Subpart S rather than developing a tool to manage their respective operating health, safety, and environmental (HSE) risks.

Because the audit process and reporting formats used by the individual operators varied significantly, and because the level of program maturity directly impacts the methodology used to assess level of implementation and ultimately effectiveness of a SEMS program, a quantitative analysis of the results of the first cycle of BSEE SEMS audits will not produce a meaningful performance assessment. However, recurring trends in performance, areas of strength, and gaps in development and implementation were identified. These include:

- **Emergency Response and Auditing were identified as the best understood, documented, communicated, and implemented SEMS elements among the OCS operating companies**. However, common opportunities for improvement were identified for the design and planning stages of the programs themselves and in the ways companies were actioning findings and lessons learned from their audits or drills.
- **There appears to be a strong focus on the historically important parts of SEMS—** mainly Training and Safe Work Practices while the "management of risk" elements such as Hazards Analysis and Management of Change (MOC) are not as consistently implemented as tools to manage risk.
- **Pre-startup Review observations showed lack of implementation of procedures.** The relatively low number of findings for this element may reflect a potential lack of understanding of the intent of the PSR element.
- **A common observation has been that SEMS elements have been implemented in isolation**, with little definition or recognition of the interactions or interdependencies between elements. For example, a requirement to perform hazards analysis is frequently documented and often referenced as a corrective action, rather than as a "system driver" or as a tool supporting other SEMS elements such as operating procedures or auditing.

[1] 86% responded by the deadline, and an additional 10% have responded to date.

- **The audit results also identified examples in which SEMS elements were implemented without establishing adequate requirements for use.** While Management of Change was widely reported to be implemented with all the requirements for 30 CFR 250 Subpart S met, little evidence was provided to demonstrate that the audited parties had defined when a change will require the use of the MOC process.

III. Audit Process Observations

There was wide variation in the format of the reports submitted to BSEE during this first audit cycle. The variation in audit report format and content, audit methodology,[2] scope of OCS activities, and the maturity of SEMS programs among operators prevents a reliable and valid statistical analysis of audit report results. Further, there were reports of operators conducting multiple SEMS audits to avoid having to report systemic nonconformances to BSEE. Although nonconformances may be a sign of a thorough audit, there was the perception among at least some operators that any nonconformance uncovered during the audit could lead BSEE to consider the operator's SEMS program to be deficient. This multiple audit phenomenon adds to our finding that a statistical analysis of first cycle audit report results is not appropriate.

While the diversity in reporting format follows the management system premise of the operators taking ownership of their SEMS, the variability in audit approaches and reporting format presented challenges in reviewing and interpreting the findings.

- Many of the reports were focused on identifying areas of noncompliance or nonconformance, likely because the regulations require operators to identify "deficiencies." Most reports did not provide sufficient information documenting compliance. However, some operators did report positive findings in addition to nonconformances. These positive findings represent a potential opportunity to identify best practices.
- The audit questions were focused on assessing compliance rather than focusing on successfully reducing or managing risk. Audit protocols required evidence of requirements, e.g., written procedures, and did not support measurement of degrees of implementation or effectiveness. Some auditors, however, provided a qualitative assessment of the operator's manner and degree of implementing particular requirements. These qualitative assessments helped BSEE gain a better understanding of the operator's SEMS program and its level of implementation.
- Some audit reports were submitted as nothing more than a completed checklist with little incorporated information or analysis. The use of compliance checklists, especially when submitted as the audit report, limits BSEE's ability to assess degrees of implementation or effectiveness.
- There was a lack of evidence that effectiveness of the various programs was routinely measured or assessed.

[2] Many audits were performed by independent third-party audit service providers (ASP); however, some audits were performed by the operator. The SEMS II Final Rule requires all audits to be performed by ASPs, but operators have *until* June 5, 2015 to comply with this requirement.

A SEMS audit should involve a review of program documentation, a review of whether the documentation content had been operationalized and implemented, a measurement of the effectiveness of the system, and ultimately an analysis of whether the system as designed is achieving the desired results. Most audit findings from the first cycle of SEMS audits addressed issues related to the quality of documentation or supporting evidence of implementation. More telling, however, were those findings which dealt with program effectiveness. Assessments of program effectiveness were especially informative when the operator had a strong internal HSE management system in place. Unfortunately, the status of implementation and effectiveness of a SEMS could not be assessed from many of the submitted SEMS audit reports because of the lack of evidence in the audit reports. The stage of system maturity was also not measured or described consistently enough to provide insight into how the programs were evolving or of the relative SEMS program maturity across the OCS.

IV. Conclusions

Based on the first cycle of BSEE audits, the general finding is that the current status of SEMS implementation is geared toward compliance. Operators, in general, did not provide evidence that they are implementing SEMS as an effective management tool.

A key learning was the recognition that the maturity of the SEMS program must be taken into account when developing the audit protocols and conducting the audit. By adapting the audit to the level of maturity, the operators and BSEE will be able to assess the progress of implementation, identify those elements that are progressing as planned, and focus on the elements where additional management attention or resources are needed.

We expect that implementation of the SEMS II Final Rule of April 2013, which mandates the use of an accredited third party audit service, will help improve audit quality during the second audit cycle. Operators must comply with the auditing requirements under 30 CFR § 250.1920 by June 5, 2015.

Areas where BSEE will be focusing our attention during the second audit cycle include:

- Encouraging operators to improve audit results through formal and informal dialogue, focusing on reporting best practices as well as deficiencies.
- Establishing expectations for data control to encourage fully supporting the audit findings within the report text.
- Publishing guidance, such as NTLs, for program implementation, auditing and measuring program maturity and effectiveness so that BSEE can more effectively report on progress against baseline criteria.
- Incorporating a SEMS maturity measure or performance indicator into the SEMS audits in order to more realistically assess progress of SEMS implementation and effectiveness both at the individual operator level as well as for the OCS as a whole.
- Continuing to work with Center for Offshore Safety to improve its widely-used audit protocol and encourage a more comprehensive analysis for each item.

- Developing representative leading indicators for SEMS performance, while continuing to track industry accepted lagging indicators for evidence that SEMS programs are driving an improvement in safety performance.
- Using BSEE personnel as audit observers and to independently assess SEMS implementation and overall safety culture of the OCS facilities.
- Engaging operators to discuss recognized best practices and sharing lessons for the benefit of OCS safety, health and environmental performance industry-wide.
- Conducting focused audits on critical process elements.

Appendix 2: Review of 2nd Cycle SEMS Audit Reports

ISSUE MEMORANDUM

TO: Doug Morris, SEMS National Program Manager, OORP October 2, 2017

FROM: Stanislaus Kaczmarek, Chief, SEMS Section, OORP

SUBJECT: Summary — Learnings from Second SEMS Audit Cycle (FY 2015 through 1st half FY 2017)

I. Executive Summary

As described in 30 CFR 250.1900, all lessees and their designated operators are required to "develop, implement and maintain" a Safety and Environmental Management System (SEMS) program. Operators are required to audit their SEMS programs within two years of initial implementation, and thereafter every three years. The 2nd audit cycle concluded in early 2017. This memo summarizes the current status of the SEMS program based on our review of the 2nd cycle SEMS audit reports. Highlights include:

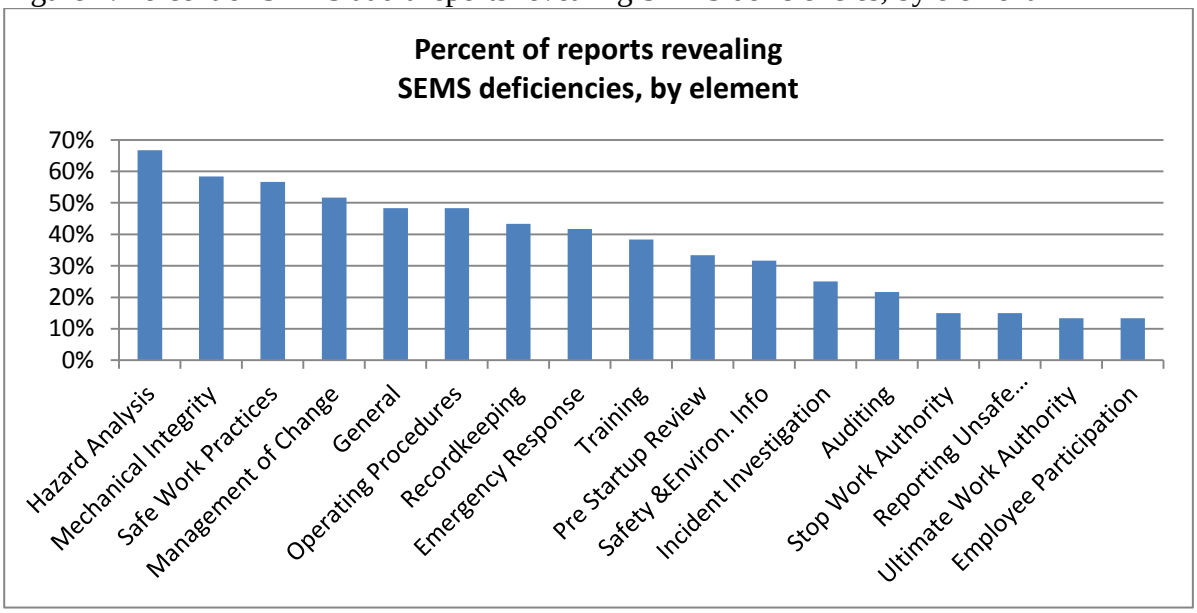
- As we approach the end of the 2nd SEMS audit cycle, the audit findings indicate a cultural/behavioral shift from checking SEMS program development to assessing the effectiveness of SEMS program implementation. This is a positive development.
- This audit cycle marked the establishment of accreditation for third party Audit Service Providers (ASP's). The accreditation program has been successful in helping BSEE address the auditing and reporting challenges we faced during the 1st auditing cycle and ensured more consistent and higher quality audits.
- Companies responsible for more than 85% of Outer Continental Shelf (OCS) energy production demonstrated to the ASP's that they had not only established but also had been implementing and maintaining their SEMS program. Companies in the other 15% were shown to be at earlier stages of SEMS establishment.

Audits performed during the 2nd SEMS auditing cycle incorporated several areas of improvement that were identified during the 1st round. For example, BSEE suggested that ASPs begin to provide a summary statement in their audit reports as to the overall status of SEMS development within each company. As a result, 87% of the 2nd cycle audit reports reviewed for this analysis contained such a summary statement. Another recommendation by BSEE was that a SEMS maturity index be developed and tracked. Accordingly, the Center for Offshore Safety (COS) suggested that SEMS maturity be estimated by looking at where ongoing challenges exist in the sequence of "develop, implement and maintain" activities required by BSEE regulations. Based on the summary statements of the ASP's and this view of how to monitor SEMS maturity, approximately 65% of the OCS operators had established and have been implementing their SEMS in a systematic (though not necessarily perfect) way, whereas approximately 22% of OCS operators at the time of their audit were still focusing on establishing and communicating their SEMS programs, documents, and procedures. The remaining 13% of company audit reports did not contain any summary statement.

BSEE's analysis of the earliest audit reports generated during the 1st cycle from 2012-2014 led to a conclusion that a statistical analysis of the individual findings was not appropriate based on inconsistencies in auditing approaches, reporting formats and statements of findings. Since then, COS' ASP accreditation program has resulted in a more structured planning, auditing and reporting process. This led to an improvement in the quality of the information and insights contained in the 2nd cycle audit reports and allowed BSEE to perform a more thorough review of the findings and to compile insights on the industry-wide status of SEMS.

BSEE spent considerable effort during this reporting cycle promoting higher consistency in how audit findings were classified. This allowed BSEE to focus its primary analysis on deficiencies rather than opportunities for improvement.[1] Deficiencies are those findings where a SEMS element either has not been fully established, consistently implemented or routinely maintained such that it risks not be successful in managing identified risks. Figure 1 presents the relative rankings of deficiencies for all of the individual SEMS elements.

Figure 1. Percent of SEMS audit reports revealing SEMS deficiencies, by element



This analysis indicates that long-established processes such as Incident Investigation and Auditing appear to be well understood and widely implemented as part of company SEMS programs. This is similar to the more qualitative conclusion reached in BSEE's prior review of the 1st cycle of SEMS audits. In addition, it appears that the newest SEMS requirements (Stop Work Authority, Ultimate Work Authority, Reporting Unsafe Working Conditions, and Employee Participation Plans) are widely understood and have been readily adopted. On the other hand, Hazards Analysis (which includes the Job Safety Analysis requirement), Mechanical Integrity, Safe Work Practices (which includes Contractor Management), and

[1] COS-2-03, Requirements for Third-party SEMS Auditing and Certification of Deepwater Operations, incorporated by reference in 30 CFR 250.198, defines three types of audit results: "Nonconformity," "Concern" and "Opportunity for Improvement (OFI)." BSEE considers both Nonconformities and Concerns as "deficiencies." All deficiencies are required to have a Corrective Action Plan (CAP). BSEE also at times challenged inappropriate uses of the OFI category, occasionally leading to reclassification of that finding as a deficiency.

Management of Change (MOC) represent the SEMS program elements in which more than 50% of the 2nd cycle audits still identified a need to improve the design, implementation and/or maintenance of their SEMS program. An analysis of the specific findings suggests that more emphasis needs to be placed by operating companies and their contractors within the context of their SEMS, to identify all process safety risks in addition to crafting the processes and maintaining equipment needed to prevent a process safety mishap.

The improved auditing and reporting process also provided more descriptions about the nature of each deficiency, allowing us to classify each as a design need, an implementation need, or a maintenance need. Though design and implementation deficiencies were noted in every SEMS element, five SEMS elements stood out as needing to provide the majority of focus on consistent implementation: Safe Work Practices, MOC, Recordkeeping, Pre Startup Review, and Stop Work Authority.

Approximately 60% of the audit reports in this cycle also called out at least one good practice that the ASPs witnessed. Most were in the General element where ASP's recognized many companies' leadership for their commitment to SEMS as well as their embrace of safety culture initiatives.

Our review of both the strengths and deficiencies from the 2nd cycle audits lead us to recommend that industry should increase their focus in the following ways to increase the value of their SEMS in preventing incidents:

a) Reinforce the need to consistently follow their SEMS procedures and adhere to their policies e.g. improve operational discipline for all SEMS elements.
b) The 2nd round of SEMS Audit Reports do not provide adequate insight as to what aspects of operations SEMS is being successfully applied to, and which types of operations lack adequate SEMS focus. Accordingly, BSEE will look for 3rd cycle Audit Plans submitted to BSEE for review by companies and ASP's, to be explicit in their facility sampling plan about which activities that are being performed by that operator such as exploration, drilling, well workover, production, abandonment and decommissioning, will be assessed.
c) Check that the policies and procedures within each SEMS program achieve the performance results, safety behaviors and cultural improvements they were designed to achieve.

Finally, after BSEE reviews and accepts a CAP, it continues to monitor and verify the company's corrective actions that result from these audits. Further, BSEE will be tracking performance metrics, especially rates and severity of incidents, and assessing if previously identified SEMS deficiencies and current corrective actions, are guiding operators to improve their underlying systems. When there is a disconnect, BSEE will consider using its "Directed Audit" authority to help both the operator and BSEE explore previously unidentified systematic gaps that may be contributing to reported incidents and non-compliance events.

II. Introduction

Our last program summary provided in July 2014 described the importance of the SEMS program to the BSEE regulatory oversight approach[2], and outlined what we had learned from an examination of the 1st audit cycle reports submitted to BSEE from Fiscal Years (FY) 2011 through 2014. At that time, we had found that 96% of the operators had a SEMS Plan though they were at varying stages of compliance. This was based on BSEE's evaluation of the reports which overall assessed compliance with the design of the different SEMS elements that were required to be in place at that time, but provided little insight into the level of implementation or the effectiveness of these elements. Our analysis also led BSEE to identify the SEMS elements that appeared to be best understood (Emergency Response, Training, Auditing and Safe Work Practices), that lacked consistent implementation (Hazards Analysis and Management of Change), and that had few deficiencies possibly showing a lack of understanding of the intent of the element (Pre-Startup Review).

During the 2nd audit cycle which spans FY 2015-2017:

- the SEMS II elements became a regulatory requirement,
- BSEE recognized COS as an Accreditation Body (AB),
- COS as an AB began to hold ASPs to account for their adherence to quality auditing standards,
- BSEE continued its work with COS to improve the consistency of auditing approaches and to standardize reporting formats,
- BSEE published several Regulatory Interpretations on BSEE.gov to clarify expectations for how to categorize and report on audit findings, and
- industry and BSEE expanded their dialog through various forums including the Task Group to revise API RP 75, to identify additional opportunities to improve the effectiveness of the SEMS regulation and the way BSEE enforces it.

As this cycle is concluding, BSEE is also beginning to utilize its Directed Audit authority under §250.1925 to help both the operator and BSEE explore previously unidentified systematic gaps that may be contributing to reported incidents and any series of non-compliance events.

The purposes of this memo are to:

- summarize insights gained from a review of the second cycle SEMS audit reports,
- characterize the maturity of SEMS implementation, industry wide,
- indicate how most OCS oil and gas operators appear to have refocused their SEMS tools towards more effective risk management,
- highlight how the audit information provided to BSEE has improved, and
- outline where SEMS implementation overall may benefit from more BSEE guidance.

[2] The July 2014 memorandum stated, "This performance-based program, the cornerstone in BSEE's move toward a hybrid regulatory approach, is designed to help drive the safety and environmental performance of OCS oil and gas operators and contractors beyond attaining full compliance to BSEE regulations."

III. Background – Applicability and Scope of SEMS Expectations

BSEE requires that all lessees and their designated operators develop, implement and maintain a Safety and Environmental Management System (SEMS) program (§250.1900). The goal is to promote safety and environmental protection by ensuring all personnel aboard a facility are complying with the policies and procedures identified in their SEMS (§250.1901). Audits conducted by accredited Audit Service Providers (ASPs) provide BSEE with insights into how well each SEMS is functioning; such audits are required to be performed and shared with BSEE within 2 years of the start of operations, and every 3 years thereafter (§250.1920).

In the first audit cycle between 2011 (when the SEMS regulations first became effective) and the end of FY 2014, BSEE received eighty-three (83) SEMS audit reports from a field of 84 operators believed to be subject to SEMS regulations. Since that time, bankruptcies and industry consolidation have reduced the number of operators on the OCS subject to the SEMS regulations to no more than sixty-seven (67). This is reflected in receipt of SEMS audit plans and reports, as follows:

- A total of sixty-three (63) "second-cycle" audit reports were or will be received during Fiscal Years 2015, 2016 and 2017, all associated with the regulatory requirement for an audit to be repeated in a 3-year cycle.
- Four (4) new operators began operating on the OCS since FY 2015; their first SEMS audit reports are expected to be received by BSEE starting in FY 2018.
- Zero (0) operators with active operations have been remiss in their obligation to perform a 2nd cycle SEMS audit. It should be noted that one (1) operator performed their SEMS audit only after being cited by BSEE that they had passed the regulatory deadline for starting their audit.

In addition to regularly scheduled audits required by regulations, SEMS audits can be required through use of BSEE's Directed Audit authority (§250.1925), under a court order as part of a plea agreement with the US Department of Justice, or voluntarily by any company. Two (2) such reports are included in this analysis. In these applications, an operator is typically requested to conduct a focused audit of specified processes, activities or programs for the purpose of verifying whether the appropriate SEMS elements are in place and then validating that the SEMS elements are achieving the anticipated results

While the 2nd round of audits were being planned and conducted, the SEMS II regulatory requirements were becoming effective in two stages:

- Starting June 2014, each OCS operator was expected to have incorporated additional processes and procedures into their SEMS such as Stop Work Authority, Ultimate Work Authority, Employee Participation, Reporting of Unsafe Work Conditions, and a more rigorous Job Safety Analysis (JSA).
- Starting June 2015, the requirement for audit teams to be led by Audit Service Providers (ASP's) who were accredited by a BSEE recognized Accreditation Body (AB), also became effective. On June 6, 2015, BSEE approved an application from the Center for Offshore Safety (COS) to be an AB.

While the industry consolidation and regulatory changes noted above were underway, BSEE continued to collaborate with industry groups, other US government agencies and individual

operators to not just comply with BSEE SEMS regulations, but to comply effectively, allowing continuous improvement in the effectiveness of their approaches to risk management. BSEE also issued several Regulatory Interpretations on its website to respond to questions from industry and provide clarification on a timely basis regarding SEMS.

Because these changes were occurring during this auditing cycle, the audit reports received during FY 2015-2017 should not be viewed as one homogenous or static group. Many companies' management processes were maturing, changing and "continuously improving" during this 3 year period, ASPs were coming under stricter oversight by the AB, and BSEE itself was honing its messaging and enforcement activities. Still, a review of the sixty (60) audit reports received by BSEE through March 2017 demonstrate that SEMS is being adopted by the industry in ways that indicate a move beyond the need to have a documented management system. Based on ASP observations and BSEE discussions with industry, more companies are using their SEMS to strengthen existing operating and management procedures and to improve their risk management activities. Conclusions provided by the ASPs in their audit reports also indicate that the SEMS programs themselves are maturing[3].

IV. Analysis of individual second-round SEMS Audit Findings[4]

In the 60 audit reports analyzed for this memorandum, BSEE reviewed over 1000 findings. ASP's classified approximately 47% of these findings as Deficiencies[5]. Deficiencies are those findings where a SEMS element either has not been fully established, consistently implemented or routinely maintained such that it risks not be successful in managing identified risks. In addition, 28% of the findings were classified as Opportunities for Improvement (OFIs), and 25% as Good Practices.

Whenever an ASP identifies a Deficiency, the operator is required to inform BSEE within 60 days of completing the audit via a Corrective Action Plan (CAP) on how they are going to address it, as well as notify BSEE when those corrective actions are completed.[6]

Looking deeper into the deficiencies identified during this 2nd audit cycle, they spanned all seventeen (17) SEMS elements (see Figures 1 and 2[7]). When we talk about SEMS elements, we are referring to the components and approaches that the SEMS regulation requires be incorporated into the definition and implementation of each management system. No one element by itself is adequate to control risks, rather it is the way that operators mix, blend and deploy the tools that each SEMS element provides that can allow risk to be managed

[3] Per COS, the maturity of a SEMS is believed to increase as emphasis moves along the path of established → implemented → maintained → continually improved. Companies who have demonstrated successes beyond the establishment of a SEMS are considered to be maturing.

[4] Numbers and percentages provided in this assessment should not be viewed as absolutes, but rather as indicators of relative importance based on an assessment of variable data from a variety of audit teams

[5] At times, an ASP finding would list multiple deficiencies in a single finding. For purposes of this analysis, BSEE counted such findings multiple times when different types of actions would be required to address it, e.g. once if it was a deficiency in the design of a SEMS element, and twice if it also described a deficiency in the implementation or maintenance of that same element.

[6] Finding SEMS "deficiencies" is to be expected, especially in a complex environment such as OCS energy production, and commitments to correct them are welcomed as the first step to continuous improvement.

[7] The count of deficiencies shown in Figure 2 reveals a slightly different distribution of deficiencies than revealed in Figure 1, because some reports list multiple deficiencies per element.

effectively. Thus a deficiency in the design or implementation of one element may be offset by the way another element is deployed. However, for purposes of this analysis, we analyze deficiencies by the individual elements and not by the interaction between each element.

The fewest deficiencies (7%) were reported in the four elements added by the SEMS II regulations; this includes Stop Work Authority (SWA) (§250.1930) and Ultimate Work Authority (UWA) (§250.1931). However, based on anecdotal feedback from BSEE inspectors and incident investigators, there are concerns that SWA may not be implemented as routinely as ASPs recorded. This is similar to the observation made during the 1st cycle audits, where the lack of findings or observations was sometimes believed to be more an indication that the program element was either not fully understood or that the auditors observed only an unrepresentative subset of operations rather than that the element was well established and consistently implemented.

The most deficiencies (60%) were reported in six long-standing SEMS elements: Safe Work Practices, Hazards Analysis, Mechanical Integrity, General (policy and leadership), Operating Procedures and Management of Change. What made these elements deficient is explored below.

In order to determine what made each element deficient, the description of each deficiency was further analyzed to determine if it reflected a need to develop, implement or maintain that element of SEMS. As described in the first sentence of the SEMS regulation (30 CFR 250.1900), there are three basic expectations for SEMS.

- When we talk about "develop" we refer to the written design of a SEMS element and whether it covers all of the risk areas in which it needs to be applied.
- When we talk about "implement" we refer to whether an element is being applied as designed and is being applied everywhere and every time it is intended to be applied.
- When we talk about "maintain" we refer to the action of determining whether the element as designed and as implemented is effective; also, when an element is not as effective as intended, are steps being taken to improve its design or its implementation.

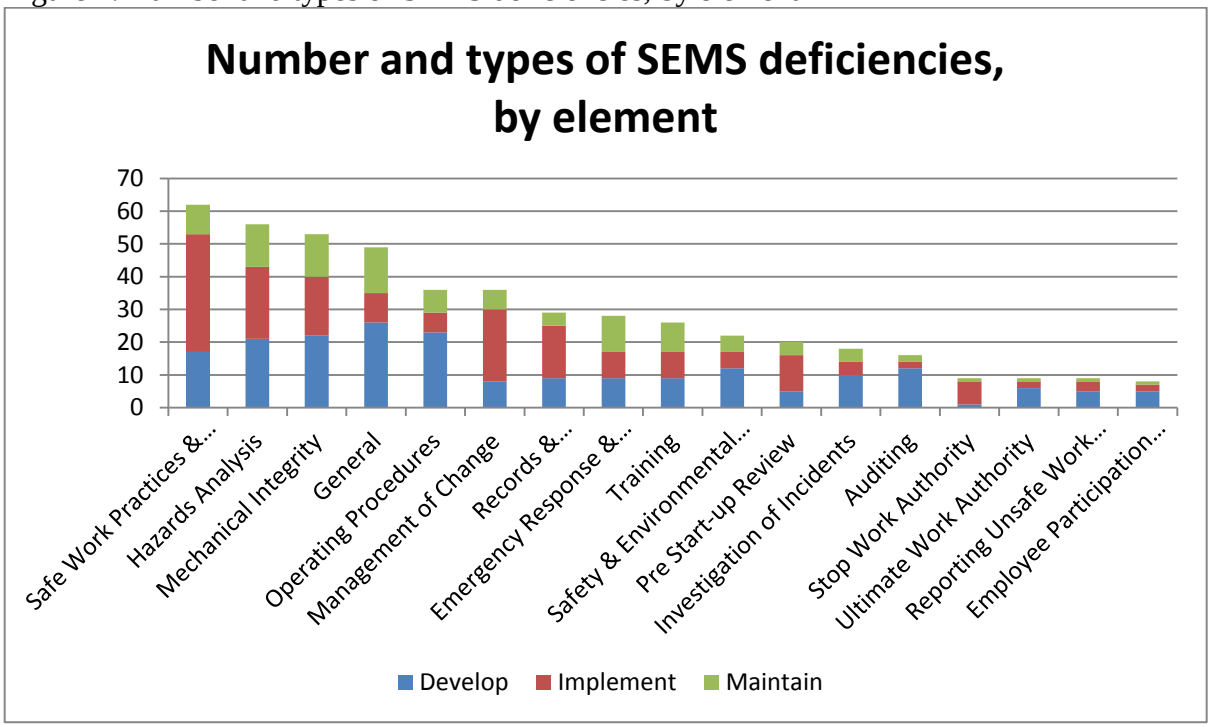
Overall, slightly more than 40% of all deficiencies reflected a need to improve the design of an element, slightly fewer than 40% reflected implementation inconsistencies, and approximately 20% noted lapses in finding and fixing design and implementation inconsistencies.

Applying this analysis to the six elements where most of the deficiencies were noted:

- General (leadership and policy) and Operating Procedures – when deficiencies were noted, the majority reflected inadequate scoping and availability of company policies and operating procedures for some of the risk areas audited by the ASPs
- Safe Work Practices (SWP) and MOC – the majority of deficiencies reflected inconsistent implementation of the tools as designed, especially to the contractor community which is covered under SWP
- Hazards Analysis and Mechanical Integrity – the deficiencies are more evenly divided between design inadequacies and implementation inconsistencies. The concerns raised under Hazard Analysis indicate that not all hazards are being routinely identified, and that there is inconsistent use of the JSA tool to ensure workers are aware of the hazards they could encounter. Under Mechanical Integrity,

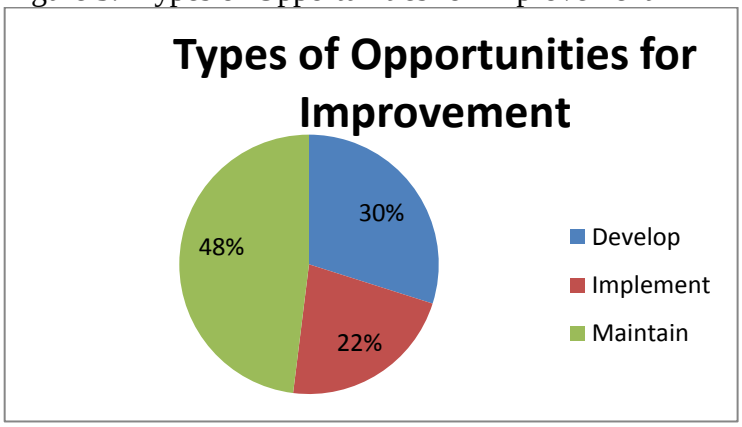
concerns were raised about identifying and implementing maintenance needs for all critical equipment. This suggests that there is a need for more emphasis on identifying and preparing workers for process safety risks in particular, and in ensuring that equipment needed to maintain process safety is known and kept in working condition.

Figure 2. Number and types of SEMS deficiencies, by element



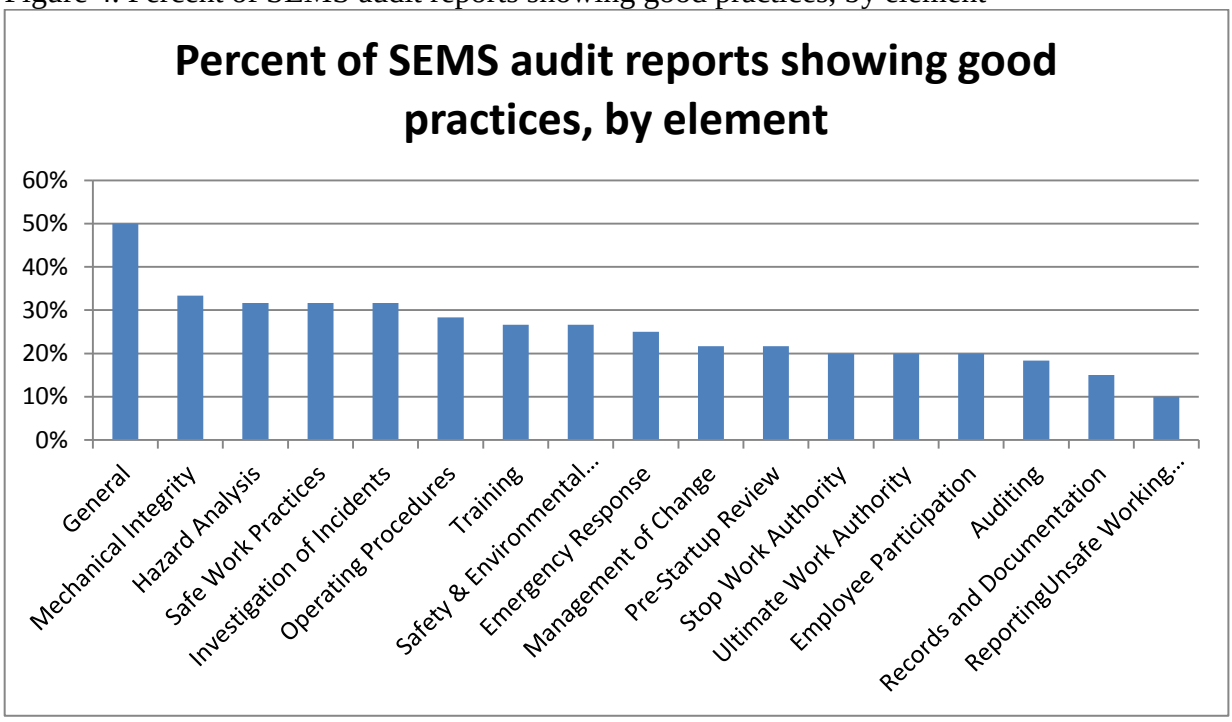
A similar analysis was performed on findings classified as Opportunities for Improvement (OFIs). OFIs do not rise to the level of a deficiency because the ASP concluded that the SEMS element was being successfully applied and was successfully managing the identified risks. Rather, OFIs could be identifying paths for continuous improvement in levels or efficiency of risk management. Figure 3 indicates that the greatest opportunity for continuous improvement in SEMS may be in improving the way that effectiveness of a SEMS element is determined and then acting to improve it, i.e. "maintaining" the SEMS elements using the jargon of the SEMS regulation.

Figure 3. Types of Opportunities for Improvement



Finally, an analysis of the Good Practices noted by the ASPs (Figure 4) indicates that most good practices are in the General element which requires management involvement and responsibility for SEMS performance. Indeed ASPs recognized half of the companies they audited for leadership commitment and for their embrace of safety culture initiatives. It is hoped that this commitment will lead to improvements in the consistency and effectiveness of SEMS implementation as their programs mature, and that such improvements will be reflected in future performance metrics.

Figure 4. Percent of SEMS audit reports showing good practices, by element



V. Analysis of Company Approaches to SEMS

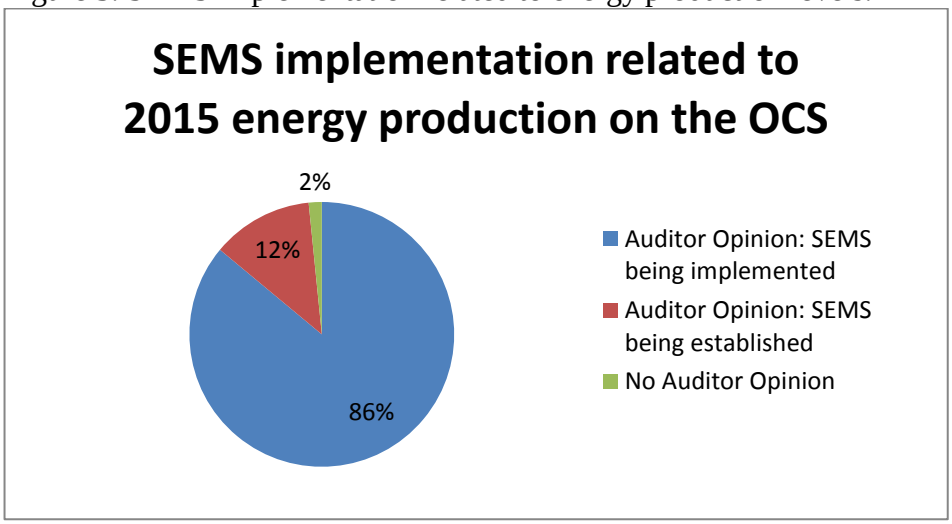
During this second round of SEMS audits, BSEE had requested that ASP's provide a summary statement or "auditors' opinion" on the overall implementation of each SEMS. Such statements were expected to describe how well the management system elements were integrated with each other and also within the company culture. Such statements may be used also provide an initial indication of company maturity.

Of the 60 reports evaluated for this memo, 87% included an auditor summary statement. The majority of these (65% of all reports) concluded that a SEMS had been established and was being implemented routinely by the organization they had just audited. A minority of the reports (22% of all reports) concluded that a SEMS was still being developed and rolled out within the company. Thirteen percent (13%) contained no summary statement.

While many of the 13% of ASP reports without an Auditor's Opinion were received early in this 2nd cycle before the expectation for such statements was widely known, Figure 5 reveals that these companies also accounted for only 2% of the energy production on the OCS in

barrel of oil equivalents (BOE). It also shows that the companies responsible for over 85% of OCS energy production (based on calendar year 2015 production values) demonstrated to the ASP's that they had not only established but also had been implementing and maintaining their SEMS program.

Figure 5. SEMS implementation related to energy production levels.



Finally, it is interesting to note that when ASPs concluded a company was still establishing its SEMS program, they identified over 12 deficiencies per report on average. However, when the ASP assessed that a company's SEMS was well into SEMS implementation, they identified less than 7 deficiencies per report, on average.

V. Conclusions

The analysis of 60 SEMS audit reports submitted to BSEE between October 2014 and March 2017 reveals that the quality of the reports has improved from the first round of audits allowing us to provide a better analysis of the status of SEMS across the industry. This is the result of an improved auditing process, in part thanks to the adoption of the Accreditation Body program through which auditing and reporting standards have been developed and are being enforced. Indeed the amount and quality of information in the reports shared with BSEE has begun to reveal a natural separation in the levels of development and implementation of the SEMS program across the industry. This will hopefully form the basis of a future maturity index.

Opportunities for improvement also exist in the auditing process. For example, it is difficult to tell from the current audit reports what types of operations SEMS is being successfully applied to, what types of operations have SEMS challenges, and whether SEMS is being applied successfully to manage both routine risks and process safety risks. One improvement in the auditing process would be to focus future audits on the aspects of operations where risks are highest, there is high volume of reported accidents/incidents, or where there are more concerns about the effectiveness of SEMS. The reports that are generated could then reveal where SEMS is working and where it is not. In other words, doing a general SEMS audit over and over again will not provide as much actionable insight

the second and third time the audit is conducted. Rather BSEE would support using the third round of audits to do focused SEMS assessments in one or more of the activities that each operator is involved in (e.g. exploration, drilling, construction, production, well maintenance, and decommissioning), on top of a review of how all elements are being applied in general. After all the purpose of the SEMS audit program is to create insights that are of value to the operator. Similarly, if BSEE identifies performance challenges based on incident reports it receives, and those challenges appear to be related to ineffective SEMS applications that are not being addressed through the Corrective Action Plan process, BSEE can consider using its Directed Audit authority to require a focused SEMS assessment outside of the regular audit schedule.

Finally, regarding the application of SEMS by operators, the types of deficiencies identified in the second round of audits reveals that while programs have been developed for all the SEMS elements, sometimes the designed programs do not have in scope all of the operations being undertaken. In addition, the designed SEMS programs are not always being implemented consistently as designed, in particular when managing contractor activities. Where operators acknowledge such challenges and work to address them, they could ask to focus future audit activities on determining the effectiveness of their revised approaches, again on top of a review of how all SEMS elements are being applied in general.