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INSIGHTS | FEBRUARY 2019

Global Trends in Energy Risk Recommendations

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Global Trends in Energy Risk Recommendations

CONTENTS

Foreword

Energy companies always need to be vigilant about improving their risk profiles and maintaining high safety standards.

For more than 25 years, Marsh has used a proprietary risk ranking system that provides an absolute measure of risk quality when compared against a defined set of criteria. As part of our assessment we also provide our clients with risk improvement recommendations (RIRs), which identify areas of deviation from industry good practice. *Global Trends in Energy Risk Recommendations* examines global, regional, and large company trends in light of these recommendations to identify areas of risk that require the greatest levels of attention.

Software is the most cited area for risk improvements, accounting for more than 50% of all recommendations in 2018. The remaining categories — hardware and emergency response — each accounted for just under a quarter.

There are also regional differences between the Middle East and North America. Software is the most cited category in both, but to a higher degree in the Middle East, with emergency response accounting for nearly a third of recommendations in North America. This year we also looked at "supermajors", the largest players in the energy sector, and found their results align closely with those in North America.

We hope this study helps to foster discussion and improvements to loss prevention efforts within the energy industry. And if you have any questions, please feel free to reach out to your Marsh representative.

Benchmarking Global Improvement Recommendations

To help clients understand and improve their risk profiles and reduce the occurrence and magnitude of losses, Marsh's risk engineers survey key energy assets such as refineries, petrochemical sites, and gas processing plants. A principal aim of these surveys is to enhance organizations' risk profiles by issuing risk improvement recommendations.

Global Trends in Energy Risk Recommendations examines more than 4,000 recommendations that were made through more than 700 surveys to extract key insights into localized behaviors, trends, and improvement areas, which will help decision makers recognize and remediate risk.

We categorize our recommendations for improvement in the following areas:

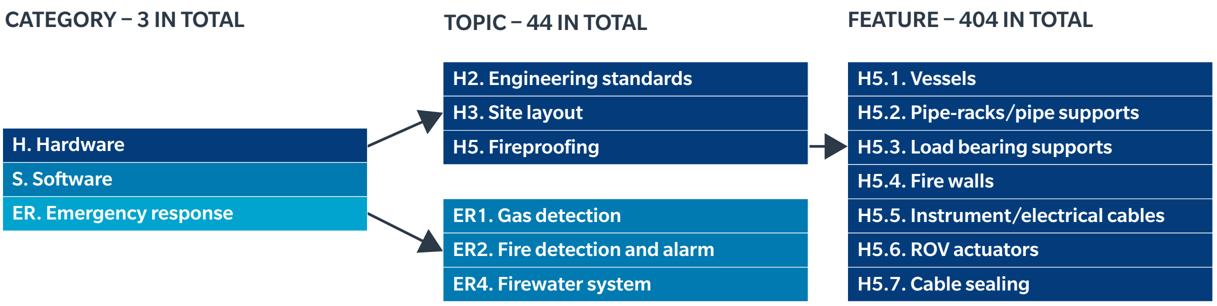
1. Hardware.
2. Software (management systems).
3. Emergency response.

Within each of these categories, recommendations are categorized further into topics and features (see Figure 1). This allows us to dive deeper as we move from broad categories to more detailed topics to the even more granular features. For example, within the hardware category is a topic on fireproofing. Within this topic, engineers will examine specific features such as pipe racks and fire walls. (Supporting information on the make-up of the recommendation database can be found in the Appendix.)

FIGURE 1

Example of categorization within the risk ranking database.

SOURCE: MARSH

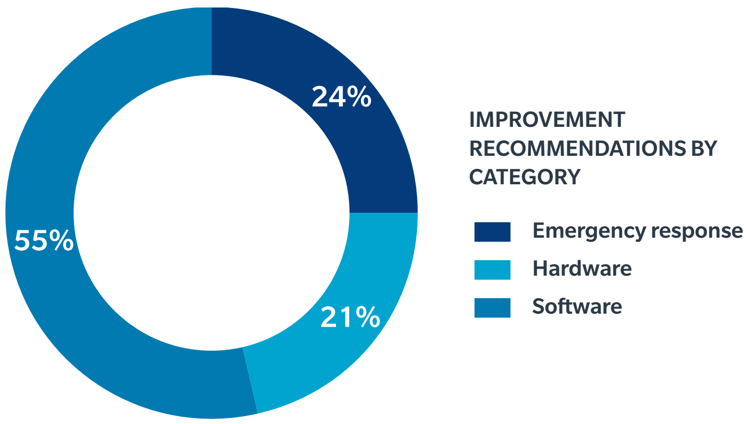


Global Round Up

FIGURE 2

Category: Software recommendations are the most common globally.

SOURCE: MARSH



Globally, the software area accounts for more than half of all recommendations (see Figure 2). This is to be expected for several reasons:

- Software failings are the most cited root cause of losses in the energy industry (in the past they have been widely categorized as human error). Whether this manifests itself in failings in permit-to-work systems, isolation practices, management-of-change systems, or training and competence, poor management systems feature heavily as root causes among the major losses in the hydrocarbon industry.
- Software risk control features can be considered barriers to the occurrence of loss events, whereas emergency response risk control features involve barriers designed to minimize impact. Efforts to improve software will generally reduce the frequency and severity of incidents, while recommendations in other areas may only reduce severity.
- Software aspects are often quicker and more cost-effective to improve compared with most hardware or emergency response related changes. Software-based recommendations often provide the highest return on investment for risk reduction opportunities.

Visits to sites not previously surveyed often highlight easy-to-remedy hardware recommendations that, when implemented, can quickly improve a facility's risk profile. Examples of such recommendations include those related to obvious variations in fireproofing protection (such as isolated pipe supports missing fireproofing) or poorly designed drains/sampling piping associated with pressurized tankage. Over a number of years, opportunities to easily improve hardware arrangements are harder to spot, and recommendations more often involve improvements to software.

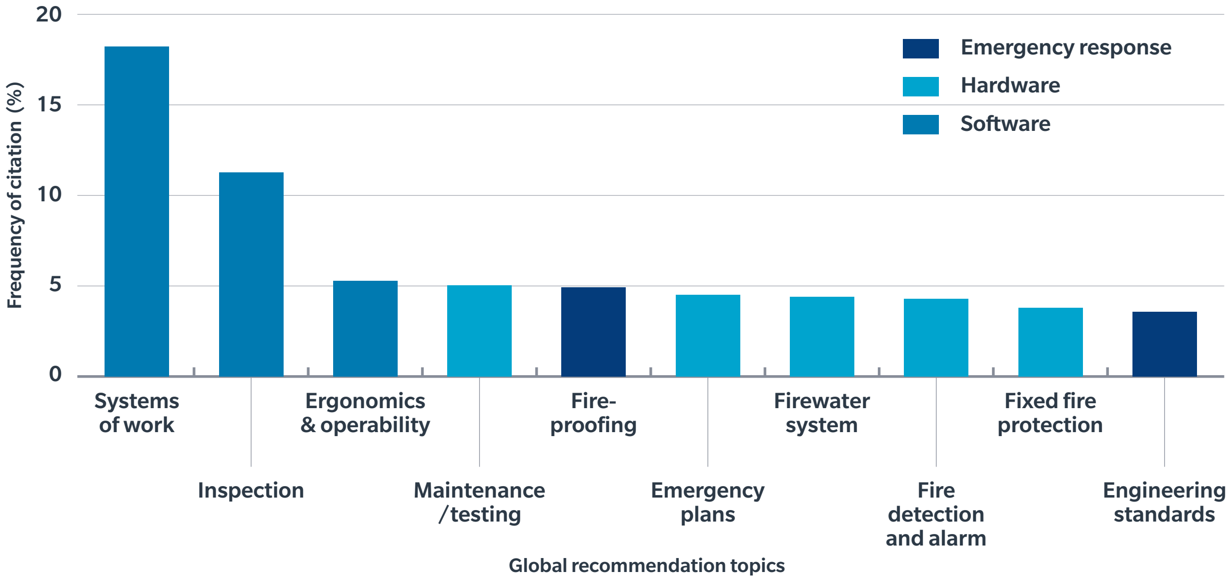
Emergency response recommendations are typically split between software failings (for example, failure to control critical firewater main valves and failure to adequately plan or simulate emergency events) and hardware failings (for example, inadequate separation between process hazards and firewater pumps, or lack of robustness of electrically driven firewater pumps connected to site power systems). This category is counted separately due to the criticality of effective emergency response measures in the eyes of underwriters.

Software-related recommendations provide the highest return on investment for risk reduction opportunities.

FIGURE 3

Topic: Systems of work is the most cited global recommendation.

SOURCE: MARSH



The top 10 topics globally are led by systems of work, a software topic that includes features such as work permits, shift handover, isolation control, management of change, and the defeat of safety critical systems (see Figure 3). This reflects the frequency with which these subjects are cited in loss analysis reports and their critical importance to the safe operation of energy facilities.

The second most commonly cited topic, inspection, covers all aspects of process equipment inspection, such as staffing and competence of the inspection department, philosophy, data analysis, and specific tools and techniques used as part of the inspection process. Risk engineers increasingly recognize the importance of this topic. A recent study by the Lloyd's Market Association concluded that "mechanical integrity failure'" was responsible for 43% of manmade losses.[1] We recommend that operators give the highest focus to the effectiveness of inspection-based barriers.

1 Lloyd's Market Association. *An Analysis of Common Causes of Major Losses in the Onshore Oil, Gas & Petrochemical Industries: Implications for Risk Engineering Surveys*, available at http://www.lmalloyds.com/LMA/Underwriting/Non-Marine/Onshore_Energy/Onshore_Energy_Wordings/Common_Causes_of_Losses_in_the_Oil%20_Petro_Industry.aspx, accessed 3 August 2017.

Improvements in these topics can significantly improve an energy company's overall risk profile in the view of underwriters.

The remaining topics featured in the global top 10 are key drivers of risk, and improvements in these areas can result in real reductions in risk.

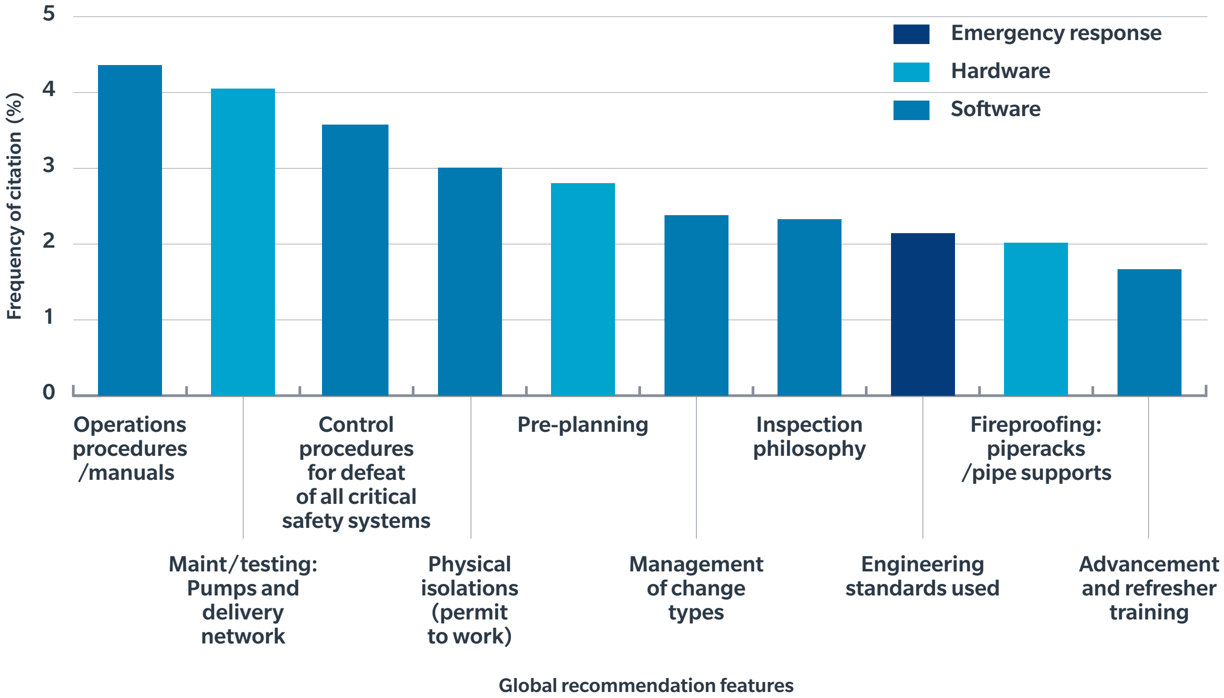
Analysis has shown that the number of recommendations on both systems of work and inspection topics has been increasing compared with topics such as fireproofing and engineering standards. Together with the previously discussed increase in the prominence of inspection as a key preventative barrier, this is likely to be due to the increasing and more consistent use of international engineering standards (such as ISO and API), which effectively reduce variability in standards of construction and engineering protections around the world.

We recommend that operators give the highest focus to the effectiveness of inspection-based barriers.

FIGURE 4

Feature: Providing operating procedures and manuals tops the list globally.

SOURCE: MARSH

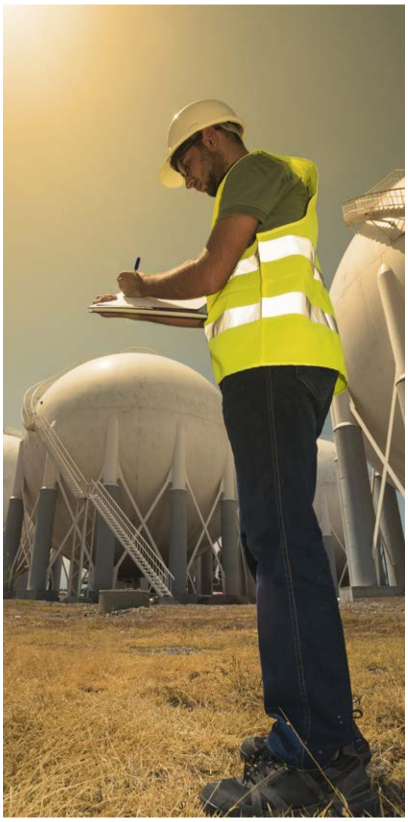


The most detailed analytical level our risk engineers track is known as the feature level. The most common feature is provision of procedures and manuals, which is basic good practice and should be attainable in all sites (see Figure 4). Good practices include providing operators with procedures and manuals that are vital to safe and reliable operations and effective incident response. These documents should be:

- Inclusive of standard operating procedures, emergency response procedures, piping and instrumentation diagrams and other technical documents required (for example, single-line diagram, cause and effect charts, and fire pre-plans).
- In hard copy and available instantly in a power/telecommunications outage.
- Located where they are needed most, which is almost always the central control room.
- Recent and inclusive of all modifications from the point of commissioning via mark-ups of construction drawings.
- Subject to a written definition: what is required to be kept, in what state, and where.
- Subject to programmed checks by management, supervision, and/or process safety personnel.

These requirements are straightforward to verify and act upon, and are a key improvement area given the continuing high occurrence of the recommendation.

The remainder of the features reflect key underwriter concerns with energy facility operations.



Hardware standards in the Middle East approach the top quartile of performance.

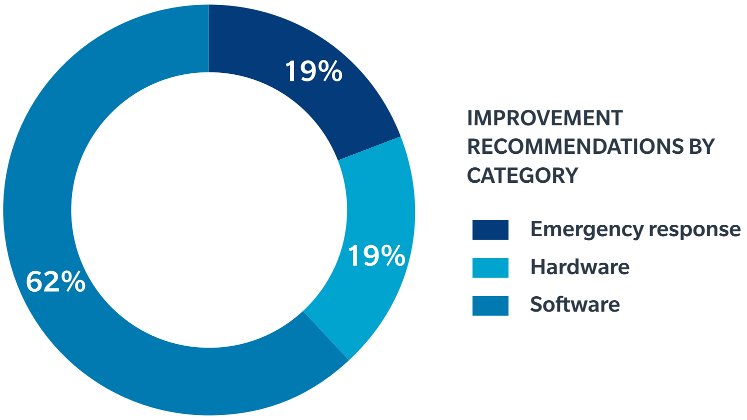
The Middle East

Regional Focus

FIGURE 5

Category: Software recommendations are more frequent in the Middle East.

SOURCE: MARSH



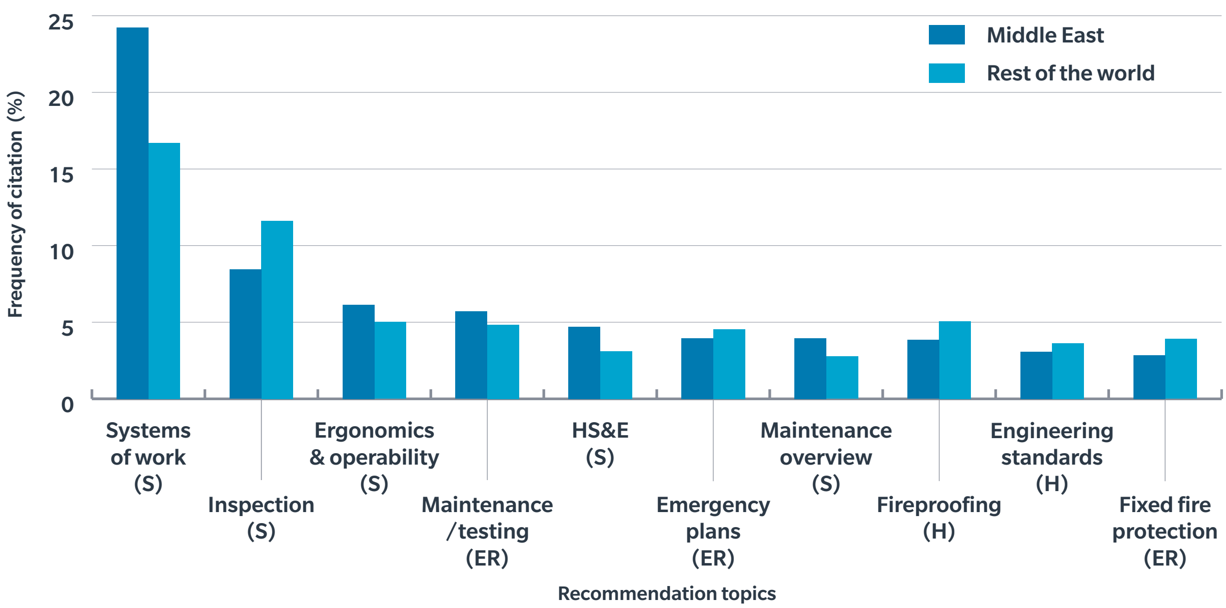
Recommendations at the category level in the Middle East are highly skewed toward software, which accounts for 62% of all recommendations, compared to 55% globally (see Figure 5). This is largely attributed to energy companies' diligence in this region in implementing earlier hardware recommendations. At the same time, many facilities are relatively new and incorporate many hardware best practices.

Hardware standards in the region have been seen to approach the top quartile of performance. Conversely, software scores are in the lower-middle quartile, compared to global scores. This opportunity for improvement is reflected in the high proportion of software-related recommendations.

FIGURE 6

Topic: Systems of work recommendation are higher in the Middle East.

SOURCE: MARSH



Similar results are found when comparing the Middle East to other regions at the topic level (see Figure 6). For example, the frequency of systems of work recommendations is significantly higher in the Middle East than it is elsewhere. Conversely, recommendations made on inspection and fireproofing are less frequent in the Middle East, possibly due to the relatively new age of the region's facilities. For example, newer facilities are built to modern and risk-adverse standards, typically providing additional passive fire protection.

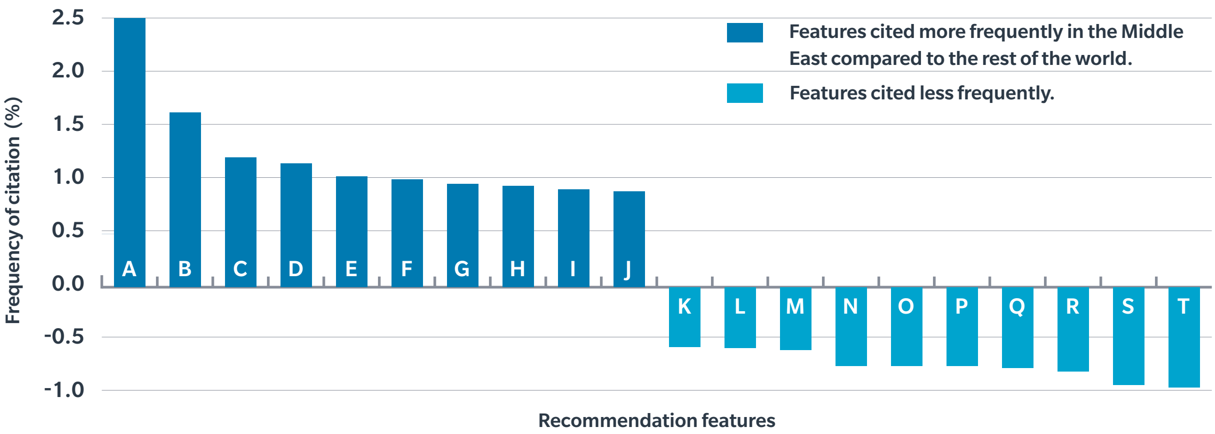
Several specific factors are suggested as generally driving the lower incidence of inspection recommendations in the Middle East. These include a low number of inspection backlogs due to high labor availability among non-destructive testing technicians, a high level of management focus on inspections, and the generally dry climate leading to fewer problems with external corrosion, including corrosion under insulation.

62% of all recommendations in the Middle East are software-related.

FIGURE 7

Features showing greatest frequency: Difference between the Middle East and rest of the world, top and bottom 10.

SOURCE: MARSH



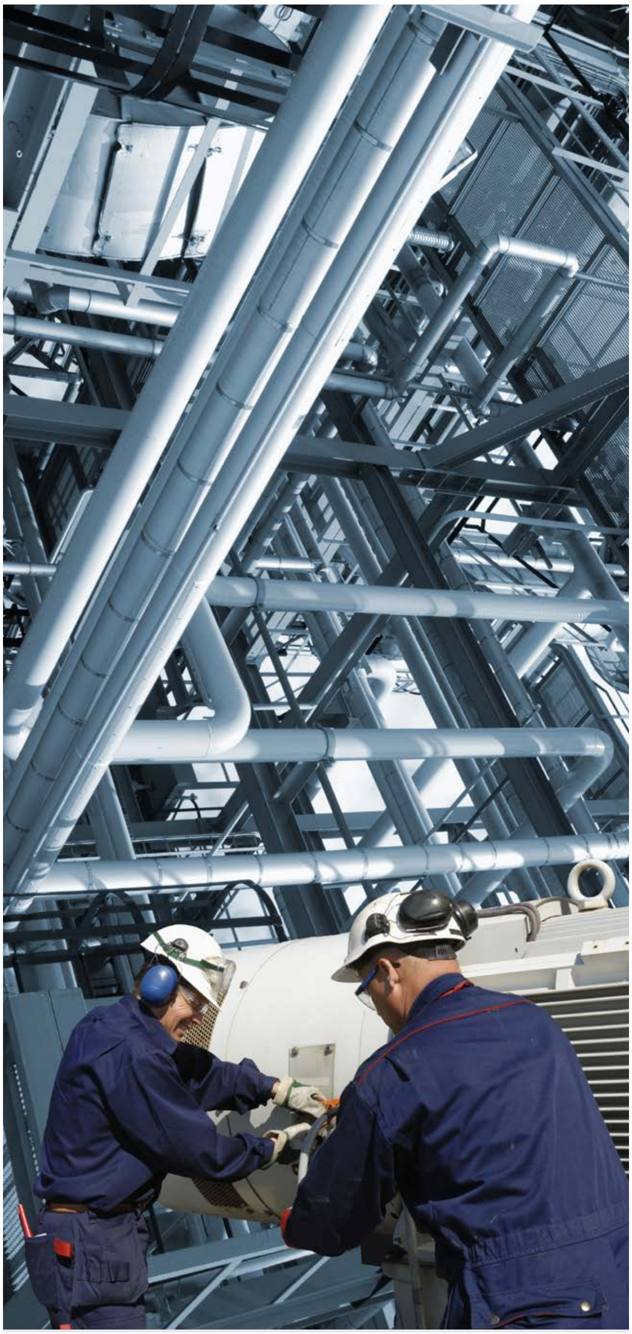
- **A** Physical isolations (permit to work)
- **B** Quality mgmt: Documentation and procedures
- **C** Safety reviews (MoC)
- **D** Maintenance: Transformers
- **E** Operations procedures/manuals
- **F** Management of changetypes
- **G** Accident, incident and near-miss reporting
- **H** Alarm management
- **I** Control procedures for defeat of all critical safety systems
- **J** Auditing (permit to work)
- **K** Fireproofing: Load bearing supports
- **L** Fire detection: Process units and tankage
- **M** Firewater pumps — capability
- **N** Firemain
- **O** Firewater sys: Trip function initiation
- **P** Extent of insp. prog. — process pipes
- **Q** What-if training
- **R** Fire detection: Switch room
- **S** Inspection philosophy
- **T** Trip testing

At the feature level, significantly more recommendations on physical isolations are made in the Middle East compared to the rest of the world (see Figure 7). The safe and reliable execution of physical isolations is a key driver in process safety. Indeed, two of the largest property damage incidents to occur since 1976 within the energy industry — the Piper Alpha platform loss in the North Sea in 1988 and the Phillips Pasadena explosion in Texas in 1989 — were caused by mismanaged physical isolations. Making improvements to physical isolations presents a key risk reduction opportunity in the Middle East.

Another key improvement opportunity in the Middle East is in the quality management of technical documentation and procedures. Recommendations include the control of key documentation, subsequent updates, distribution, and disposal of procedures and drawings.

Areas of relative strength in the Middle East include features related to inspection practices, notably inspection philosophy and inspection practices and progress: process piping. This is borne out by the relative infrequency with which the topic of inspection is cited.

Making improvements to physical isolations presents a key risk reduction opportunity in the Middle East.



Recommendations at the category level in North America are more balanced between hardware, software, and emergency response compared to global results.

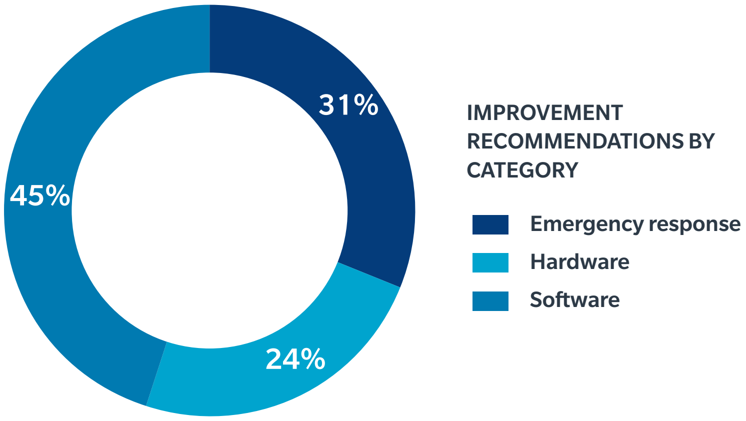
North America

Regional Focus

FIGURE
8

Category: Software recommendations are less prevalent in North America than the Middle East.

SOURCE: MARSH



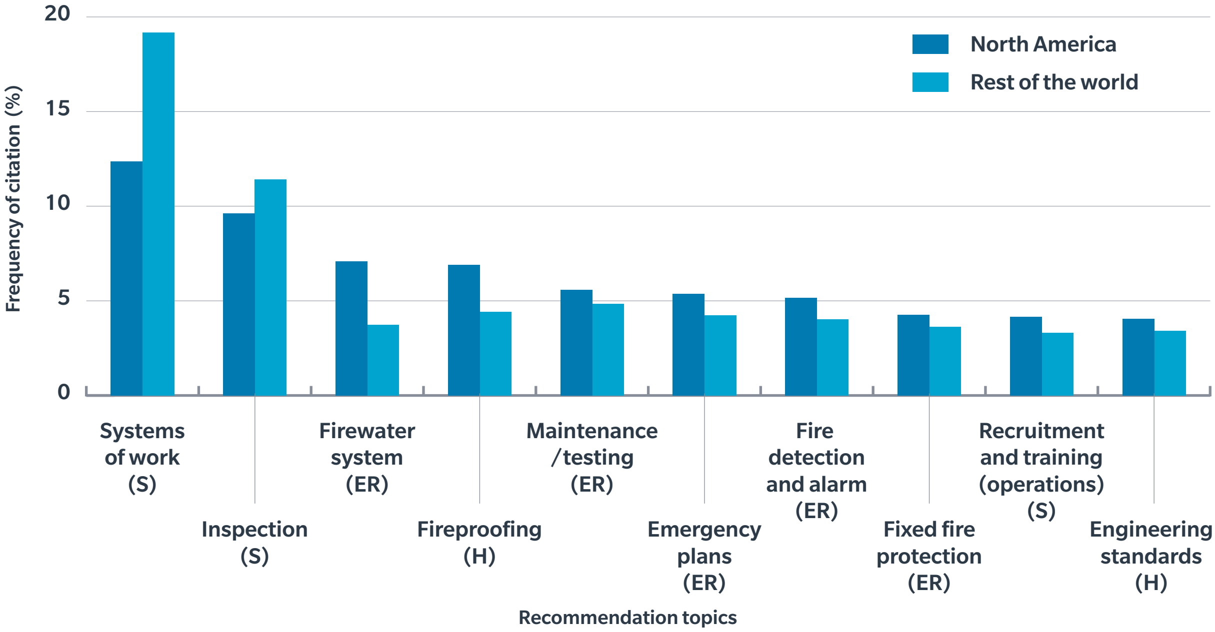
Recommendations at the category level in North America are more balanced between hardware, software, and emergency response compared to global results (see figure 8). In North America, software accounts for 45% of recommendations compared to 52% globally, and 61% in the Middle East.

The most striking feature at the topic level in North America is the relatively uncommon citing of systems of work based recommendations. The topic is still the most frequently cited, but less so than it is globally.

FIGURE
9

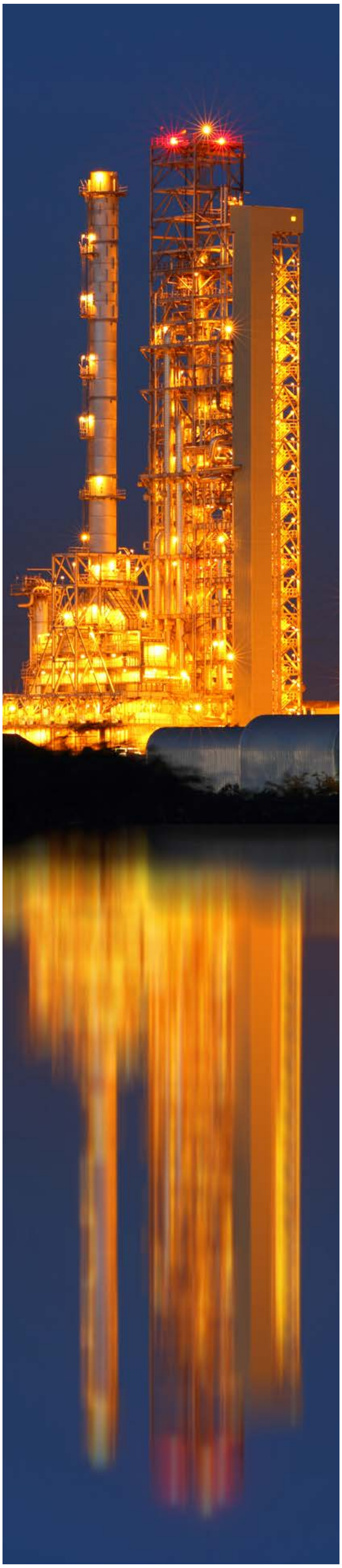
Topics: Systems of work recommendations are less common in North America.

SOURCE: MARSH



Key reasons include:

- North American facilities are owned by a comparatively small number of experienced operators, each of which is likely to have a long history of operations and well-developed systems of work. This observation is supported by Marsh's risk ranking, which recognizes North American systems of work as a significant strength against global standards.
- The relative maturity of individual facilities, given the region's early emergence as a major energy player. The higher than average age of facilities, and therefore use of earlier, less risk adverse engineering standards, will tend to make hardware-related recommendations more pressing in terms of immediate risk reduction, compared with software issues.
- Arguably, insurance risk engineering in this region has historically focused more on the presence of highly visible loss prevention aspects, such as plant separation or passive fireproofing, as opposed to software-related topics.



Firewater systems

Recommendations for improvement in firewater systems are relatively common in North America. While having little bearing on the frequency of incidents, risk engineers consider firewater systems to be critical to reducing the severity of losses. During a risk engineering survey, many aspects of site firewater systems are looked at, including, but not limited to:

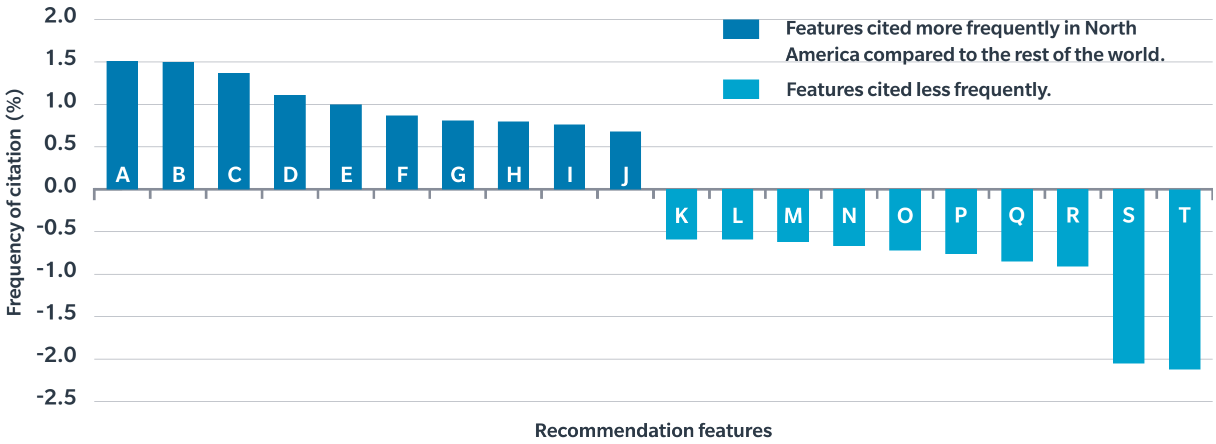
- **Sizing:** Has the maximum anticipated firewater demand been calculated, and is this known by the staff responsible? How long could firefighting at this water demand rate carry on in the worst case scenario?
- **Redundancy:** In the event of damage, power outage, breakdown, or maintenance, is there enough backup to tackle the worst case fire scenario?
- **Application method:** Insurers have a clear preference for remotely operated systems, such as deluge or automatic monitors, over more basic hydrant and hose arrangements.
- **Robustness:** Are systems in place for controlling planned or inadvertent outages in the system, inclusive of maintenance operations and potential operation errors for critical valves?
- **Mutual aid:** Are municipal or neighbouring industrial firefighters trained and ready to respond to incidents at the site?
- **Verification of performance:** Are firewater pumps tested as per best industry practices, as defined by the National Fire Protection Association (NFPA) 25. Specified by the insurance underwriters and widely recognized across the industry, this standard is considered essential for proving fire systems are fit for purpose and reliable. Key considerations include an annual multi-point pump curve test to ensure flow in all scenarios.

Risk engineers consider firewater systems to be critical to reducing the severity of losses.

FIGURE 10

Features showing greatest frequency: Difference between North America and rest of the world, top and bottom 10.

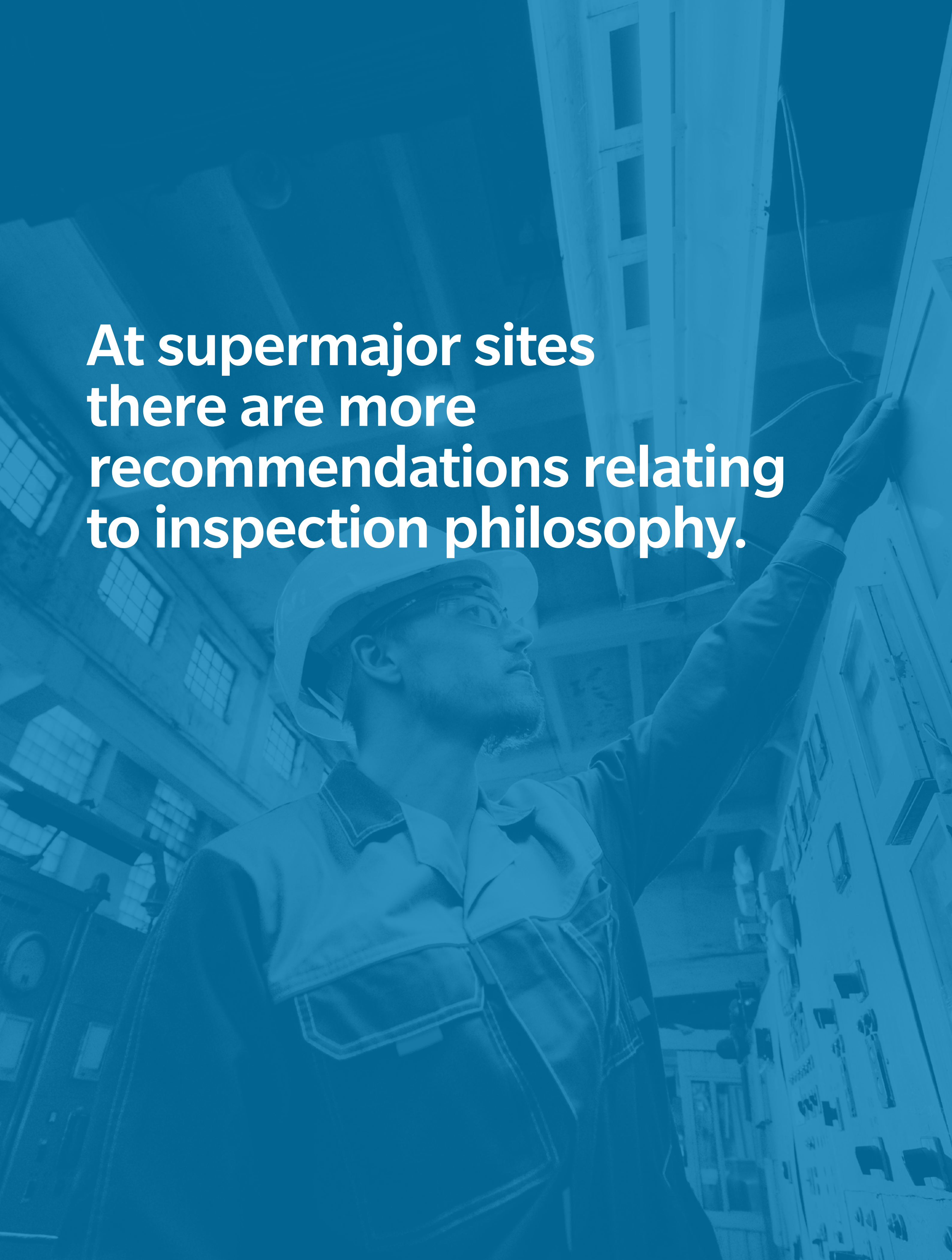
SOURCE: MARSH



- **A** Fireproofing: Piperacks/pipe supports
- **B** Firewater sys: Design
- **C** Firewater pumps — capability
- **D** Engineering standards used
- **E** Maintenance philosophy
- **F** Control rooms
- **G** Fire detection: Switch room
- **H** What-if training
- **I** Corporate/contingency planning
- **J** Pre-planning
- **K** Alarm management
- **L** Maintenance: Transformers
- **M** Safety reviews (MoC)
- **N** Management of change (MoC) types
- **O** PHA
- **P** Valve system security
- **Q** Operations procedures/manuals
- **R** Extent of insp. prog — relief valves
- **S** Physical isolations (permit to work)
- **T** Control procedures for defeat of all critical safety systems

At the feature level, North America is dominated by emergency response features, such as firewater systems: design; fire detection; and fireproofing: piperacks/pipe supports. These types of systems are essential for early detection, containment, and effectively reducing or preventing damage resulting from fires. The high incidence of such recommendations within North America could be partly attributable to the regional trend to rely on appliance-based firefighting (including municipal services) in place of fixed systems.

From a loss prevention perspective, the comparative lack of recommendations on key software subjects, most notably physical isolations and control procedure for defeat of safety systems, is positive. These two subjects are cited frequently as causes of major losses; the lack of recommendations in these areas suggests mature and effective systems are commonplace across North American energy facilities.



At supermajor sites there are more recommendations relating to inspection philosophy.

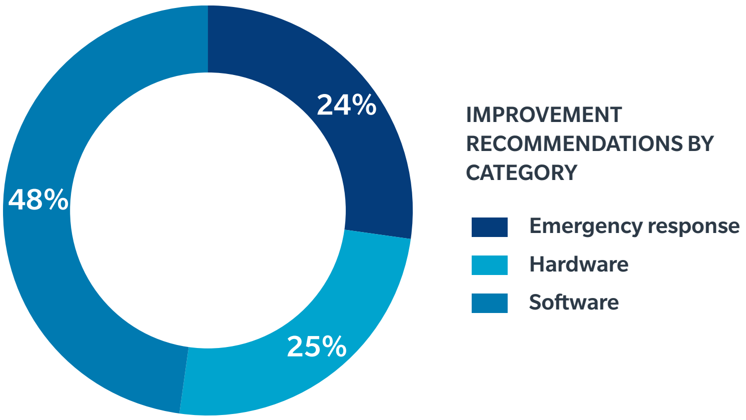
Supermajors

For this analysis, "supermajors" refers to the six largest publicly owned (with no state control) oil companies by market capitalization, as of the start of 2019.

FIGURE 11

Category: Software accounts for less than half of recommendations for supermajors.

SOURCE: MARSH

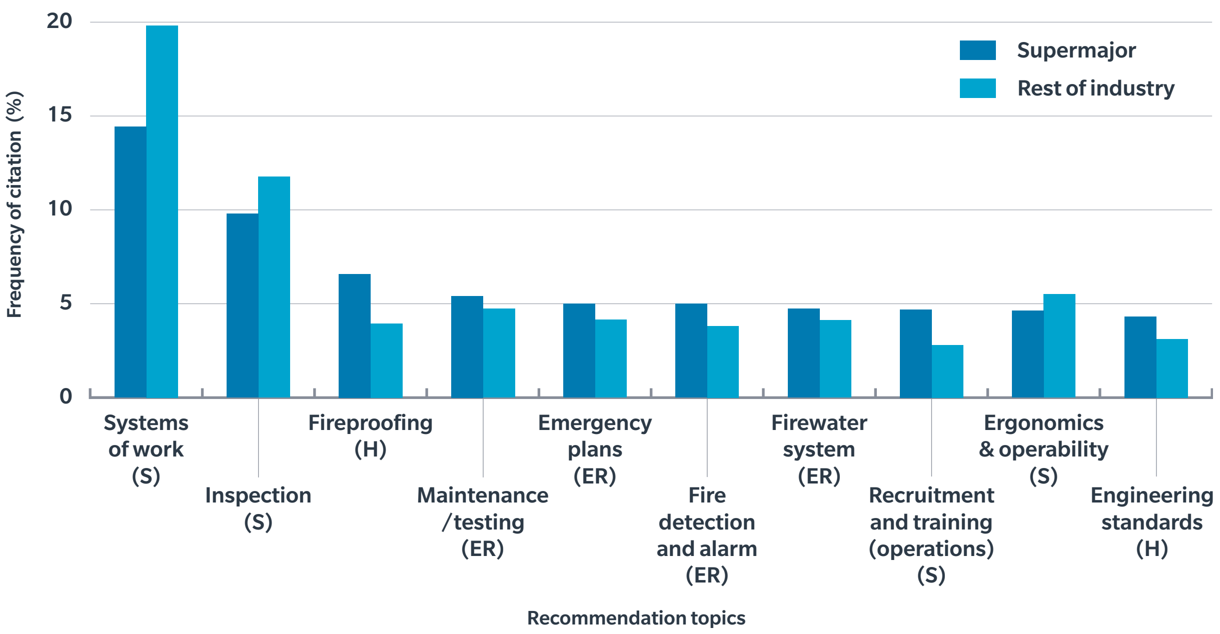


There are similarities in the recommendations given to supermajors and those given to companies in North America.

FIGURE 12

Topic: Supermajors share four of the top five with North America.

SOURCE: MARSH



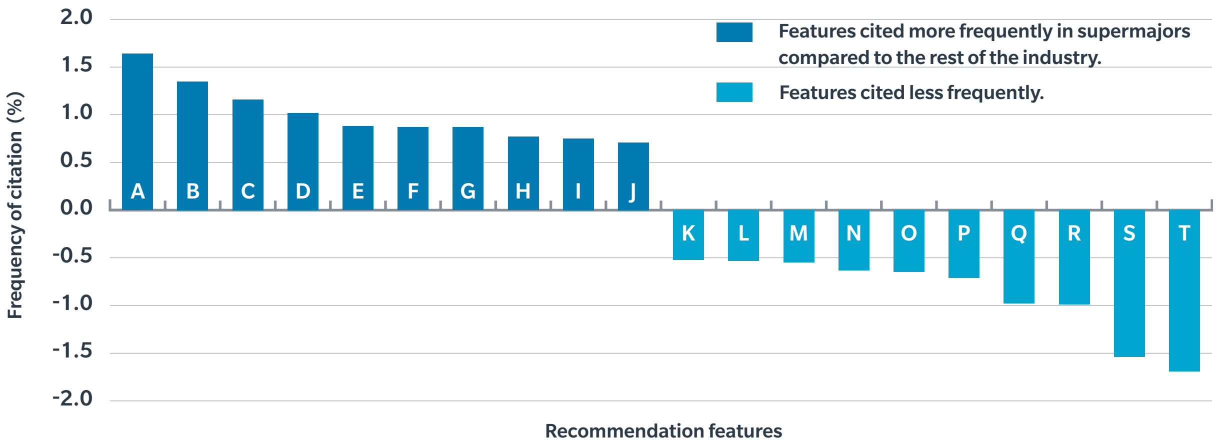
At both the category (see Figure 11) and topic (see Figure 12) levels, there are similarities in the recommendations given to supermajors and those given to companies in North America. In both cases, software recommendations are lower than in the rest of the world, and four of the five most-cited topics are the same.

It is worth noting that while the location of headquarters of the companies classified as supermajor are equally split between Western Europe and North America, only 28% of supermajor recommendations in this analysis were made at plants located in North America. Similiarities behind the types of recommendations made at North American facilities and supermajor facilities could perhaps be explained by the fact that all supermajors have some North America operations and tend to have relatively uniform operating practices and processes globally.

FIGURE 13

Features showing greatest frequency: Difference between supermajors and rest of the world, top and bottom 10.

SOURCE: MARSH



- **A** Engineering standards used
- **B** Fireproofing: Piperacks/pipe supports
- **C** Advancement and refresher training
- **D** Control rooms
- **E** Pressurised tanks: Instrumentation
- **F** Pre-planning
- **G** Fire detection: Compressor building (incl. gas turbines)
- **H** Gas detection: Coverage
- **I** Quality mgmt: Documentation and procedures
- **J** Inspection philosophy
- **K** Auditing
- **L** ESD System
- **M** Operations procedures/manuals
- **N** Valve system security
- **O** Extent of insp. prog. — process pipes
- **P** Extent of insp. prog. — relief valves
- **Q** Physical isolations (permit to work)
- **R** Management of change (MoC) types
- **S** Safety reviews (MoC)
- **T** Control procedures for defeat of all critical safety systems

The high frequency of inspection-related recommendations suggests that a greater focus on this subject is needed at supermajor operators.

There are also similarities at the feature level between supermajors and North American operators (see Figure 13). In both cases, there is a relatively low frequency of key software topics, such as physical isolations, management of change types, and control procedures for defeat of safety critical systems. These areas are considered to be key loss prevention aspects, so the low incidence of recommendations in these areas at supermajor facilities is positive.

While similar, there are some notable differences between the recommendations made at supermajor and North American operations, including significantly more recommendations at supermajors relating to advancement and refresher training. Such recommendations suggest implementation of periodic refresher training or testing on subjects, such as what to do in an emergency or how to properly implement routine systems. While intial training in supermajors is generally excellent, it could be argued that there is some systemic complacency around updating these skills. This could be due to the low staff turnover often seen at supermajors, leading to operators being in a single position for extended periods. The practice of refresher training is vital to avoid the loss of key skills.

At supermajor sites, compared to the rest of the industry, there are more recommendations relating to inspection philosophy. These often relate to management of inspection anomalies, management of inspection backlogs, or gaps in inspection programs. The latter often takes the form of lack of attention to a particular equipment type, such as small bore piping, or deep well pumps, or no recognition of a potential corrosion mechanism. A Lloyd's Market Association study concluded that mechanical integrity failure is responsible for 43% of losses, and emphasized the importance of a suitable inspection program at all energy facilities. The high frequency of inspection-related recommendations is somewhat unexpected, given the reputation of the companies involved. It suggests that a greater focus on this subject is needed at supermajor operators, particularly during economically challenging times.

Conclusion

There are several opportunities for risk improvement in the energy sector, particularly relating to software, which accounts for the greatest number of overall recommendations. The implementation of software changes are typically less costly — both in terms of time and expense — than hardware or emergency response recommendations.

Software systems include subjects such as permit to work, isolation systems, management of change, and training/competence management. Gaps in the application of these systems are significant contributors to some of the largest historical losses in the energy sector. It is worth noting that the gaps that survey recommendations address can be with the design of these management systems, or their implementation. It is also worth noting that management systems that are generally mature and well thought-out may still have specific attributes missing, which makes them ineffective in certain circumstances.

Budget constraints in the energy sector, driven in part by oil price volatility and an uncertain economic climate presently, should make the benefits of software enhancements a more attractive strategy for risk improvement, when relevant.

Notable differences in the frequency of recommendations by category between the Middle East and North America reflect differing standards and relative ages of assets between the two regions. For example, Middle Eastern operations present greater risk concerns around software than North American operations, but emergency responses are cited more frequently in North America.

Historical loss trends reveal a potential correlation between significant oil price falls and increased energy losses. The implementation of cost-cutting measures, such as reduced employee training and delaying non-critical maintenance, could be partially to blame. For example, training within supermajors is highlighted as an area with improvement opportunity. Energy companies must exercise caution when implementing cost-cutting measures designed to counteract/offset the effects of low oil prices.

Understanding where the opportunities are for making risk improvements is the first step to implementation. Having an unbiased and impartial perspective, with recommendations that are underpinned by industry good practice, can be used as a real catalyst for change.

Historical loss trends reveal a potential correlation between significant oil price falls and increased energy losses.

Appendix

Risk Improvement Recommendation database background information

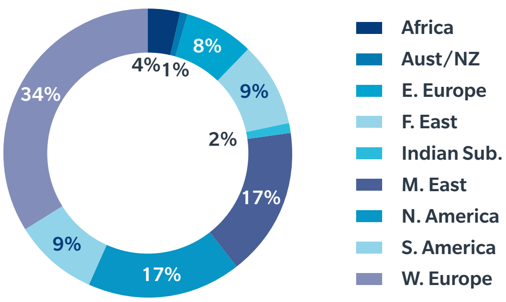
FIGURE 14

Risk improvement recommendation database background information.

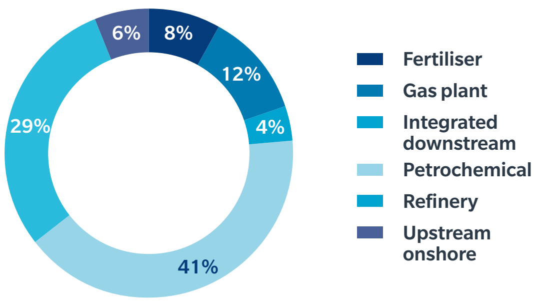
SOURCE: MARSH

Full database

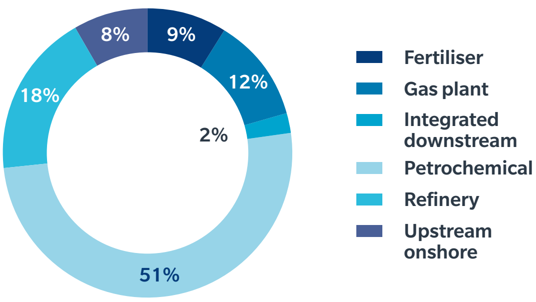
Recommendation regional origins



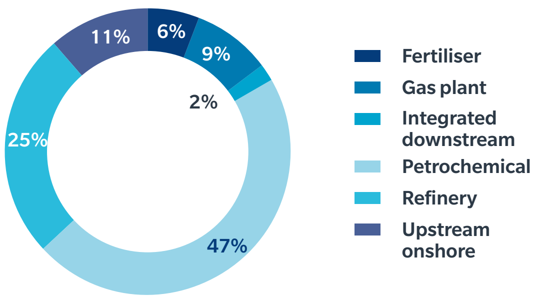
Recommendation asset type origins



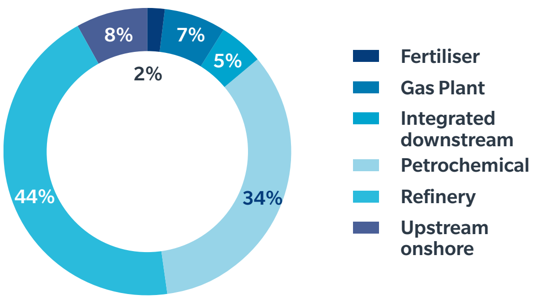
Middle East recommendation asset type origins



North America recommendation asset type origins



Supermajor recommendation asset type origins



Marsh risk ranking and benchmarking parameters

Marsh's risk ranking and benchmarking systems evaluate and compare the risk quality of topics grouped under three key categories — hardware, software, and emergency response — in addition to providing an overall score.

The 44 defined risk quality topics Marsh uses to evaluate and compare onshore operations are:

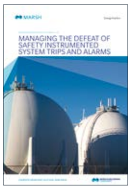
Hardware 1	Location/climate
Hardware 2	Engineering standards
Hardware 3	Site layout
Hardware 4	Process layout
Hardware 5	Fireproofing
Hardware 6	Drainage, kerbing, effluent
Hardware 7	Process buildings
Hardware 8	Control rooms
Hardware 9	Atmospheric tankage
Hardware 10	Pressurised tankage
Hardware 11	Refrigerated tankage
Hardware 12	Process control
Hardware 13	Isolation, depressuring, and umping
Hardware 14	Pressure relief and flare
Hardware 15	Utility reliability
Hardware 16	Machinery features
Hardware 17	Fired heater combustion safeguards
Hardware 18	Road and rail
Hardware 19	Jetty operations
Software 1	Corporate loss control policy
Software 2	Recruitment and training (operations)
Software 3	Ergonomics and operability
Software 4	Systems of Work
Software 5	Control of ignition
Software 6	Maintenance overview
Software 7	Maintenance electrical
Software 8	Maintenance mechanical
Software 9	Maintenance instruments
Software 10	Inspection
Software 11	HS&E
Software 12	Security
Software 13	Housekeeping
Software 14	Quality management
Software 15	Contractors
Software 16	Environmental monitoring
Software 17	Jetty software
Emergency response 1	Gas detection
Emergency response 2	Fire detection and alarm
Emergency response 3	Fixed fire protection
Emergency response 4	Firewater system
Emergency response 5	On-site fire fighting service
Emergency response 6	Emergency plans
Emergency response 7	Mutual aid
Emergency response 8	Maintenance/testing

Further reading

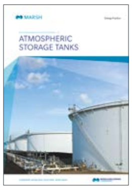
Engineering Position Papers

Marsh's Global Risk Engineering team regularly produces position papers on a variety of issues faced by those in the energy industry, ranging from process safety to fire pre-plans. These papers are aimed at clients to help improve risk and are intended to define the standards rated highly by Marsh within the oil, gas, and petrochemical industry. They can also be used to support the identification of risk improvement opportunities in the various areas the papers address. In many cases these papers have aided our clients in moving along risk improvement recommendations, contributing to some of the risk quality improvements discussed in this paper.

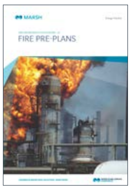
Pre-Start-Up Safety Review
These recommendations can be used to support and define risk improvements and also provide detailed advice to clients seeking to improve their management systems.



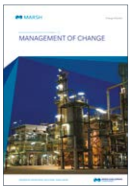
Managing The Defeat Of Safety Instrumented System Trips And Alarms
Whenever a safety instrumented system (SIS) is defeated, the risk exposure is increased to an extent that depends on the nature of the hazard involved.



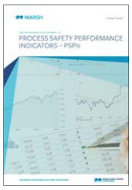
Atmospheric Storage Tanks
Following numerous incidents involving atmospheric storage tanks, data has been compiled indicating that overfilling of atmospheric storage tanks occurs once in every 3,300 filling operations.



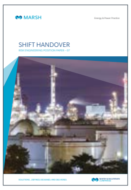
Fire Pre-Plans
There have been numerous large damaging fires over the years, including tank fires. These involve massive product losses and process unit fires that cause major plant damage and process interruption.



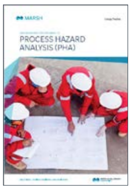
Management of Change
During the lifetime of an operating process plant, many changes will occur, including to the physical hardware of the plant, control systems, business processes, or to the organization running the plant.



Process Safety Performance Indicators
The process industry has a long history of major incidents that are well-publicized. The underlying causes of major incidents are often related to failures in process-safety management.



Shift Handover
A lack of effective information transfer has led to serious incidents in the process industry. Clear and effective communication during a shift handover provides a key layer of protection in the prevention of major incidents.

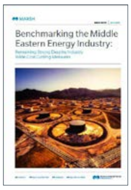


Process Hazard Analysis
Major accidents on energy sites have the potential to result in hundreds of millions of dollars of physical damage, present a danger to employees and the local population, and can lead to significant business interruption. In this paper we look at process hazard analysis as a key tool for understanding major accident hazard.

Benchmarking Papers

Marsh's regional benchmarking papers contextualize risk quality and explore regional trends. They aim to help clients understand current trends and standards and provide a comparative view of the risk quality of their assets and operations. Marsh's risk ranking system provides an absolute measure of risk quality when compared against a defined set of criteria, the benchmarking this data enables us to perform has proved to be a catalyst for change for many of our clients.

Energy Risk Quality Benchmarking In The Middle East
This paper contextualizes risk quality in the Middle East and explores regional trends to gauge the comparative risk quality of oil, gas, and petrochemical facilities relative to more than 500 similar facilities worldwide.



Benchmarking The Asian Energy Industry: Remaining Strong Despite Industry Wide Cost Cutting Measures
A benchmarking study to gauge the comparative risk quality of Asian onshore oil, gas, and petrochemical facilities relative to similar facilities worldwide.

Claims Analysis

The 100 Largest Losses
The 25th edition of *The 100 Largest Losses* reviews the 100 largest property damage losses that have occurred in the hydrocarbon processing industry since 1972. This review is based on Marsh's energy loss database, which compiles information gathered in the course of our interactions with the industry, as well as from the public domain.

ABOUT MARSH

A global leader in insurance broking and innovative risk management solutions, Marsh's 30,000 colleagues advise individual and commercial clients of all sizes in over 130 countries. Marsh is a wholly owned subsidiary of Marsh & McLennan Companies (NYSE: MMC), the leading global professional services firm in the areas of risk, strategy and people. With annual revenue over US$14 billion and nearly 65,000 colleagues worldwide, MMC helps clients navigate an increasingly dynamic and complex environment through four market-leading firms. In addition to Marsh, MMC is the parent company of Guy Carpenter, Mercer, and Oliver Wyman. Follow Marsh on Twitter @MarshGlobal; LinkedIn; Facebook; and YouTube, or subscribe to BRINK.

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