

Benchmarking the Middle Eastern Energy Industry:

Remaining Strong Despite Industry
Wide Cost Cutting Measures





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FOREWORD



In 2013, Marsh issued its first benchmarking study gauging the comparative risk quality of Middle Eastern oil, gas, and petrochemical facilities relative to similar facilities worldwide, based on Marsh's database. In 2015, Marsh repeated this study, concluding that over the intervening two years, the Middle East, demonstrated a rate of improvement three times faster than the global population in many areas.

Our updated 2018 study examines whether risk quality has significantly changed in the region, taking into consideration internal and external factors, such as the sustained lower global oil price, which have the potential to affect expenditure and priorities. As Marsh's report *Rethinking Business Interruption Risks in an Optimized Oil and Gas Industry* described, mature energy operators are responding to an increasingly competitive market through integration and consolidation of existing infrastructure. Despite the potential positive impact on shareholder returns, this trend could have a negative impact if resource optimization is not managed appropriately.

Marsh's risk ranking system provides an absolute measure of risk quality when compared against a defined set of criteria, while our benchmarking determines a client's (or even a region's or industry's) position relative to its peers. The features and topics reviewed in this report using these proprietary systems are based on the views of both Marsh's risk engineers and those of the insurance market.

This paper will contextualize risk quality in the Middle East as observed in recent years and explore regional and global trends to examine the factors driving risk quality. It aims to help operators, underwriters, and investors understand current trends and standards and provide a comparative view of the risk quality of assets and operations.

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SPOTLIGHT

In this paper, we distinguish between the average (mean) score and the median. The mean, despite being the most commonly used method of describing central tendency, has the disadvantage of potentially being affected by any single value that is very high or very low compared to the rest of the sample. However, the size of the populations considered in this paper is significant enough for outliers not to have significant impact on the mean, and given the largely normal distribution of the data, using the mean is understood to be an appropriate measure. Where a noteworthy difference between the mean and the median was identified, this has been noted.

Comparisons are made between data collected during surveys carried out in the periods 2012 – 2014 and 2015 – 2017 with the periods selected based on a typical survey frequency of two to three years.

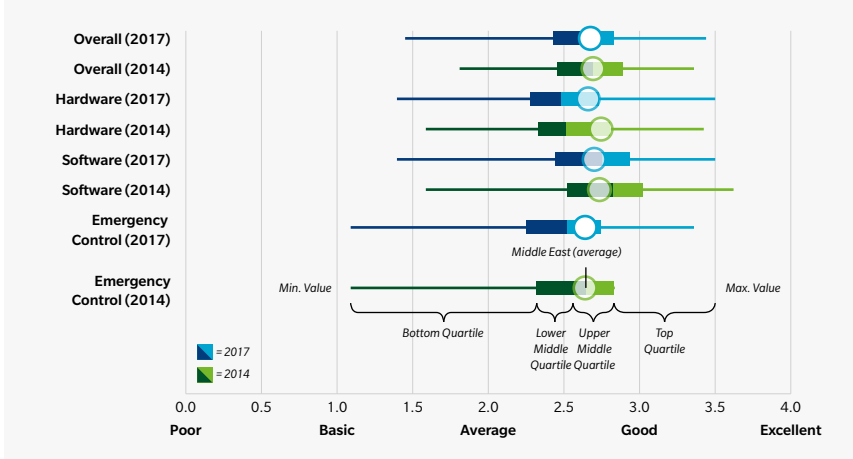
EXECUTIVE SUMMARY

From the overall benchmarking scores, it is evident that the Middle Eastern energy portfolio has maintained its risk quality position in the upper middle quartile, despite showing less improvement than noted in previous years.

RISK QUALITY CATEGORY	2013 GLOBAL STUDY QUARTILE	2015 GLOBAL STUDY QUARTILE	2017 GLOBAL STUDY QUARTILE
OVERALL	UPPER MIDDLE	UPPER MIDDLE	UPPER MIDDLE
HARDWARE	TOP QUARTILE	TOP QUARTILE	TOP QUARTILE
SOFTWARE	UPPER MIDDLE	UPPER MIDDLE	UPPER MIDDLE
EMERGENCY CONTROL	LOWER MIDDLE	UPPER MIDDLE	UPPER MIDDLE

The Middle East appears to have followed the downward global trends in risk quality, albeit at a rate on average of three times slower than its global peers (referred in this paper as “rest of the world”). Hardware remains a key strength, with software (management systems) and emergency control remaining the key areas for improvement. Previous momentum in improving risk quality has slowed, with the deceleration likely to be associated with the oil price collapse, a more challenging economic environment leading to delay or cancellation of projects and shifting priorities towards maintaining profitability.

FIGURE 1 Overall Benchmarking Scores - Middle East vs Rest of World (Then vs Now)
Source: Marsh



However, inspection of the medians indicate that within the top 50% of the Middle Eastern energy portfolio (that is, facilities that fall within the upper middle and top quartiles), there has been some improvement, with the most significant evident in the category of emergency control (see Figure 3). Inspection of the rest of the world median suggests that there has been a more consistent decay across the population in general, although at a slower rate among the top performers.

A great deal of the activity in the oil and gas sector is focused on Organization of the Petroleum Exporting Countries (OPEC) countries and the US, but other regions may also play a key role in the coming years. For example, in Latin America, the investment environment is improving, and the number of clients we are providing with engineering support is also increasing significantly. It may take some time for these companies to reach the same level of maturity as some of the more established geographies which have, in many cases, benefitted from several cycles of risk engineering surveys. Therefore, the introduction or growth of certain subpopulations within the database could have an impact on the subpopulation results, which have contributed, to some extent, to a more significant downward trend seen for the rest of the world.

FIGURE 2 Overall Rate of Change 2014 vs. 2017 (Mean)

Source: Marsh

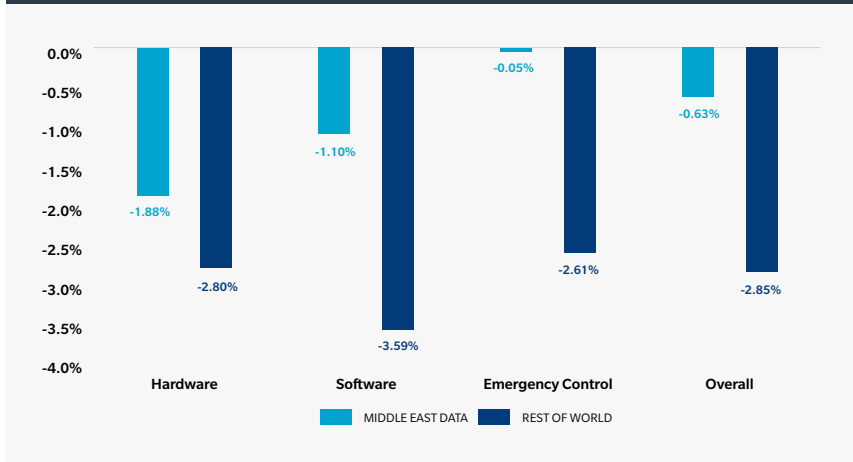
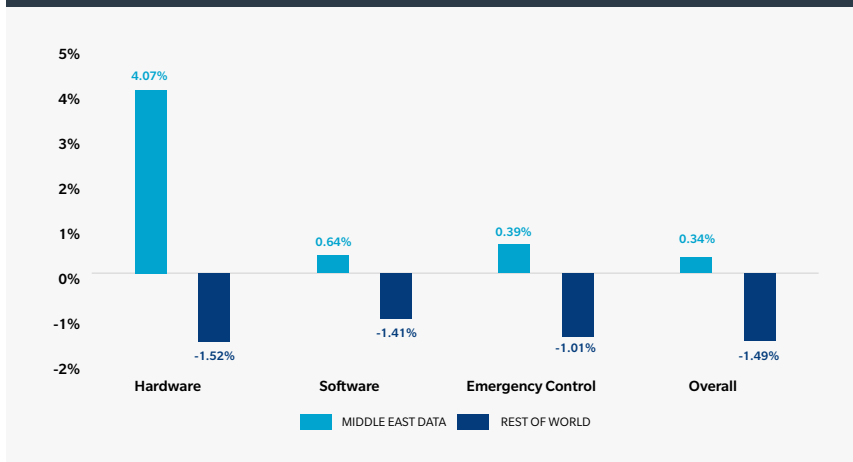


FIGURE 3 Overall Rate of Change 2014 vs. 2017 (Median)

Source: Marsh

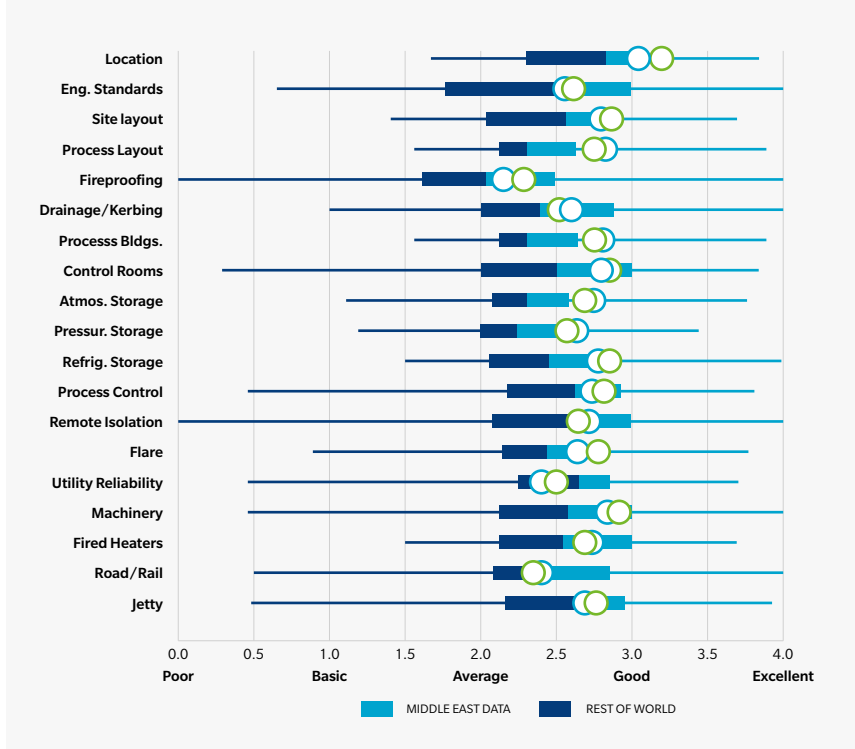


HARDWARE

Hardware continues to be a key strength despite a slowdown as a result of a more challenging economic environment.

It appears that in recent years hardware improvements in the Middle East, and globally for that matter, have been slower. Previous improvements were partly attributed to new projects coming online, with the Middle East receiving a significant part of such investments. New facilities generally benefit from best in class features with more modern designs. The oil price collapse, among other factors, contributed to a more challenging economic environment. This triggered a wave of cost reduction with global oil and gas companies slashing capital expenditures by about 40% between 2014 and 2016.¹ As part of this cost-cutting campaign, projects (including expansion and betterment projects) that did not meet certain profitability criteria were often canceled or deferred.

FIGURE 4 Hardware Benchmarking - Middle East vs. Rest of World
Source: Marsh



However, in an Exploration and Production (E&P) Spending Survey,² Barclay's predicted that oil and gas industry capital expenditures would increase by as much as 7% in 2017, which could explain why there has been some improvement in Middle Eastern hardware scores when considering the median scores, albeit at a slower rate than prior to

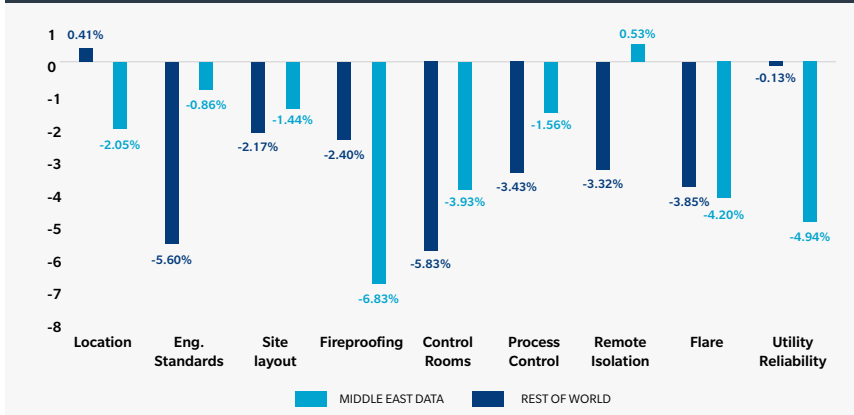
the significant downturn in the oil-related economic environment. It is expected that such investments could take a considerable time before they are fully reflected in risk ranking and benchmarking scores.

LOCATION

Location scores are heavily dependent on seismic ratings, with this being the most heavily weighted feature in Marsh's assessments. In 2010, Munich Re issued its first detailed analysis of natural hazards in the Middle East, categorizing the United Arab Emirates' earthquake risk exposure as Zone 2 – MM VII, with the MM VII rating described as "very strong" on the earthquake intensity scale. It is clear that where there is a change in risk exposure, there is likely to be a consequent change in the assessment of the risk.

As a result of a growing book of business in the UAE, Marsh has seen a larger number of clients being subject to this exposure.

FIGURE 5 Rate of Change 2014 Hardware (Mean) 2017 vs. 2014
Source: Marsh



*Other includes: Automotive, Chemicals, Construction, Education, Forest Products, Hospitality & Gaming, Public Entity, and Real Estate.

ENGINEERING STANDARDS

The shifting median suggests that engineering standards have seen some improvement among the top 50% of the Middle Eastern population. A common recommendation is for hazard and operability (HAZOP) and other process

hazard analyses (PHAs) to be revalidated at least every five years. This has become established practice at several sites, with tracking of action items until completion becoming a key feature.



FIREPROOFING

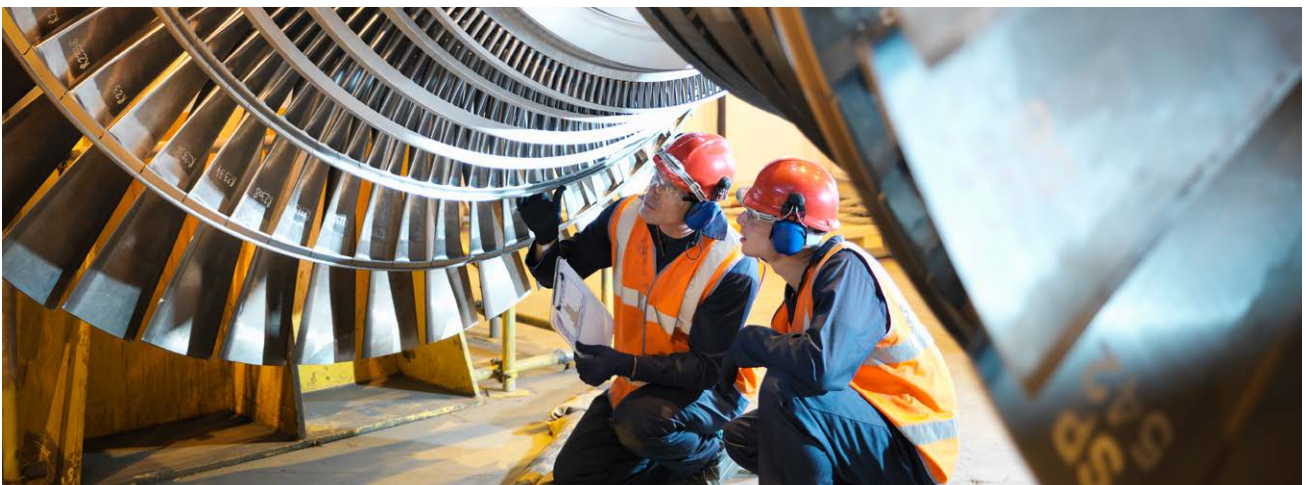
Fireproofing remains a common recommendation theme across the region with high rejection and slow completion rates. It is likely that the financial investment required versus the perceived benefit of retrofitting to existing facilities plays a major role on decision making. Furthermore, some facilities have adopted an active fire protection philosophy and some gas plants (even some new low value ones) are based on a burndown philosophy. Common subthemes include the lack of full height firewalls between oil filled transformers, unprotected instrument and electrical cables routed over process equipment, fireproofing of remotely operated isolation valves, and sealing of cables where they enter critical infrastructure such as motor control centers (MCC). The business interruption risk and potential knock-on effects associated with losing critical infrastructure is often overlooked due to the potentially relatively insignificant property damage risk associated with some of these loss scenarios. It is often the case that, as the insurance market sees several cumulative losses or one major loss associated (for example, the loss of transformers due to a major fire), it becomes a key focus during insurance risk engineering surveys, which is then reflected in recommendations and risk ranking scores.

CONTROL ROOMS

The launch of MarshBLAST in 2017, our upgraded software tool for modeling insurance losses associated with vapor cloud explosions, has enabled enhancements such as updating the reactivity of propylene to medium, differentiation between low and high flame speed explosions etc. As expected, in some cases, these improvements have resulted in changes in the estimated maximum loss compared with SLAM. This could see for example, the control room exposed to more damaging overpressures than previously estimated and with that revised risk ranking scores. Construction standards and layout which have previously been viewed as appropriate might need to be reassessed.

ALARM MANAGEMENT SYSTEMS

There is an increasing onus on operators to have effective alarm management programs in place with evidence of performance a standard expectation during surveys. In previous surveys, operators may have been given credit for developing and investing in alarm management software and programs, acknowledging that there is often a period of time between start-up and achieving stable alarm performance. However, it is widely understood that implementation has a greater bearing on risk quality than system architecture and factual existence. Therefore, sites can be penalized during follow-up visits if it is evident that alarm management programs, despite the quality of the software, are not effective in managing alarm rates towards reaching the ultimate goal of “stable” or “predictive” alarm management performance, as defined in EMUAA 191. An “excellent” score in Marsh’s risk ranking tool would also require a facility to be equipped with the latest generation control systems. Therefore, if regular investment is not made over time, control system scores could see reductions.



CRITICAL VALVES

Car-sealing of critical valves, including isolation valves upstream and downstream of pressure relief valves, is another common recommendation theme. The absence or poor implementation of a valve security system and procedure results in sites being penalized, affecting, for example, flare risk rankings. Poor implementation of such a system was identified as a contributing cause to a major explosion in 2013. However, some of the larger companies in the group have shown significant improvement in this area, with a 28% improvement in the recommendation completion rate in recent years.

REMOTE ISOLATION

Remote isolation has historically been another common recommendation theme in the Middle East with slow rejection and high rejection rates. The Middle East was able to maintain some of the momentum shown in 2015 in comparison to a declining score for the rest of the world. Organizations are often reluctant to accept and implement this recommendation

as it would require hardware modifications and financial investment. Such a project could take years as installation is likely to be turnaround dependent.

UTILITY RELIABILITY

Understanding utility reliability, or rather the likelihood and consequence of loss of utilities, is a key part of understanding potential business interruption exposures. A study³ of 100 major losses in the onshore, oil, and petrochemical industries identified that power failure is the most common precursor for losses that occurred during unplanned events. A number of facilities are, for example, wholly dependent on supply of power from a third party supplier, such as the local grid, with no internal capabilities. With supply chain risks accounting for 50-70% of all insured property losses,⁴ potential exposures, available mitigations, and client resilience have seen more scrutiny than ever. As our understanding of these risks increases, we have a better understanding of what it means to have good resilience and contingency planning in place.

The reasons behind declining hardware scores are often more difficult to understand. Some changes are due to the dynamic nature of Marsh's client base, revised risk ranking criteria to keep up with the ever-evolving standards of today, or planned improvement projects not taking place due to cost cutting. Losses within the industry also tend to draw attention to certain contributing features, putting these under more scrutiny than before. However, it is expected that, if and when oil prices and the economic environment recover to more positive territory, projects will be revived. And as a result, we are likely to see the region regain the momentum of improvement witnessed in previous years. But, despite challenging market conditions, the region has managed to maintain a strong position in the top quartile, with the 25% of the population within the lower middle quartile showing a stronger performance in this area than the bottom 50% of the rest of the world.



SOFTWARE

Cost conscious versus safety conscious.

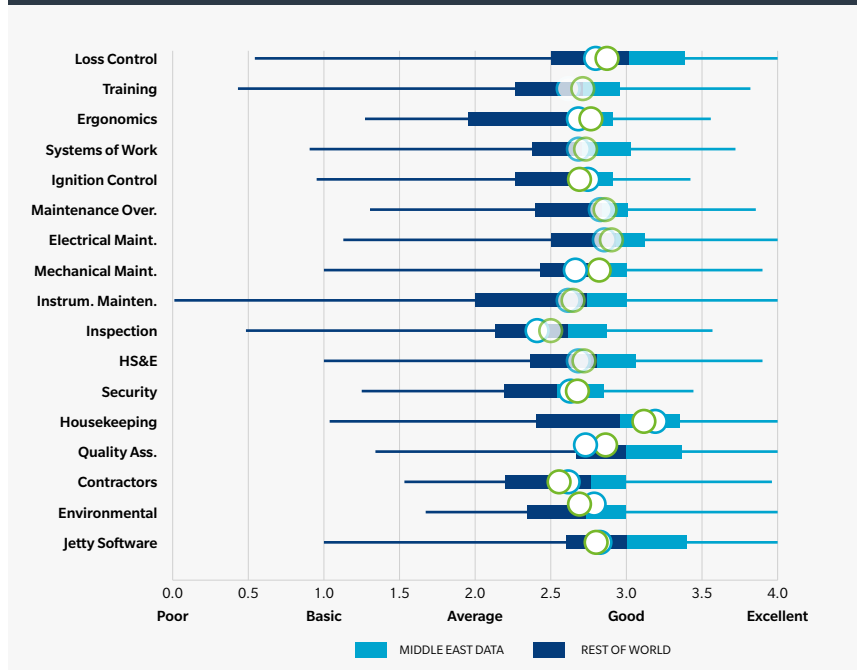
Given changing market conditions, companies in the Middle East, including national oil companies (NOCs) which tend to emphasize production volume targets, have had to adapt by increasing their focus on cost efficiency and profitability. This has required a significant shift in corporate culture and outlook; even large state-owned companies are looking for ways to cut costs and sharpen fiscal discipline.

As companies are driven to focus on profitability and lean processes, priorities may shift away from other key areas, such as process safety, to for example, managing reduced maintenance budgets and restructuring efforts. This is also sometimes evident in the leading and lagging indicators reviewed during insurance risk engineering surveys. The Middle East has maintained its position in the upper middle quartile with the average Middle Eastern site slightly better than the average rest of the world site.

LOSS CONTROL

Despite significant strides made by some of the larger and more mature organizations, and even by many smaller players in the region (2.61% improvement on average seen for top 50% of the Middle East), several facilities remain that still focus on personal safety alone with no clear policy on how process safety will be implemented and managed and with no dedicated resources. Given current market conditions and potentially shifting priorities, developments where process safety management and culture have not yet been established, are expected to continue to be slow. Performance indicators at these facilities tend to focus on slips,

FIGURE 6 Software Benchmarking - Middle East vs. Rest of World
Source: Marsh



trips, and falls, which do not give an indication of the health of key safety barriers. It has been recognized that the focus on personal safety is only one side of preventing accidents and the underlying causes of major incidents are often related to failures in process safety management.

TRAINING

Some of the momentum in improving training programs appears to have been lost in the Middle East, also likely to be due to a shift in priorities following the lingering effects of a more challenging economic environment. Comprehensive training programs typically exist for emergency response teams responding to incidents such as fires, however specific training, such as “what-if” training, to prepare operators for process upsets and/or abnormal conditions are often not being considered. The top 50% of the Middle Eastern energy portfolio continues to improve in this area

at an average rate of 3.66%, with well-defined training matrices that include regular refresher training among the positive features at these sites.

The recent downturn in oil prices, in addition to reductions in capital expenditures, has also resulted in some 400,000 global retrenchments,⁵ most evident in the upstream oil and gas sector. According to analysts, however, retrenchment for Gulf oil producers are considered relatively small in scale, as production costs are often much lower than for most international rivals. Nevertheless, if and when the oil price recovers, rebuilding competency levels could prove challenging, even in the Middle East. Training should be among the key priorities as a wave of worker layoffs in recent years is likely to have resulted in a loss of experience, knowledge, and skills.

FIGURE 7 Rate of Change 2014 Software (Mean) 2017 vs. 2014
Source: Marsh

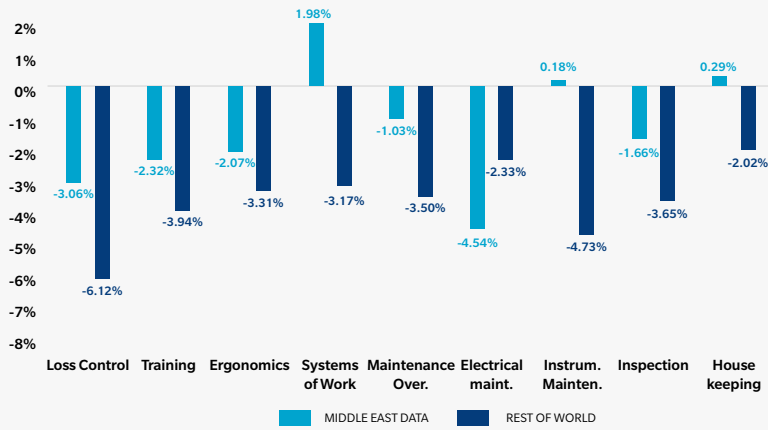


FIGURE 8 Top 50% Rate of Change Software 2017 vs. 2014
Source: Marsh

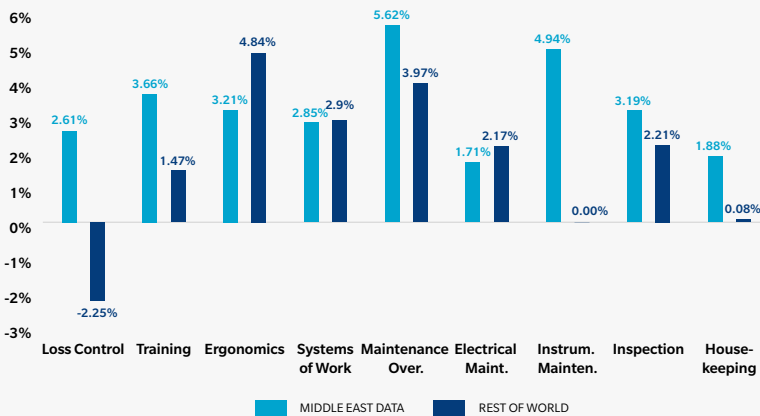
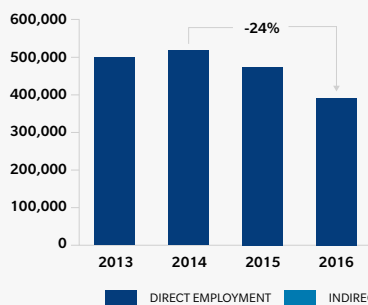
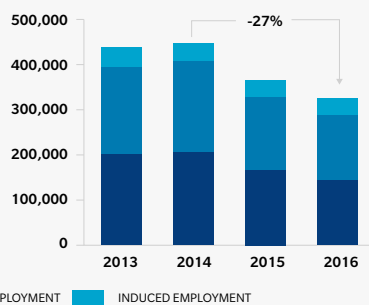


FIGURE 9 Oil Price Cost Reduction Measures Resulted in a Loss of Critical Talent
Source: US Bureau of Labor Statistics

Number of US employees in upstream oil and gas



Number of UK offshore employees in upstream oil and gas



CONTROL OF OPERATING DOCUMENTATION

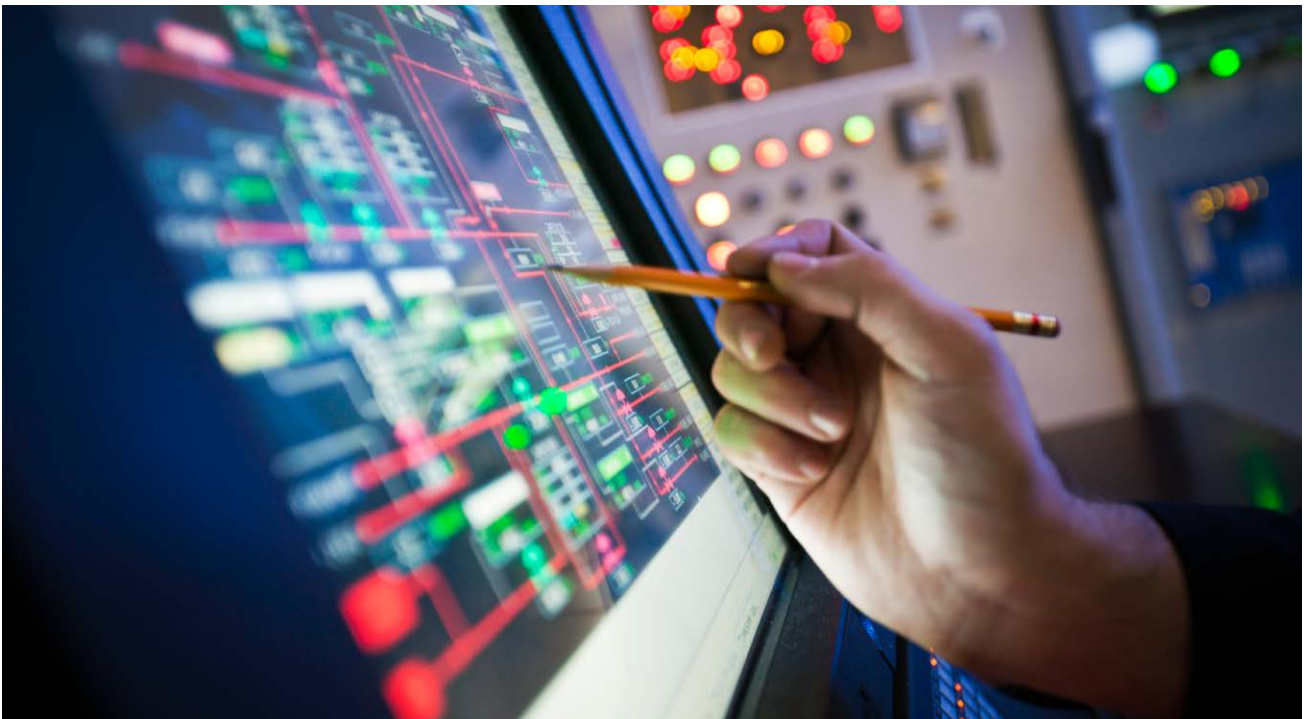
The Middle East's top performers have shown strong progress towards better control of key operating documentation (including standard operating procedures and piping and instrumentation diagrams (P&IDs)), which is reflected in improved ergonomics scores. The Middle East overall, however, has seen this score drop off by 2.07% on average. Operating procedures are critical when carrying out infrequent activities such as equipment start-up or equipment switching, and a study⁷ by the Lloyd's Market Association⁶ suggested that more than 60% of non-mechanical failure losses occur during transient operations (non-routine/infrequent and abnormal/unplanned operations) which is typically when such procedures are used. Plant start-up was found to be the most common precursor, contributing to almost 20% of such losses. A high rate of reoccurrence of recommendations suggests short corporate memory, with around 50% of these recommendations

related to updating P&IDs. Failure to use accurate P&IDs could result in unsafe decisions being made, particularly in the event of a plant emergency or when planning isolations.

SYSTEMS OF WORK

Systems of work have not seen the same level of improvement as in previous years. The effects of a challenging economic environment, which in many cases has included aggressive cost cutting and human resource restructuring, has potentially led to priorities moving away from safety and towards profitability and optimization. In previous years, the Middle East showed significant momentum in improving and aligning with industry best practice. Again, the top 50% of the Middle Eastern energy portfolio has seen improvement in this area.

The concept of process safety and safety culture is subject to ever increasing scrutiny, as it is widely recognized as having an important effect on accident causation and accident prevention. Therefore, there is an increasing focus on implementation versus factual existence. Where in the past, a facility would have likely been given credit for having sound system, policies, and procedures in place (such as permit to work, isolation standards etc.), risk engineers are now more concerned than ever with the way in which the systems are being used. Poor implementation is likely to be reflected in systems of work scores decaying. On average, the Middle East compares well with its global peers. Some improvements in system architecture, with many of these associated with insurance recommendations, include better cross referencing between key documents, such as permits and isolation confirmation certificates, the requirement for a fire watch, and sign-off discipline.



While most facilities have a management of change (MOC) procedure, it remains an area of focus for risk engineers, being one of the top five most common recommendations in the past five years. As larger players are standardizing the procedure across all operating facilities, varying standards of implementation remain. Some recurring issues include recognition of change, management of backlog, reporting and monitoring key performance indicators (KPIs), managing temporary changes, and updating documentation as part of the close-out procedure.

With a number of findings under the systems of work topic, including recurring recommendations, it is often suggested that the frequency of audits on system effectiveness or the effectiveness of existing audit programs be reviewed.

MAINTENANCE

Maintenance is frequently one of the first areas where cost cutting is carried out. It often results in reduced maintenance budgets significant backlogs as a result of understaffed teams, and limiting planned shutdown activities to maximize production with planned turnarounds deferred. The Middle East appears to have largely followed this downward trend, albeit at a much slower rate than their global peers, with the exception of instrument maintenance where the region has seen some improvement.

Testing of safety instrumented systems, which is dependent on the technology, system architecture, and target safety integrity level, can be difficult to achieve if the aim is to maximize production. This often requires shutdown if online testing is not possible. Some modern facilities are able to test instrument loops (including the final element) online and therefore score much better in this area.

INSPECTION

With risk based inspection and an increasing number of organizations reaching a higher level of maturity in this area, it is becoming increasingly difficult for organizations not investing to keep up with their peers. Furthermore, resourcing remains a concern, filling vacancies in essential positions is a challenge as available talent with the relevant competencies is scarce. Strong performers in this area are continuing to see the impact of their investment and efforts, with the top 50% on average 3.19% better than in previous years.

Housekeeping is another area where a decaying process safety culture could manifest. Global statistics indicate a downward trend but with the Middle Eastern population showing some improvement in housekeeping standards. Marsh data shows a high rate of reoccurrence of housekeeping recommendations albeit with a high completion rate which might suggest that symptoms are treated and the root cause is not

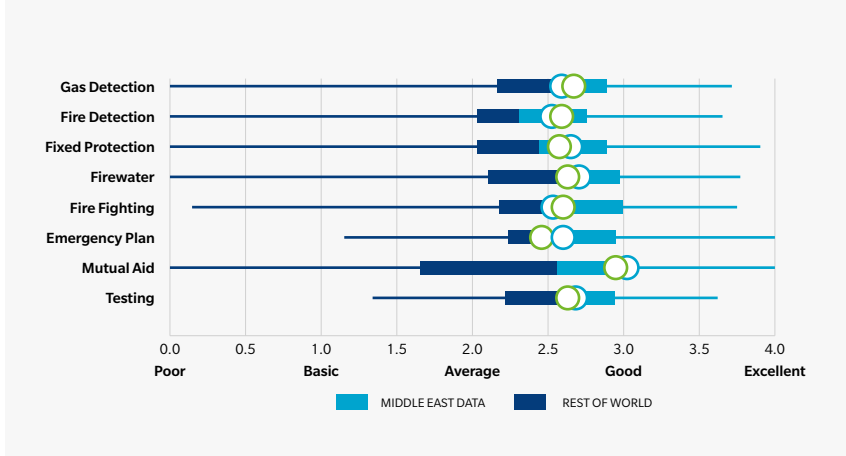
being addressed. Some common themes include control of open ends, vents and drains (plugs, caps, and blinds), storage of combustible material, short bolting, and electrical junction box bolting (ignition source control). The consequences of poor housekeeping are often restricted to personal injury rather than catastrophic loss. However, in addition to being indicators of poor safety culture the wider range of housekeeping issues can include potential contributory factors in more significant incidents.

The data suggests that the better performing facilities (that is, the top 50%) of the Middle Eastern population have improved, while the rest of the population appear to some extent to have yielded to the pressure of an increasingly challenging and competitive environment, albeit at a slower rate than their global peers. One might argue that the top performers have established more mature process safety cultures and realize the potential risks of cutting costs associated with maintaining safety barriers in the face of challenging economics. The data further suggests that it is often the larger organizations in the Middle East, possibly having access to more resources, rather than say a small standalone site, that are able to maintain improvement despite having to adapt to external factors.

EMERGENCY CONTROL

FIGURE 10 Emergency Control Benchmarking - Middle East vs. Rest of World

Source: Marsh



As noted in the 2015 paper, the hardware features associated with emergency control remains a key strength of the region. Improvements to firewater systems have continued in recent years, albeit at a slower rate than previously noted. In some cases these improvements are attributed

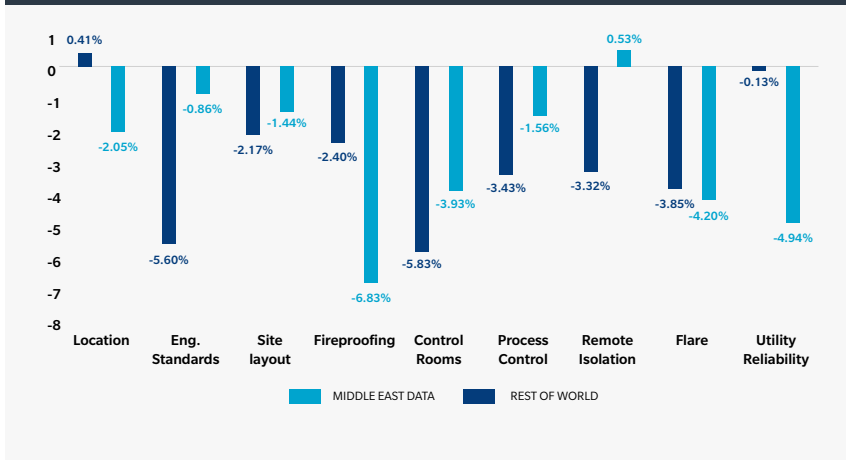
to sites replacing firewater pumps which have in the past not performed well or upgraded water supply and pump capacity given a better understanding of the maximum fire case. Such changes are often in response to insurance recommendations.

Another area where there has been very good improvement is emergency planning. The availability and quality of fire plans reviewed at a number of sites has drastically improved; however, the rest of the population would need to catch up to these standards for the group to move to the next quartile.

Maintenance and testing of firefighting systems, and in particular, firewater pumps, remains a common recommendation in the region. Some of the larger companies have embedded the requirements of the National Fire Protection Association (NFPA) in their corporate standards, however, as seen for management systems, the level of implementation varies.

FIGURE 11 Rate of Change 2014 Emergency Control (Mean) 2017 vs. 2014

Source: Marsh



SUMMARY

Despite a more challenging economic environment which has led to aggressive cost cutting in the industry, the Middle East has managed to maintain its position in the upper middle quartile overall. Hardware improvements in the region, and globally for that matter, have been slowly realized, especially compared to previous years when a number of new projects came online. New facilities generally benefit from best in class features with more modern designs, but the wave of cost reduction has meant that several projects (including expansion and betterment projects) that did not meet certain profitability criteria were either canceled or deferred. Some of the previous momentum gained in improving software (management systems), appears to have also slowed down, with poor implementation often manifesting as priorities shift away from safety and towards profitability. Some features of emergency control have seen good improvements, with many of these improvements driven by insurance recommendations.

It is worth noting that improvements are more evident among the top 50% of the Middle Eastern energy portfolio. This suggests that where safety management practices are already embedded and good safety culture established, operators are less inclined to allow deteriorating safety standards, despite facing the factors associated with a challenging economic environment. As these companies improve on safety standards and performance, it becomes increasingly difficult for those not investing in sustaining and improving safety to keep up. In general, it is the larger organizations in the Middle East that have been able to sustain improvement, with smaller companies working hard to keep up.

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