

Benchmarking the Middle Eastern Energy Industry:

Strengths & Opportunities of an Energy Superpower





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FOREWORD



In 2013, Marsh issued a benchmarking study gauging the comparative risk quality of the Middle-Eastern oil, gas, and petrochemical facilities relative to more than 500 similar facilities worldwide, as present in Marsh's database. In 2015, Marsh repeated the study to understand how the risk quality of region has changed in the intervening two years.

This paper will contextualize risk quality in the Middle East and explore regional trends. It aims to help clients understand current trends and standards and provide a comparative view of the risk quality of their assets and operations.

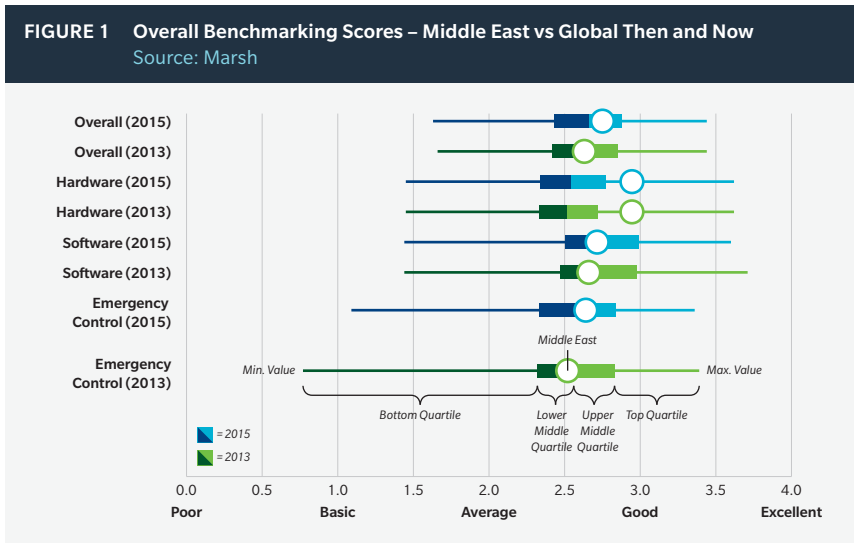
Marsh's risk ranking system provides an absolute measure of risk quality when compared against a defined set of criteria, while benchmarking determines a client's (or even a region's or industry's) position relative to its peers. These proprietary systems have been developed and enhanced over the past 25 years and are based on the views of both Marsh's risk engineers and those of the underwriting market. Marsh developed its benchmarking tool to provide a proactive risk-improvement approach based on current standards and best practice, in sharp contrast to improvement plans that are based on historical performance. For many of our clients, Marsh's benchmarking reports have already proved to be a catalyst for change.

Improving risk quality has advantages for both clients and underwriters. High-quality risks tend to produce fewer losses and are more attractive to underwriters, generally resulting in better rates and capacity.

Ian Henderson
Global Energy & Power Engineering Leader

EXECUTIVE SUMMARY

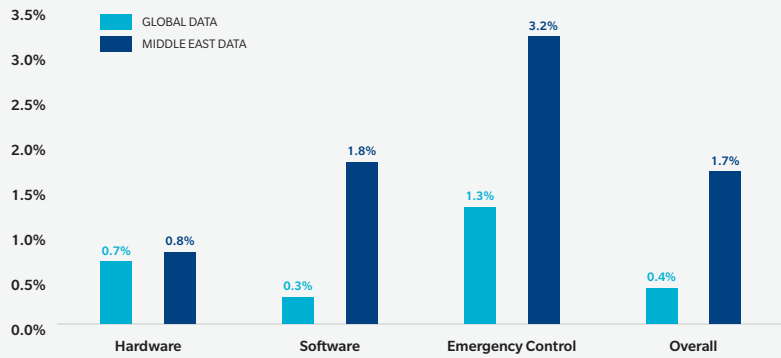
This paper highlights a significant increase in the risk quality of Middle Eastern facilities compared to the global population, as well as demonstrating that in many areas the rate of change for the Middle East region is more than three times faster than for the global population.



The size of the global peer group is more significant than in 2013 and hence there may be more “change inertia”, but the Middle East comprises around 35 plants in the database, also a very significant asset base. As illustrated here, there is no ignoring the way that the Middle East has made great strides towards improvement compared to the rest of the world, particularly related to management systems (software) and emergency response arrangements.



FIGURE 2 Overall Rate of Improvement 2015 vs 2013
Source: Marsh



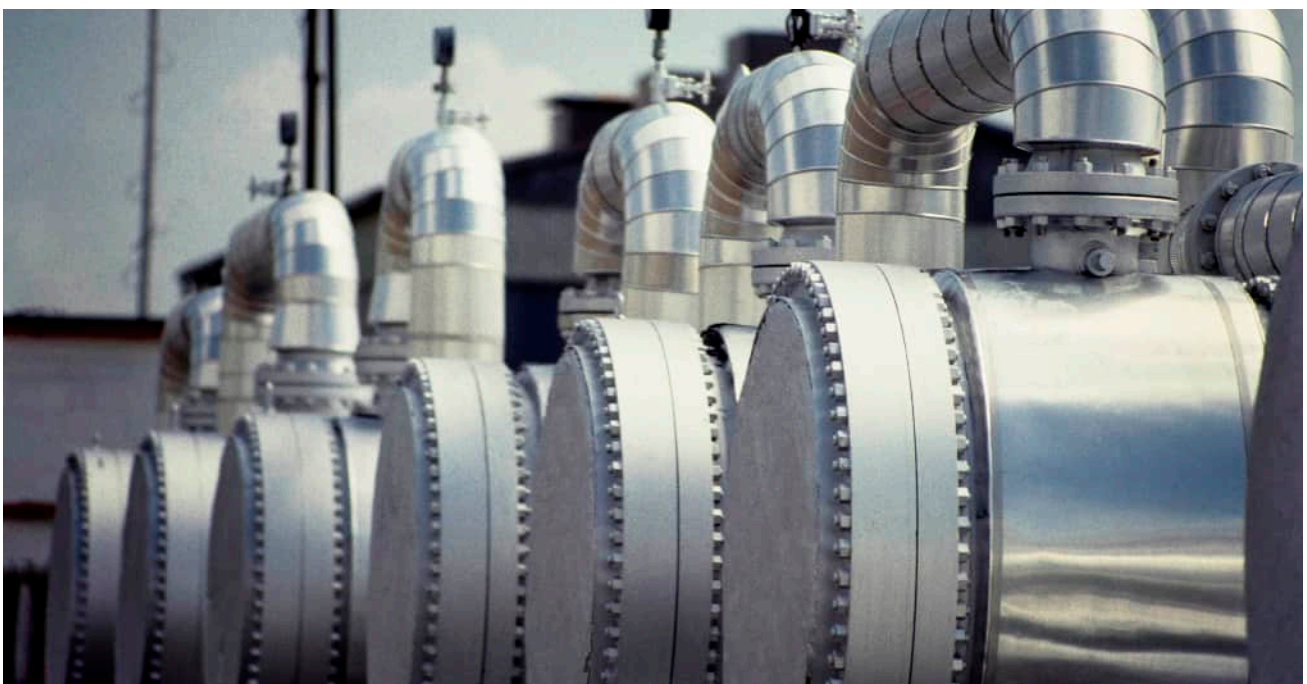
The data above may reflect that risk engineering efforts in the region have been focused on software (management systems) and emergency control topics, where the Middle Eastern facilities have historically been rated as behind their peers. High risk improvement recommendation completion rates across a number of facilities, including some of the large regional players, are likely to be a significant contributory factor in enabling the region to achieve such a dramatic change compared to the rest of the world.

The most noteworthy improvement in the region is seen across the emergency control features, with the Middle East now a strong player in the upper-middle quartile. Marsh and insurers have been working with clients to address some of the consistent themes of deficiency in the region, such as fire pump availability, fire pre-plans, fireproofing, etc.; as well as making specific risk improvement recommendations to clients. These recurring themes have also been addressed by means of loss

seminars and focused initiatives to improve client awareness and gain commitment to securing improvements for the longer term.

Commendably, the Middle East has secured a strong overall position within the upper middle quartile of the Marsh benchmarking database and, if such high improvement rates continue to be achieved, then it will trend towards being top quartiles within the next two to three years. While only emergency control has moved quartile, there is a strong upwards vector in all categories.

Risk Quality Category	2013 Global Study Quartile	2015 Global Study Quartile
OVERALL	Upper-Middle	Upper-Middle
HARDWARE	Top Quartile	Top Quartile
SOFTWARE	Upper-Middle	Upper-Middle
EMERGENCY CONTROL	Lower-Middle	Upper-Middle



HARDWARE: CONTINUES TO BE A KEY STRENGTH

Hardware remains a key strength of the region, reflecting the investment in new projects, and the investment in asset management and maintenance for existing facilities.

Globally, a number of new facilities have come online in recent years, with the Middle East receiving a significant part of such investments. New facilities not only benefit from best-in-class features and more modern designs, but also, by being subject to formal risk assessment and plot plant reviews during the design phases, when it is easier and less costly to implement changes. Furthermore, expansion projects tend to be implemented with previous recommendations and lessons learned taken into consideration.

For the Middle East, site layout is close to being top quartile, and remains a key area of strength.

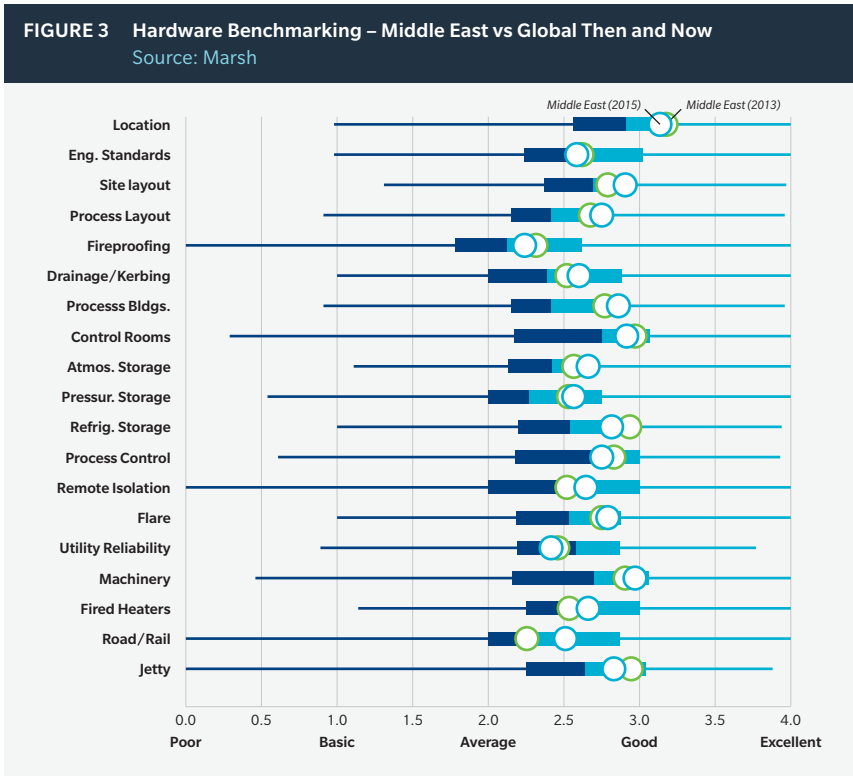
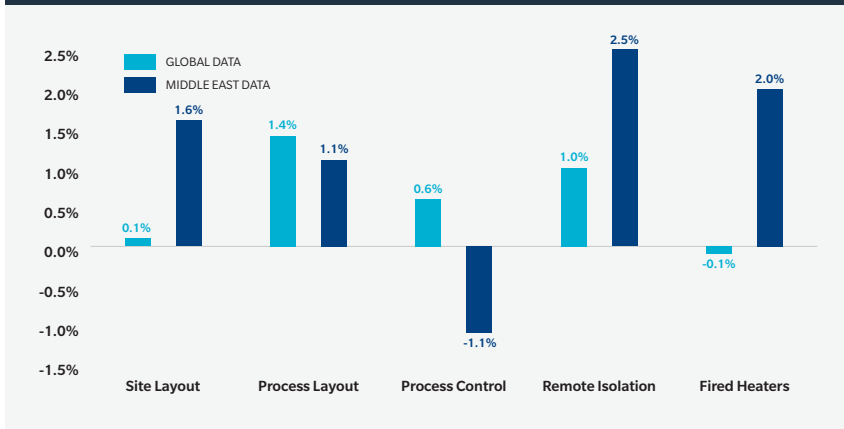


FIGURE 4 Middle East and Global Rate of Improvement – Hardware 2015 vs 2013
Source: Marsh



Newer facilities feature excellent unit-to-tankage, unit-to-utilities, and unit-to-unit separation, limiting the potential for knock-on effects and with firewater pumps and control buildings generally remote or well separated from process and storage areas. Furthermore, process areas are laid out to remove or separate potential ignition sources and are constructed to limit the levels of confinement and congestion which are directly related to the potential and severity of loss scenarios, such as vapor cloud explosions.

Fireproofing remains a common recommendation theme across the region; however, with a high rejection rate. 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 ones) are based on a burndown philosophy. It is suggested that operators review the provision of passive fire protection (PFP) against the requirements of API RP 2218 and their understanding of the local fire risk.

Alarm management, a key feature of process control, has been an area of focus in recent years within the risk engineering community. For new plants, there is often a significant time period between start-up and achieving stable alarm management, despite having sophisticated data communication system (DCS) and specific alarm management software packages. There is evidence of older facilities investing resources (time and equipment) with the goal of reaching “stable” or “predictive” alarm management performance, as defined in EMUAA 191.

The expectation is that this area will see improvement over the next few years, as there is evidence of significant investment in alarm management software on both new projects as well as retrospective application. This is one area where the standards have improved, but the Middle East has yet to move at the same rate as global peers.

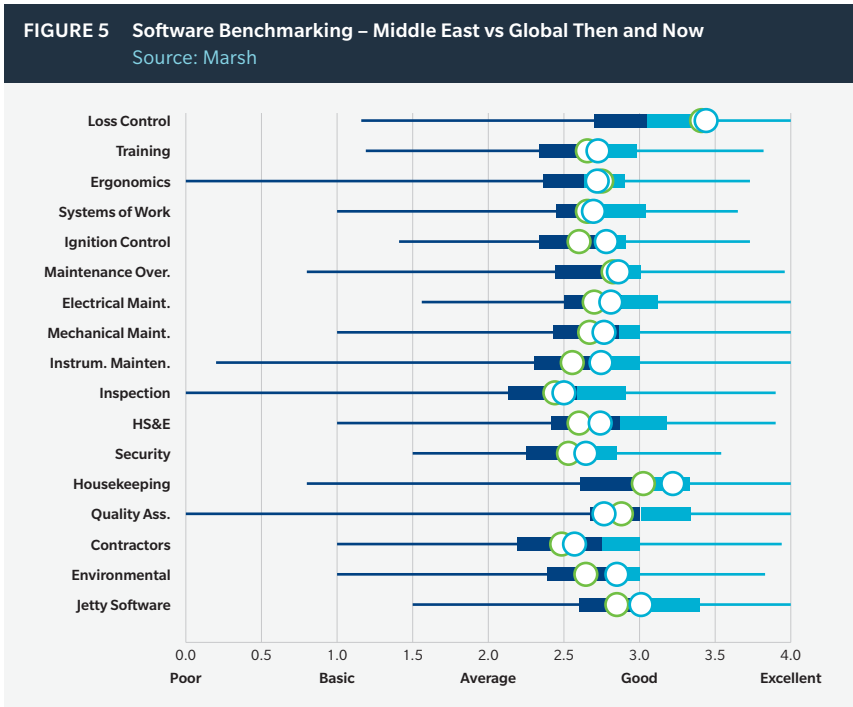
Remote isolation has been another common recommendation theme in the Middle East, historically with a low completion and high rejection rate due to the need for hardware modification and financial investments. In the last three years, there has been significant improvement globally and regionally, with the Middle East improving at double the rate of the rest of the world. This is partially due to newer facilities benefitting from good design features, but also a number of existing sites have now accepted and implemented this recommendation. In a similar vein, a key improvement area for fired heaters has been the provision of automated double block and bleed systems on the fuel/pilot lines: Upgrades in this area have also been a key improvement driver.

SOFTWARE: FOCUSED RISK ENGINEERING EFFORTS GIVE RISE TO RAPID IMPROVEMENT

The Middle Eastern energy portfolio has, in the past, been perceived as having less rigorous management systems and/or risk management practices than their global peers, often with implementation that was less robust than international norms.

Encouragingly, development in this area is very evident and management systems in the region appear to be maturing, with energy operators working towards aligning themselves with industry best practice. Between 2013 and 2015, the Middle East has moved into a stronger position in the upper-middle quartile for management systems.

Some of the key players in the region have, in recent years, invested in developing internal and corporate management systems, standardizing the management systems across a number of facilities. Such organizations also tend to benefit from regular interaction with Marsh and the risk engineering community (and, in some cases more experienced joint venture partners) and therefore have access to the latest engineering standards and industry best practice.



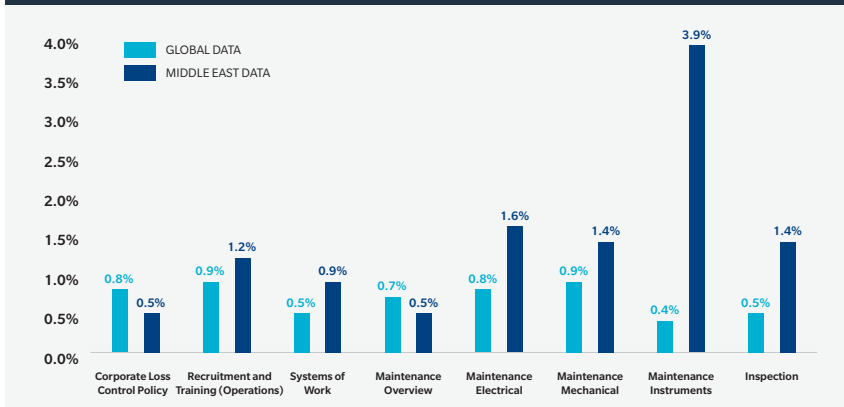
Multi-site organizations are also starting to look at understanding recurring themes in risk engineering recommendations, and with this comes the opportunity to share learning between different facilities.

Such initiatives are likely to result in year-on-year improvement if implementation, auditing, and follow-up are given adequate focus and resource, with key performance indicators (KPIs) given a sufficient level of management attention. Senior management should remain mindful that these initiatives are only effective if implemented properly, and that having a procedure and/or system is no guarantee that the risk is being managed within acceptable levels.

Marsh’s Middle East engineers visit around 50 facilities each year and the general impression is that process safety is regarded with increasing importance; even many smaller organizations now have dedicated process safety teams, with a clear policy on how process safety is to be implemented and managed.



FIGURE 6 Middle East and Global Rate of Improvement – Software 2015 vs 2013
Source: Marsh



The suite of process safety performance indicators now used across the region is a considerable improvement compared to those visible three years ago, where there was still a heavy reliance on personal safety indicators.

In 2013, training was highlighted as a potential area for improvement for the Middle East. Improvement has been realized but the region remains within the lower-middle quartile. Some facilities are experiencing high turnover levels due to project activity in the region. Forward-thinking sites are investing in succession plans and training programs to manage turnover before it becomes an issue. However, the Q4 2015 drop in the oil price has resulted in recruitment restrictions for many, potentially leaving critical vacancies empty.

More sites are seeing the benefit of having training matrices for each role, which identify the minimum required qualification as well as the need for continuous professional development. At some less mature facilities, training of technical staff still tends to be limited to initial/induction training, with the lack of advancement and refresher training a recurring theme.

Systems of work have seen major and consistent improvement since 2011; however, it is still within the lower-middle quartile. Procedures have improved, with more robust management of change, permit to work, and override controls in place, in particular, at larger multi-site organizations such as NOCs, where these are being standardized. Procedures seen at some stand-alone sites, however, are not yet in-line with this improving trend. Interpretation and implementation of these procedures remain the challenge and the region could generally benefit from more rigorous auditing and tracking and follow-up of findings. While most facilities have a management of change (MoC) procedure, the “recognition of change” in particular, the more subtle changes, remains an improvement opportunity.

Maintenance across the region is improving as more and more organizations pursue a philosophy of reliability centered maintenance (RCM), with a mix of preventive (time based), predictive (condition based), and corrective maintenance; this is also supported by investment in computerized maintenance management systems and more

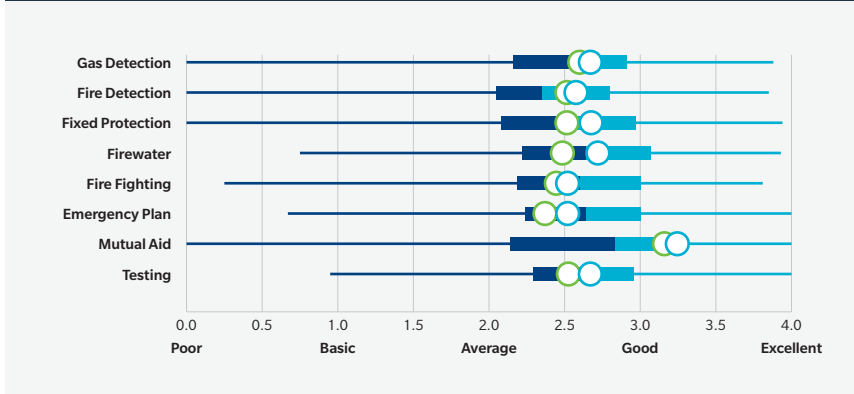
comprehensive KPIs structures. Where RCM has been implemented, maintenance routines are influenced by the equipment criticality taking into consideration potential safety, health and environmental consequences as well as other factors such as impact on production. The criticality ranking is seen to also influence maintenance planning, work order prioritization (in terms of scheduling), and spares holding.

Maintenance of transformers and backup systems (for example, uninterruptible power supplies, emergency diesel generators, etc.) has been an area of focus following a number of losses related to failure of such equipment. The impact of addressing the issues is clear from the significant improvement of the region’s performance in this area.

Inspection in the region is slowly moving towards a philosophy of risk based inspection (RBI). Resourcing, however, remains a concern, with vacancies in essential positions being a challenge for a number of facilities. This is a highly weighted feature within the Marsh benchmarking database and is a key focus area during risk engineering surveys.

EMERGENCY CONTROL: TURNING GOOD PRACTICE INTO COMMON PRACTICE

FIGURE 7 Emergency Control Benchmarking – Middle East vs Global Then and Now
Source: Marsh



In general, the hardware features associated with emergency control have always been a strength of the region, reflecting the significant investments in fire gas detection and fixed firefighting protection. Often, site-based staff had little understanding of the maximum firewater demand case versus the actual onsite capacity, but this is an area which has received considerable attention recently and, in part, explains why the region is now in the upper-middle quartile.

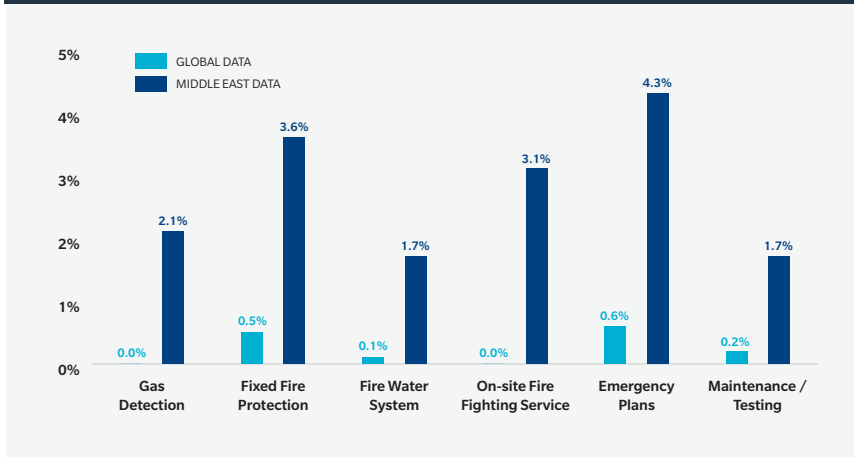
Maintenance and testing of firefighting systems and, in particular, firewater pumps, has been another common recommendation theme in the region, but risk engineering recommendations and seminar events have gained traction, with good improvement evident. Application of the requirements set by NFPA 25 is now embedded across a much larger portion of the regional peer group than in the past, with some organizations developing this as a corporate standard. Firewater systems should be treated as safety critical, and we are seeing more and more evidence of such a mindset across the Middle East, in part driven by the focus given by Marsh risk engineering surveys.

On-site firefighting has seen some improvement in recent years. Marsh and insurers have been working with clients to address some of the gaps, with a common theme being lack of specific on-scene commander training.

Emergency planning, despite still being in the lower middle quartile has seen important progress. The value of having clear fire pre-plans is not yet fully understood by many companies, however, there are some examples of best-in-class fire pre-plans at some facilities.

The region has seen commendable improvements in this area, especially when compared to global peers. Focused risk engineering efforts, together with commitment to loss prevention, has enabled the region to move this category, (previously highlighted as a major area for improvement and the only category in the lower-middle quartile) into a strong position in the upper middle-quartile.

FIGURE 8 Middle East and Global Rate of Improvement – Emergency Control 2015 vs 2013
Source: Marsh



SUMMARY

With significant investment potential in the region, hardware has always been a key strength. Significant improvement in this area is not expected in a two to three year time-frame, due to the longer timescales for the investment required as well as already strong position of the Middle East. New projects and retroactive application of some more modern safety features have, however, resulted in the region retaining its strong position despite the moving goal posts. The features embedded in the software category are considered, by both risk engineers and underwriters, to be the most important in determining risk quality. Focused risk engineering efforts and greater commitment towards risk reduction from a number of Middle Eastern sites are likely to have been significant contributions in the region's rating improving at a much faster rate than its global peers.

Remarkably, the region's rating for emergency control has improved significantly since 2013 and, in 2015, it has attained a position in the upper-middle quartile for emergency control. Emergency planning, understanding the maximum fire case and testing of firewater pumps in line with the relevant international standards are just some of the areas where facilities have effected substantial improvement.

Benchmarking studies and other value-add services, such as common recommendation themes analysis, have enabled Marsh, together with our clients, to identify the key areas for improvement at both regional, company, and site level. The expectation is that the region will continue to see more improvement over the next few years, potentially moving into the top quartile if the improvement rates are sustained.

POSITION PAPERS

PERSPECTIVES, EXPERTISE, AND GUIDANCE ON RISK QUALITY ISSUES FACED BY THE ENERGY INDUSTRY

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 by Marsh as very good 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.

Such position papers are distributed to clients and prospects globally. In many cases these papers have aided our clients in moving along risk improvement recommendations which in doing so have contributed 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.

FURTHER READING



BENCHMARKING THE ASIAN ENERGY INDUSTRY: STRENGTHS AND OPPORTUNITY IN A RAPIDLY DEVELOPING MARKET

A benchmarking study to gauge the comparative risk quality of Asian onshore oil, gas, and petrochemical facilities relative to similar facilities worldwide.



THE 100 LARGEST LOSSES

The 24th 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.

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