Evolution of safety performance in the oil and gas sector

2004-2014

arpel
REGIONAL ASSOCIATION OF
OIL, GAS AND BIOFUELS SECTOR COMPANIES
IN LATIN AMERICA AND THE CARIBBEAN

EXECUTIVE SUMMARY

The purpose of this report is to show the evolution and improvements in industrial safety performance of the companies in the oil and gas sector in the region, based on the statistics collected by ARPEL on recordable incidents and fatalities reported by its member companies in the last 10 years, and on interviews with selected contact staff of such companies.

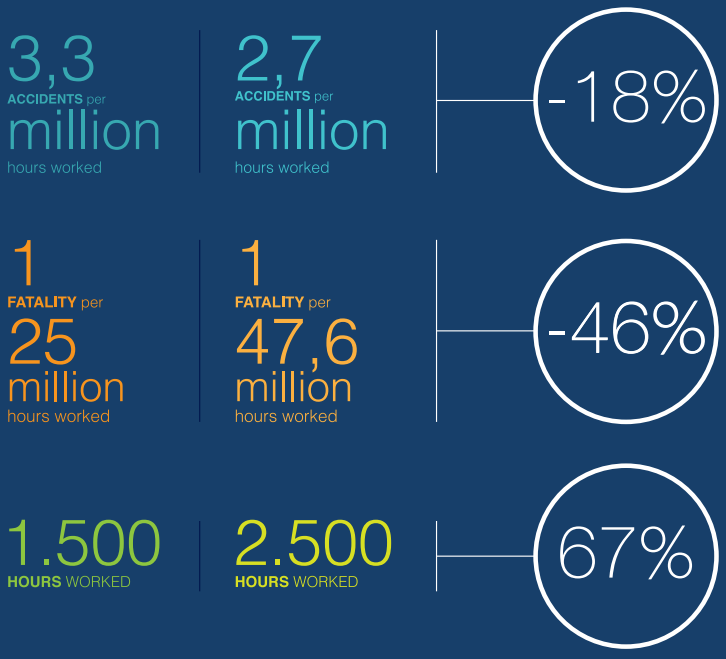
On the basis of these statistics, we can state that performance indicators in industrial safety have shown a significant improvement in the industry as a whole and throughout its value chain.

During the period considered for this report, the average of accidents per million hours worked decreased from 3.3 to 2.7 accidents, which represents a fall of 18 %. The fatality rate decreased from one fatality every 25 million hours worked to one fatality every 47.6 million hours worked in this period.

This improvement was general to all the lines of business considered (E&P, Refining, Transportation, Distribution and Others), showing a clear downward trend for both indicators in the majority of the cases.

In turn, this improvement in performance is accompanied by a 67 % increase in the man-hours worked, from an annual average of 1.5 billion hours at the beginning of the period to 2.5 billion at the end.

The interviews showed that the key to these improvements lies mainly in the generalization of a safety culture, supported proactively by the companies through the adoption and implementation of management systems and a consistent leadership throughout the process.



INTRODUCTION

The purpose of this report is to show the evolution and improvements in industrial safety performance of the oil and gas industry in the region, based on the statistics collected by ARPEL between 2004 and 2014, and on interviews with selected contact staff of such companies.

ARPEL has been collecting and comparing industrial safety statistics since 1997, on the basis of some key reactive indicators (lagging indicators) of widespread use in the industry and in any productive activity. The indicators collected since the first reports are Total Incidents' rate, Incidents' frequency rate with lost workdays, Incidents' gravity rate and Fatal incidents' rate. These indicators are opened by line of business and by company employees or contractors. In turn, in the last few years, proactive indicators (leading indicators) have been incorporated with regard to planned observations and training tasks. The aim is to move toward the comparison of indicators of process safety. Based on our statistics we can state that there are significant improvements in industrial safety performance indicators of the sector as a whole.

In turn, the approach of this report is not purely quantitative, but a number of interviews were conducted with selected experts from leading companies in the industry, so as to identify the keys to the improvement in safety performance as well as future challenges, the road ahead and the efforts being made so that the industry conducts its operations in a safe, healthy and environmentally friendly manner.

METHODOLOGY

For the preparation of this study, the statistics of industrial safety gathered annually by the Association and reported directly by member companies were taken into account.
For purposes of this report, the indicators selected were Total incidents' rate and fatal incidents' rate, as they are those with the greatest comparability and representativeness throughout the period under study.

$$\text{Total incident rate} = \frac{\text{Total recordable cases (injuries+diseases+fatalities)}}{\text{Million hours worked}}$$

$$\text{Fatality rate} = \frac{\text{Number of fatalilties}}{\text{Million hours worked}}$$

* While both indicators are commonly used, if further information is required on the indicators or definitions, please refer to the User Manual on Industrial Safety Benchmarking (6th edition 2012), available on ARPEL web page.

In order to assess the progress of the industry in safety performance, trends were observed in the moving averages (3 years) of the indicators of total incidents and fatalities (company + contractors) between 2004 and 2014. While statistics have been collected from 1997, data from 2004 were used for this report because a hard core of companies has been consistently reporting throughout the period, which facilitates comparability. On the other hand, regional representativeness, measured in hours worked from that date, is much greater than in earlier years.
For the qualitative assessment, six interviews with experts in industrial safety from ARPEL member companies were conducted in July and August 2015, with the purpose of inquiring about the keys that have enabled improvement in performance.

PERFORMANCE INDICATORS

The total average of incidents for the industry overall between 2004 and 2006 was 3.3 incidents per million hours worked, while the total recorded for the period 2012-2014 was 2.71. This is equivalent to a reduction of 18 %.

Concerning the fatality rate, the decline was 46 %, since 0.040 fatalities per million hours worked were recorded for the period 2004-2006, while 0.021 were recorded for the period 2012-2014.

All lines of business showed a decline in the fatality rate when comparing this rate for the period 2004-2006 vs. 2012-2014. E&P showed a decrease of 36 %, Refining, 34 %, Distribution, 38 %, Transportation, 26 %, and Others, 70 %.

While all lines of business show values lower than those recorded 10 years ago, the downward trend is very clear in E&P, Refining and Others, while a more stable trend is shown in Distribution and a growing trend in Transportation. The latter began to be reversed in the last three years.

2004-2014

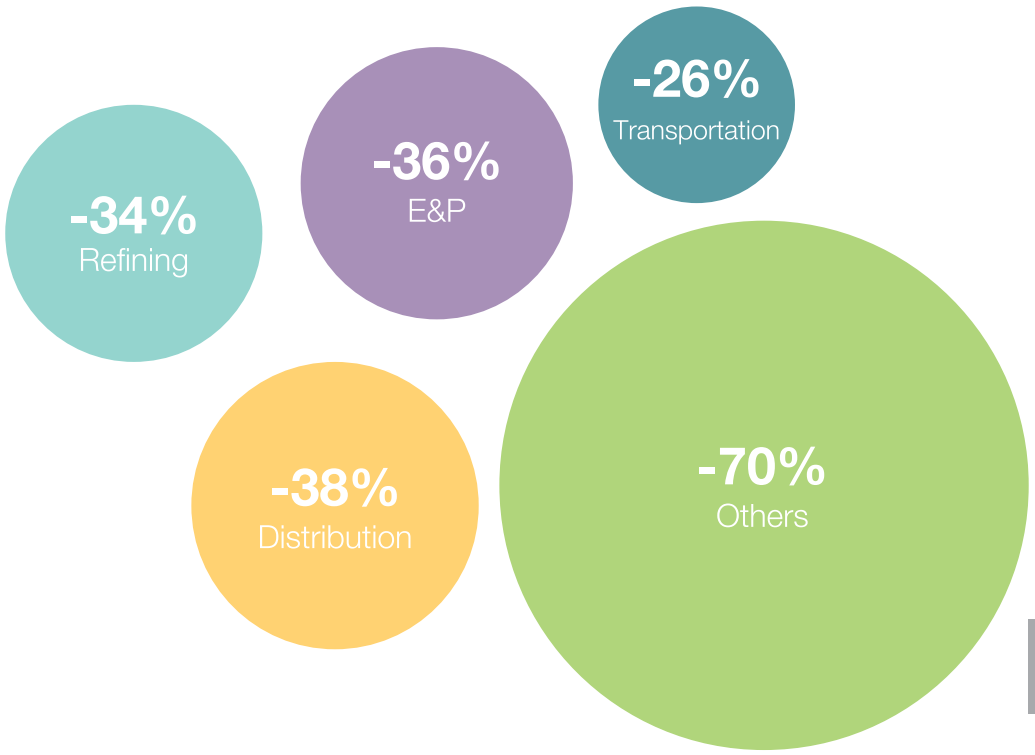
-18%

Total average of incidents

-46%

Fatality rate

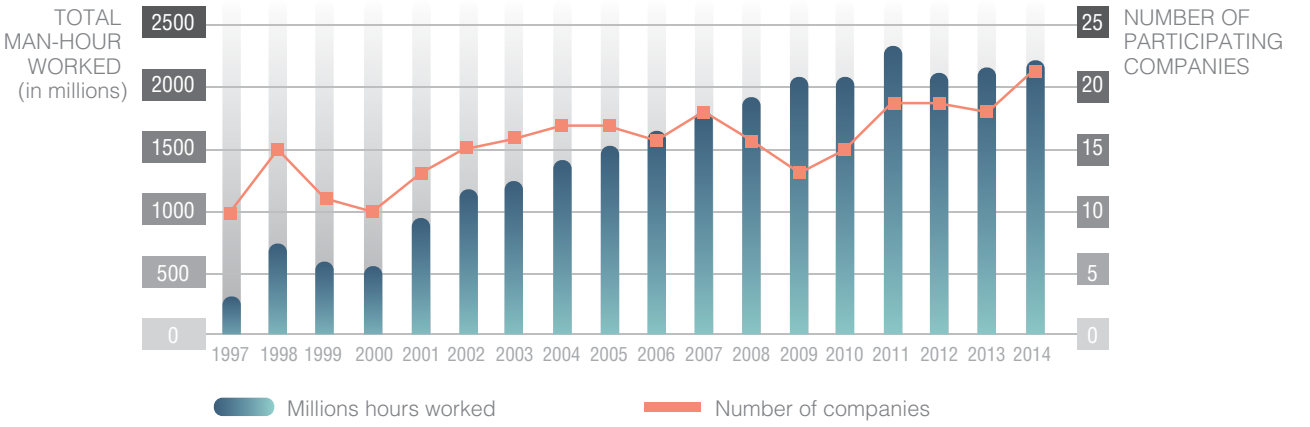
Fatality rate per lines of business



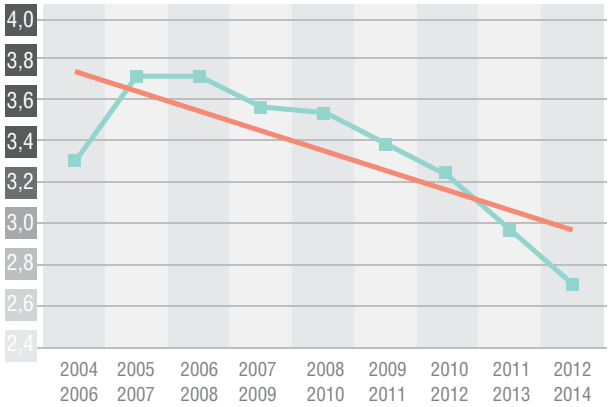
In turn, all lines of business showed a decrease in the total incident rate when comparing the period 2012-2014 to the period 2004-2006: E&P, 3 %, Refining, 27 %, Transportation, 60 %, Distribution, 35 % and Others 22 %. This shows clear downward trend in all lines of business.

The number of hours worked reported increased by 67 % in the period, from an annual average of 1.5 billion hours in 2004-2006 to 2.5 billion hours in 2012-2014.

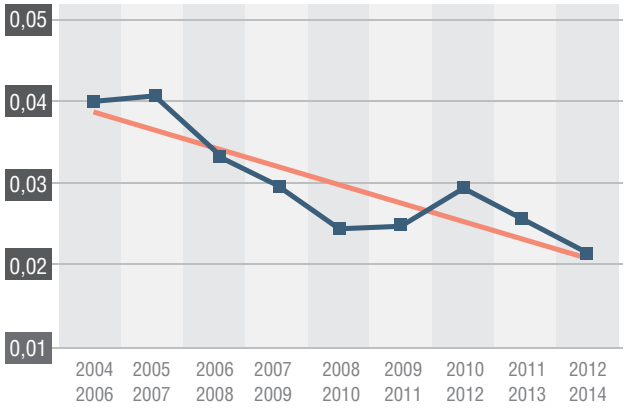
EVOLUTION OF TOTAL HOURS WORKED REPORTED AND NUMBER OF PARTICIPATING COMPANIES



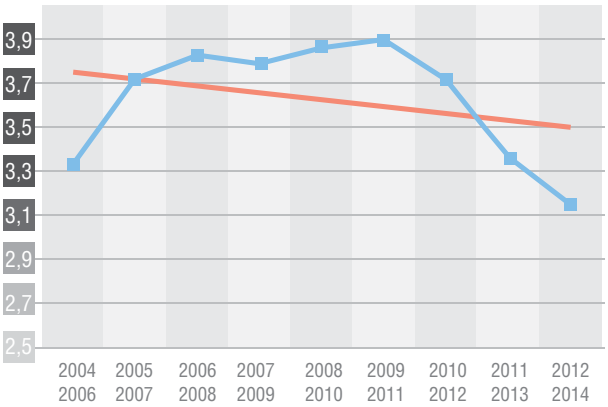
TOTAL INCIDENTS' RATE - GLOBAL INDUSTRY



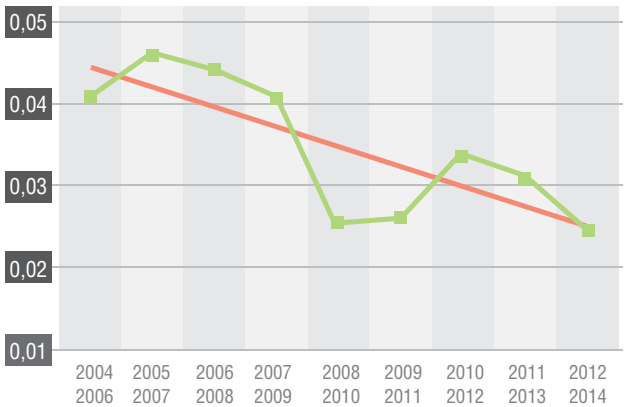
FATALITIES' RATE - GLOBAL INDUSTRY



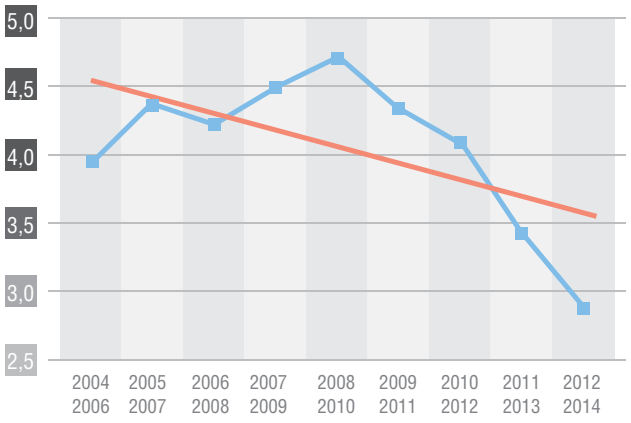
TOTAL INCIDENTS' RATE- E&P



FATALITIES' RATE - E&P



TOTAL INCIDENTS' RATE - REFINING



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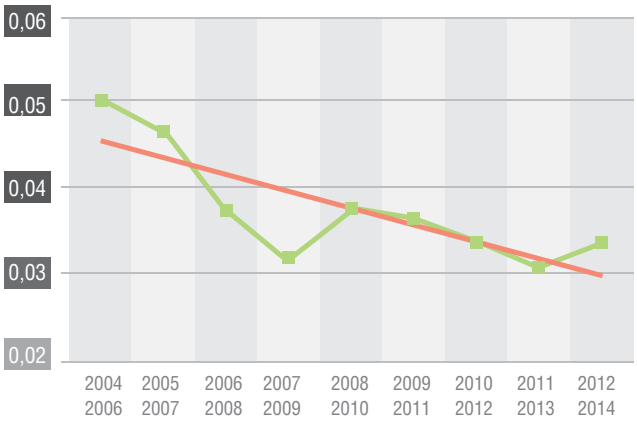
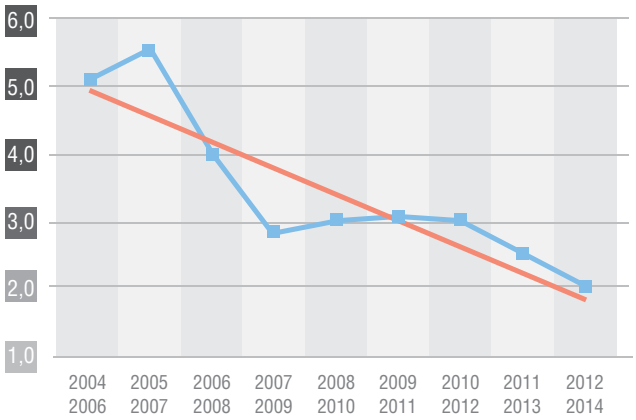
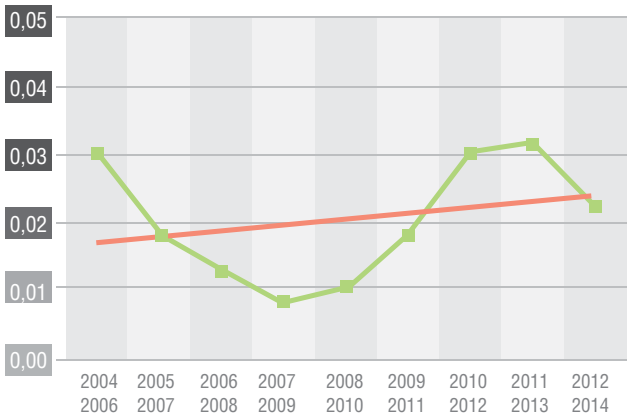


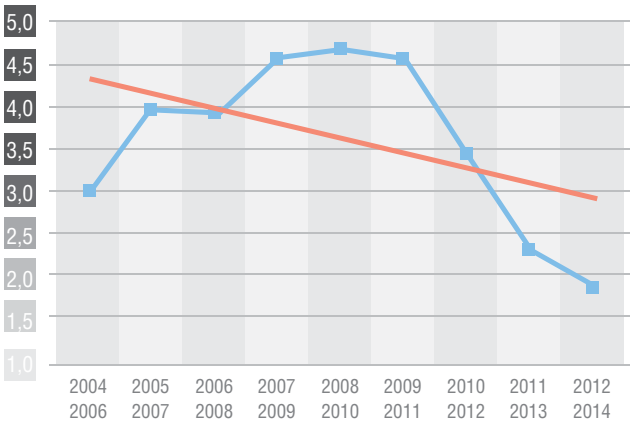
TOTAL INCIDENTS' RATE - TRANSPORT



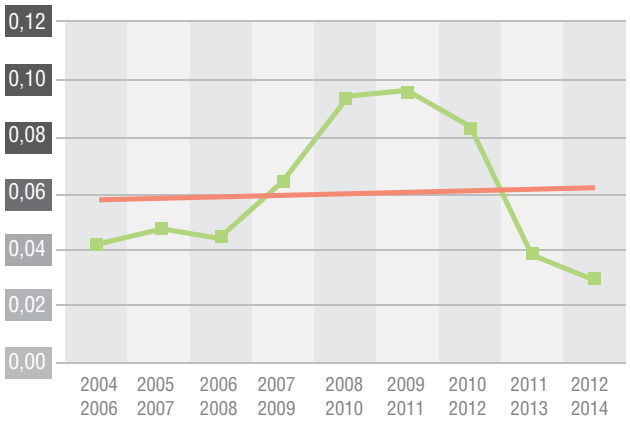
FATALITIES' RATE - TRANSPORT



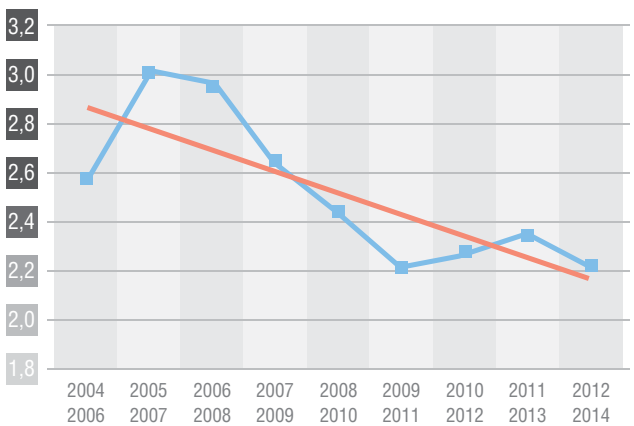
TOTAL INCIDENTS' RATE - DISTRIBUTION



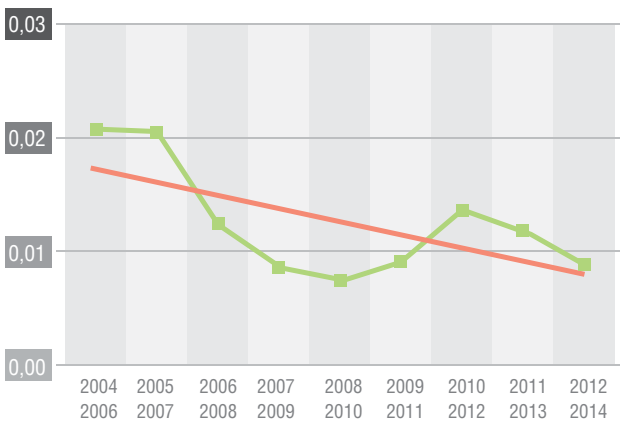
FATALITIES' RATE - DISTRIBUTION



TOTAL INCIDENTS' RATE - OTHERS



FATALITIES' RATE - OTHERS



KEYS TO IMPROVEMENT IN PERFORMANCE

In July and August 2015, six interviews were held with experts in industrial safety of ARPEL member companies.
Following are the professionals interviewed:

César Aragón
Process Safety, Industrial Safety and Health Manager - Equión Energía (Colombia)

Gustavo Correa
Health, Environment and Safety Manager, Downstream Sector - YPF (Argentina)

Ruy Girard
Coordinator of the Subdirectorate of Operational Discipline, Safety, Health, and Environmental Protection - Petróleos Mexicanos (retired in 2014)

Ángel Gutiérrez
Environment Manager for South America - Schlumberger (International)

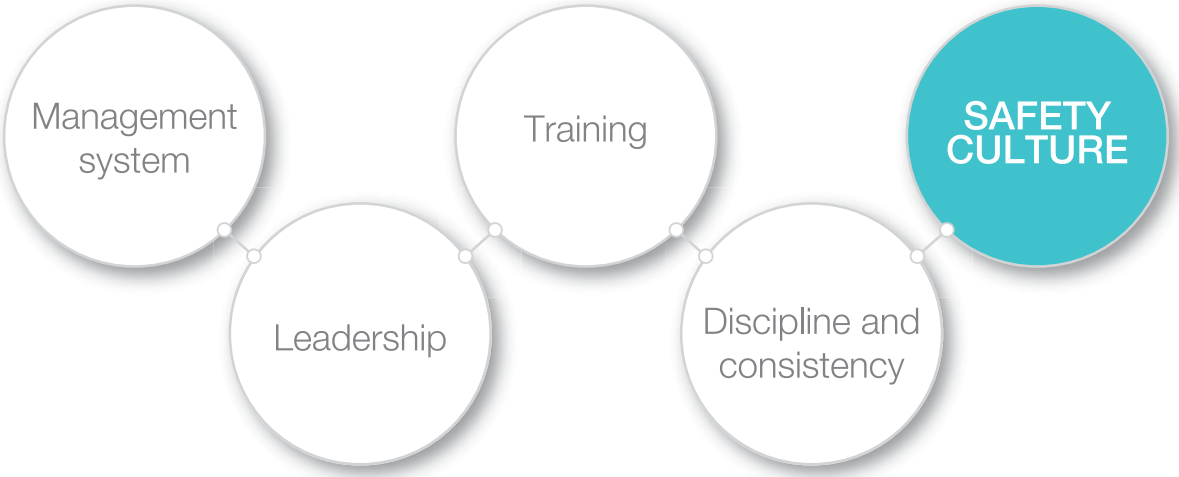
Walter Sarmiento
QHSE Manager - YPFB Transporte (Bolivia)

Carlos Videla
E&P Safety Manager - Repsol (International)

The main questions during the interviews inquired in depth about the keys that have enabled the significant improvement in industrial safety performance, the incentives granted, the role of technological advances, the development of a safety culture, the performance measurement, the management of contractors, the role of the trade union organizations and also the future challenges to further improve performance.
Below are the main results of these interviews.

Management systems, leadership, culture, discipline and consistency

All interviewees mentioned the five interdependent concepts as key in the improvement in industrial safety indicators in the operations of the oil and gas industry.



Management systems

"Management systems should be simple, should be a useful tool to safely organize the daily work and facilitate continuous improvement"
Ruy Girard, Retired from Pemex

Management systems were mentioned as an important element for the development of a safety culture, since they are the basis on which to support the safety professionals to be able to establish continuous improvement and develop safety management in a disciplined, consistent manner. The improvement in industrial safety performance can be separated into two major stages: before and after the implementation of management systems. The design, structure and methodical, systematic implementation of management systems has made possible the gradual involvement of top management, line of command and workers in the elements that make up the systems; their responsibilities, scopes of competence and authority are clearly defined. In the medium term, this promotes and strengthens leadership and commitment of all workers in the company.
In this regard, all companies in the industry have made progress in the certification of their operations under international references. The adoption and implementation of management systems is an essential foundation to develop a safety culture, as it establishes the reference framework for action.

Culture

"Years ago, safety work was meeting the specific requirements established by a supervisor. It is now a matter of attitude, employees care for themselves understanding that they do so for their own sake and for their families."
Walter Sarmiento, YPFB Transporte

The generation of a safety culture has been identified by all respondents as the most notable change observed in recent years, as well as the key factor in the reduction of accidents in the hydrocarbons industry.
In the past, work systems were more autocratic and discipline was exercised through rewards and punishments in a vertical way. Today, work systems are more horizontal and workers incorporate respect for safety and perceive the risks inherent in the operations of the industry. Employees currently exert greater self-care, with stronger empowerment, taking an active role in the improvement in performance, i.e. forming part of the solution to the problem of accidents in the industry.
Any company that is able to develop a safety culture will not only operate more safely, but also play the role of supervision more efficiently.
The development of a safety culture is a long process, and a number of practical recommendations were mentioned by the interviewees.

Recommendations for the development of a safety culture

- Strengthen leadership and commitment at all levels of the company
- Train staff, especially leaders
- Be consistent and keep strict discipline with regard to safety standards
- Establish creative systems of incentives that reward the attitude and proactivity of personnel toward safety, beyond other practices, such as performance bonuses or bonuses for reaching a certain level of accidents
- Manage contractors exerting the influence required to implement good safety practices through the approval of safety plans since the start of the projects.
- Apply new technologies and telecommunications in order to facilitate the management of information on safety applied to operations

Leadership

"Slow and consistent improvements in safety indicators reflect a cultural change in workers, and this is due to leadership."
Gustavo Correa, YPF

Management policies and systems are a support, or as stated above, a framework of reference for action, but their actual implementation depends on the ability of the directors, senior management, middle management and workers to lead the process, providing the appropriate space in management to safety issues.
Leadership must be incorporated into all levels of the organization, from the higher hierarchies who define the priorities, establishing corporate policies and assigning resources, to more operational levels that actually face the risks of the operation.

A recommended practice to carry on the culture development process is to have safety leaders at all levels throughout the organization who must be identified and trained by the companies to be able to properly carry out their duties.
At the same time, consistency and coherence in the decisions are necessary to exercise leadership, prioritizing safety above other objectives, whenever the operation so requires it. An illustrative example of a good practice applied by several companies is the empowerment granted to all personnel to stop an operation if they believe that it is unsafe.

On the other hand, one of the priorities to generate a safety culture and to sustain leadership is to maintain a strict discipline in decision-making. This means that no exceptions are allowed at the level of safety standards, thus avoiding the laxity and flexibility in disciplinary actions, an element very rooted in Latin American culture.
Punishing breaches, applying exemplary disciplinary actions and demanding accountability to operators, middle management and senior management when incidents occur result in the obligation to respect the established procedures.

This is not about punishing by applying coercion, unless really warranted because the integrity of the staff or facilities has been put at risk, but rather being inflexible in the requirement to comply with safety rules without exceptions. Accountability, rather than repression, is something that helps to incorporate culture.

The “paradox” of proactivity

Proactivity is a desirable feature of workers; it must be encouraged and employees must be empowered; however not to the point of generating an excess of proactivity that will lead to lack of discipline and failure to comply with established procedures.

Discipline and consistency imply demanding respect for procedures providing, in turn, the necessary means to make this possible.
A crucial aspect is that the investigation of incidents must be well disciplined and strict, because this is the source of lessons learned to prevent future incidents. A recommended good practice applied in the industry is the requirement that a root cause analysis be necessarily done of all incidents of a certain magnitude and potential for damage after 30 days of occurrence, and that a detailed follow-up be made of both this analysis and the implementation of the recommendations established. The socialization of lessons learned is a widespread practice in the industry and of critical value to incorporate such lessons and to avoid incidents.

The virtuous circle of safety

“To have consistency between what is said and what is done, conduct an in-depth investigation of the incidents, comply with the corrective actions derived from the analysis of incidents and be transparent in communications”
Gustavo Correa, YPF

Incentives

“Economic incentives have a limited life because after a certain time the additional bonus is internalized and loses its characteristic of incentive. In that respect, it is more effective that hierarchies recognize that things were done correctly, that they show satisfaction”
Carlos Videla, Repsol

While there is number of typical pecuniary incentives in regard to safety performance, generally related to obtain a certain level or improvements in accident rates, companies have developed a wide range of incentives that have proved to be more effective in generating a change in behavior.
In all cases, the prizes awarded are more symbolic than economic and emphasize the recognition by the line of authority of the good behavior of their staff regarding safety.

Below are some examples whose aim has been to motivate employees to report unsafe acts, to focus attention on proactive activities of observation and intervention and develop a culture of observation, reporting, self-criticism and self-care.

- Setting goals that each facility of a company issue a certain number of reports of unsafe activities. This fact has multiplied the number of reports and helped to develop the critical observation of working conditions as regards safety, a key factor to internalize and perceive the risks inherent in the operations of the industry.
- Rewarding in a symbolic manner the best reports on deviations of safety conditions, which are set out in brief talks on safety held at the beginning of each workday. This initiative has also favored self-criticism and the socialization of good practices, with the focus on encouraging the participation of operators in the improvement in safety conditions.
- Setting short-term goals, 60 days, for example, instead of annual goals, to avoid rendering the incentive ineffective due to failure to reach an annual target from a date close to the start.

The role of technology

"Technological progress has not been the only pillar; the focus of improvements is on the cultural change of people"
Ángel Gutiérrez, Schlumberger

While it is recognized that technology and advances in telecommunications have played an important role with regard to improving safety performance, they are not the most important component. It is understood that the behavioral factor and the development of the concept of self-care have been determining in the reduction in the accident rate in the hydrocarbons industry.
Among the main virtues of technological advances is the ability to manage information much more efficiently and effectively. At the same time, these advances provide the possibility of remotely controlling facilities with the use of sensors and tracking software, allowing the early detection of operational problems and their proper management.
Another of the fundamental pillars of telecommunications is that they facilitate the preparation and response to emergencies in the case of an incident.
On the other hand, advances developed with regard to materials, personal protective equipment, new machinery, etc. have significantly reduced the exposure of workers to operational risk.

Management of contractors

"The challenge to improve the management of contractors is to involve them in process safety"
Gustavo Correa, YPF

Most of the operations of the oil and gas industry, mainly in the stages of exploration and production are developed by contractors, so proper management is key to avoid incidents.
For this reason, all companies exert a strong control on their contractors and seek to exert a positive influence on them so that they work with the best safety standards.

Some good practices identified and carried out by different companies have been the following:

- Making management and procedures manuals available to contractors, sharing them during bidding procedures or freely on their own institutional web sites
- Conducting regular meetings with representatives of contractors in order to have feedback with regard to the performance in safety of operations, and incorporate the recommendations into manuals and procedures, if applicable, thus encouraging the cycle of continuous improvement
- Performing an assessment of contractors, their safety plans and their technical personnel, so that they are consistent with the plans and performance standards of the contracting company
- Requiring investigations of incidents
- Conducting training for providers
- Reserving the power to request the contractor to reassign any worker who routinely fails to comply with safe operating procedures
- Establishing contract termination clauses due to the breach of safety conditions by the contractor.

In general, all companies maintain certain practices of "development of contractors", that is, there is a series of specific actions taken by the companies to adequately prepare their contractors and proactively collaborate so that they meet the requirements of the company and the industry regarding safety. This factor is important, taking into account customary statutory provisions on local development.

Relations with trade unions

It is very difficult to draw general conclusions on this matter, since the relations of the companies with their trade unions are very particular and should be analyzed on a case-by-case basis.
However, it is possible to state that companies have been very proactive in implementing improvements in safety and that the existence of Joint Committees (which are mandatory by law in many countries) is the best practice to achieve a common understanding and an improvement in safety management and performance.
The implementation of management systems and the generation of a safety culture in a company can only be achieved by working together with common goals with the workers represented by their unions.

THE OBJECTIVES OF THE JOINT COMMITTEES

(example taken from Colombia)

- Promoting safety and health
- Participating in the investigation of incidents
- Conducting audits
- Monitoring the compliance with standards
- Taking part in risk analysis teams
- Improving communication between employees and employers

Challenges

The major challenges stated by the interviewed professionals are the following:

- Consolidating and extending the concept of process safety beyond personal safety
- Improving the way to measure safety performance by developing leading indicators much further
- Achieving an adequate level of training in new personnel without prior experience in the industry
- Developing operation logistics safety (aviation, maritime transportation), which is increasingly complex (isolated areas, offshore, jungle, etc.)
- Advancing in the integration of social issues, community relations and safety of facilities

CONCLUSIONS

1 According to the statistics compiled by ARPEL, there is a significant decrease in reactive safety indicators as compared with those recorded 10 years ago.

2 During the period considered in this report, the average of accidents per million hours worked decreased from 3.3 to 2.7 accidents, which represents a fall of 18 %. The fatality rate during this period decreased from one fatality every 25 million hours worked to one fatality every 47.6 million hours worked, which represents an improvement of 46 %.

3 The improvement in indicators of total incidents and fatalities was general to all the lines of business considered (E&P, Refining, Transportation, Distribution and Others), showing a clear downward trend for both indicators in the majority of the cases.

4 This improvement in performance is accompanied by a 67 % increase in the man-hours worked, which implies an additional challenge due to the incorporation of a large number of new personnel to the industry.

5 The main factor in this improvement, according to the interviewed professionals, has been the cultural change recorded in the industry, generating greater awareness and self-care on the part of the workers.

6 The adoption and implementation of management systems has been a major factor in sustaining this cultural change.

7 Leadership was identified as the main factor for the development of this safety culture, supported in a strict discipline and consistency in the application of safety management policies and systems.

8 Technology has played an important role by facilitating telecommunications, information management, the development of early detection systems and materials that greatly reduce the risk exposure of workers. However, cultural change was considered to play a more important role than technological change in the improvement in safety performance.

9 Companies have taken a proactive role in the improvement in safety and have reached a proper agreement with trade unions on the implementation of improvements. They have also been proactive in developing their suppliers to improve their safety standards.

10 The implementation of process safety, the proactive measurement of performance, the training of new personnel, and logistics safety in the light of the expansion of E&P frontiers were identified as the major challenges for the coming years.

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MEMBER COMPANIES

ANCAP
AXION energy
cenit
Chevron
Coga Compañía Operadora de Gas del Amazonas
ecopetrol
ENAP
EP PETROECUADOR
equion Energía para la vida
Hunt
IHS
OCENSA
PETROLEUM CORPORATION OF JAMAICA
PDVSA
PEMEX
PETROAMAZONAS EP la nueva era petrolera
BR PETROBRAS
Petropar
PETROPERU
Petrotrin
pluspetrol
recope
REPSOL
Schlumberger
Spectrum
STAATSOLIE
Tecpetrol
SEGURIDAD & MEDIO AMBIENTE tema
Weatherford
YPF
YPFB Corporación

MEMBER INSTITUTIONS

AIHE Asociación de la Industria Hidrocarburífera del Ecuador
aipn
CBHE
cier
Club Español de la Energía Instituto Español de la Energía
IAPG Instituto Argentino del Petroleo y del Gas
ibp
IOGP International Association of Oil & Gas Producers
IPIECA
Oil Spill Response
RAC-REMPEITC Caribe
SLOM Sociedad Latinoamericana de Operadores de Terminales Marítimo Petroleros y Monoboyas
WORLD ENERGY COUNCIL CONSEIL MONDIAL DE L'ENERGIE For sustainable energy
World Petroleum Council

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