International Association of Oil & Gas Producers

REPORT 459 | AUGUST 2018

IOGP Life-Saving Rules

Acknowledgements

This report was authored by the Life-Saving Rules Task Force of the IOGP Safety Committee.

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REPORT
459

AUGUST
2018

IOGP Life-Saving Rules

Revision history

VERSION	DATE	AMENDMENTS
3.0	August 2018	Major revision
2.0	April 2013	Amendments to safety icon designs
1.0	February 2012	First issued

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Scope

With the revision of Report 459, IOGP launches a simplified set of Life-Saving Rules to provide workers in the industry with the actions they can take to protect themselves and their colleagues from fatalities. IOGP aims to improve the level of industry-wide adoption across the global oil and gas industry. The reduced number of rules (nine) still cover a similar scope to that of the original 18 Life-Saving Rules: since 2008, 376 lives could have been potentially saved by following the revised IOGP Life-Saving Rules.

IOGP Report 459 introduces the revised IOGP Life-Saving Rules, provides implementation guidance and the background data analysis. Additional implementation materials are available from https://www.iogp.org/life-savingrules.

1. Foreword

IOGP Member companies recognise the value of providing clear, simple, and consistent information regarding risks in the workplace and the proper use of barriers and safeguards to protect the workforce. In 2010 IOGP published a set of Life-Saving Rules to mitigate risk and reduce fatalities in the oil and gas industry. These were derived from analysis data reported to IOGP: 1484 fatal incidents (1991-2010) and 1173 high potential events (2000-2010). Following these simple rules could have prevented around 70% of these fatalities.

While member companies and others benefit from implementing their own programmes, there is greater clarity and effectiveness to be gained in standardising Life-Saving Rules across the industry. Over 80% of the workforce, and around 80% of fatalities, are contractor employees (Fig 1). Contractors are required to learn numerous process requirements for each client, even though the operating practices, activities, and risks are fundamentally the same.

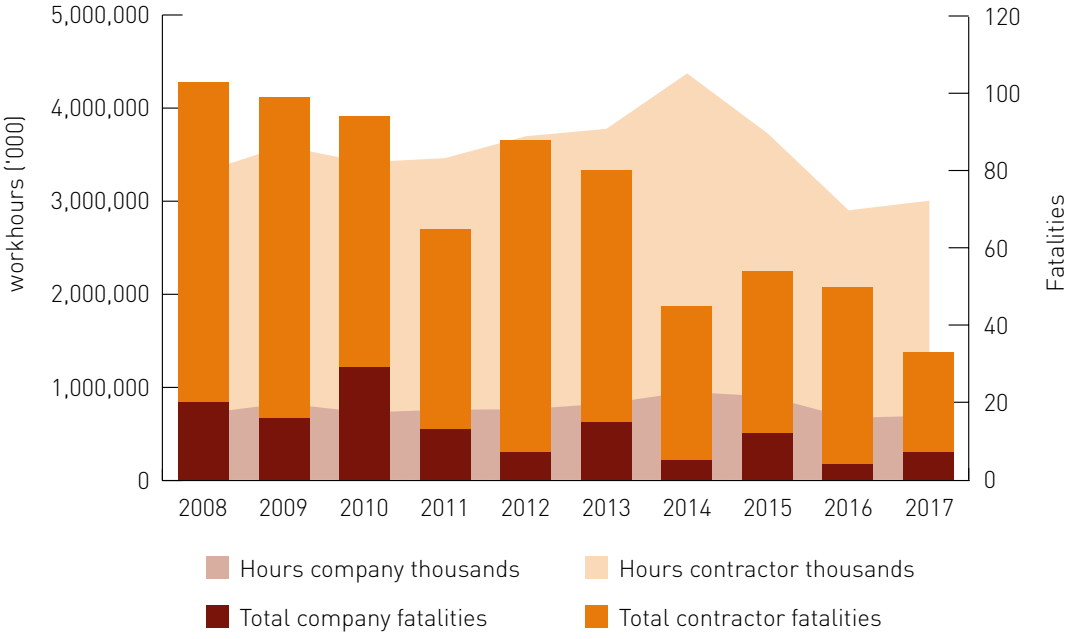


Figure 1: Fatalities reported to IOGP (2008-2017), and associated workhours

In 2018, IOGP re-examined the applicability of the 2010 Rules against the most recent fatality data. With the revision of this report, IOGP launches a simplified set of Life-Saving Rules (Figure 2) to provide workers in the industry with the actions they can take to protect themselves and their colleagues from fatalities. With a reduced number of rules (nine reduced from 18), but still covering a similar scope, IOGP aims to improve the level of industry-wide adoption across the global oil and

gas industry. Since 2008, 376 lives could have been potentially saved by following the revised IOGP Life-Saving Rules (See Appendix A for data analysis, Rule development, and applicability).

The IOGP Life-Saving Rules are not intended to address all risks and hazards in the oil and gas industry; they are meant to draw attention to the activities most likely to lead to a fatality, and the life-saving actions over which an individual has control. The Rules are intended to support existing company management systems. They are not intended to replace company management systems, policies, safety training programmes, operating procedures, or work instructions, and in fact rely on this framework being in place.

Standardisation of Life-Saving Rules across the oil and gas industry:

- Enables better transfer of knowledge, experience and lessons learned
- Increases individual awareness ownership of critical safeguards that prevent fatalities
- Is a step towards an industry-wide common safety language
- Improves clarity and allows consistent use by contractors and operators doing similar work across the world

To achieve the benefits of standardisation and prevent workforce fatalities, all 9 Rules should be adopted as written and not be modified or substituted; organisations should:

- Adopt the IOGP Life-Saving Rules if they currently have no equivalent program
- Transition to the revised IOGP Life-Saving Rules if using a different set of rules or if using the previous set of IOGP rules
- Encourage joint ventures and partners to implement the revised IOGP Life-Saving Rules
- Accept and encourage contractor use of the revised IOGP Life-Saving Rules

This document provides an introduction to the revised Rules, data analysis, and implementation guidance. Additional implementation resources are available from the IOGP website.

2. The Life-Saving Rules

The nine Life-Saving Rules are shown in Figure 2. These Rules focus on the activities which, through rigorous data analysis, have been shown to most likely result in fatalities. Each Rule consists of an icon and simple life-saving actions individuals can take to prevent a work related fatality.

Bypassing Safety Controls

Obtain authorisation before overriding or disabling safety controls

- I understand and use safety-critical equipment and procedures which apply to my task
- I obtain authorisation before:
  - disabling or overriding safety equipment
  - deviating from procedures
  - crossing a barrier

Confined Space

Obtain authorisation before entering a confined space

- I confirm energy sources are isolated
- I confirm the atmosphere has been tested and is monitored
- I check and use my breathing apparatus when required
- I confirm there is an attendant standing by
- I confirm a rescue plan is in place
- I obtain authorisation to enter

Driving

Follow safe driving rules

- I always wear a seatbelt
- I do not exceed the speed limit, and reduce my speed for road conditions
- I do not use phones or operate devices while driving
- I am fit, rested and fully alert while driving
- I follow journey management requirements

Energy Isolation

Verify isolation and zero energy before work begins

- I have identified all energy sources
- I confirm that hazardous energy sources have been isolated, locked, and tagged
- I have checked there is zero energy and tested for residual or stored energy

Hot Work

Control flammables and ignition sources

- I identify and control ignition sources
- Before starting any hot work:
  - I confirm flammable material has been removed or isolated
  - I obtain authorisation
- Before starting hot work in a hazardous area I confirm:
  - a gas test has been completed
  - gas will be monitored continually

Line of Fire

Keep yourself and others out of the line of fire

- I position myself to avoid:
  - moving objects
  - vehicles
  - pressure releases
  - dropped objects
- I establish and obey barriers and exclusion zones
- I take action to secure loose objects and report potential dropped objects

Safe Mechanical Lifting

Plan lifting operations and control the area

- I confirm that the equipment and load have been inspected and are fit for purpose
- I only operate equipment that I am qualified to use
- I establish and obey barriers and exclusion zones
- I never walk under a suspended load

Work Authorisation

Work with a valid permit when required

- I have confirmed if a permit is required
- I am authorised to perform the work
- I understand the permit
- I have confirmed that hazards are controlled and it is safe to start
- I stop and reassess if conditions change

Working at Height

Protect yourself against a fall when working at height

- I inspect my fall protection equipment before use
- I secure tools and work materials to prevent dropped objects
- I tie off 100% to approved anchor points while outside a protected area

Figure 2: The 9 IOGP Life-Saving Rules

3. Implementing the Life-Saving Rules

Standardisation of Life-Saving Rules simplifies training, aids compliance and understanding of critical safeguards, and helps transfer of experience and lessons learned. Effective industry wide implementation requires collaboration between operators, contractors, and subcontractors.

To achieve the benefits of standardisation, all 9 Rules should be adopted as written and not be modified or substituted.

It is accepted that operational risk profiles may differ, and the Rules may not address all an organisation's fatality risks. In this case, companies are encouraged to manage these other risks through existing management systems or in other ways, e.g., campaigns, training, and workforce engagement, rather than creating additional Life-Saving Rules.

It is important that the Rules are understood by all individuals, their supervisors, and their leaders, and that management have created the conditions necessary to enable everyone to follow the Rules.

3.1 Fundamental requirements

Successful implementation of the Rules requires the following, as a minimum:

- Organisations have an existing safety management system, containing the following supporting policies, processes and systems:
  - Worker Fitness for Duty including a drug and alcohol policy
  - Contractor (and subcontractor) Management program including bridging arrangements, if applicable
  - Journey Management program
  - Safe systems of work including permit to work, and energy isolation
  - Management of change
  - Hazard identification and awareness, risk assessment and safeguard management
  - Field (self) verification providing checking and verification of critical tasks
- A commitment that work does not start until all individuals involved are aware of and can confirm they can follow the Life-Saving Rules that are relevant to that work.
- A requirement that work is not conducted without a pre-job risk assessment and a safety discussion, such as a toolbox talk, appropriate for the level of risk.
- Organisations define which procedures and equipment are safety critical and ensure impacted workers clearly understand what these are.
- Personnel are trained and competent for the work they conduct.
- Equipment is fit for purpose, properly maintained, and in working condition.

- Before work starts, there are emergency response plans in place that have been developed from a review of potential emergency scenarios, which have suitable and sufficient resources available, and which are periodically drilled/tested.
- Everyone is authorised to intervene or stop work without adverse consequences if they are in any doubt about the safety of an activity.
- Suitable personal protective equipment is provided and worn in accordance with the requirements identified by the risk assessment and worksite policies.

3.2 Lessons learned in rules implementation

Senior Management commitment is essential to successfully roll-out the Life-Saving Rules. The following steps for effective implementation are based on the experience of IOGP member companies that have successfully implemented Life-Saving Rules equivalent programmes:

- Conduct a risk assessment of your organisation's activities and review historical data related to fatalities and high potential events within your own organisation (both company employee and contractors) and determine how these align with the Life-Saving Rules.
- Develop a business case/change management programme and discuss with leadership of both your organisation and your contractors and subcontractors to ensure commitment to implement the Life-Saving Rules.
- Ensure implementation, use and compliance are owned by line-management (e.g. maintenance, facilities, operations, etc.) and supported by HSE professionals.
- Develop a communications and roll-out plan for the implementation of the Life-Saving Rules (stakeholder mapping, communications plan, accountability and compliance strategy in consultation with legal, supply chain and human resources departments).
- Develop performance monitoring methods to determine the effective implementation and ongoing use of the Life-Saving Rules.
- Use the IOGP Life-Saving Rules roll-out and engagement materials.

Helping people follow the Rules

Experience from member companies shows that the Life-Saving Rules, when consistently applied, prevent fatalities. Simply communicating the Rules and then holding people accountable for following them is not enough for effective implementation.

To enable individuals to follow the Life-Saving Rules, organisations need first to provide the right conditions:

- Everyone needs to know the Rules, understand their value, and what following the Rules means for their role.
- The physical workplace conditions required to be able to follow the Rules need to present (e.g., certified anchor points provided for all work at height, vehicles equipped with seatbelts)
- There need to be clear expectations set and supported from the top of the organisation that work must not start unless the Rules can be followed, and these must be visible to the workforce, by, for example, ensuring physical workplace conditions are present.
- Everyone must be given the authority and be encouraged to stop work and intervene if they observe a Life-Saving Rule (or indeed any other unsafe activity) actually, or potentially, not being followed. Proactive intervention may be the last opportunity to prevent injury or fatality.

The focus on personal accountability for following the Rules is about care and concern for the individual and the well-being of everyone who works in our industry.

If a Life-Saving Rule is not followed, organisations need to determine the reason to learn and improve workplace conditions, whether it resulted in undesirable consequences or not. Organisations have a role in positively reinforcing an open reporting culture, i.e. for self-reported errors and peer-to-peer interventions and responding appropriately where cases of 'non-reporting' are found. The intent is to understand what conditions and environment meant that a Rule was not followed, and drove people to do what they did, so that lessons can be identified, applied and learned.

If a Life-Saving Rule is not followed, despite organisations providing all the necessary enabling conditions, then consequence management may have a place. This might be relevant for the individual, or for those responsible for providing the enabling conditions. However, companies should also consider that such occasions are rare and should always follow their internal processes for dealing with such matters.

An IOGP Member recently looked at 353 of their incidents that had been tagged as a potential human violation (not necessarily related to a Life-Saving Rule). Of these, system-level issues were identified as causal in 90% of cases; these issues include unclear procedures (23%), capability and resources (30%) and mistakes due to labelling, alarms or tool issues (21%). That means that only a very small proportion of all incidents were actual violations[1]. This experience matches that of other IOGP Members, and that of other industrial sectors (in the construction industry, for example, human violations account for only 5% of incidents[2]). IOGP strongly encourages all organisations considering applying

[1] F.K. Bitar et al. 'From individual behaviour to system weaknesses: The re-design of the Just Culture process in an international energy company. A case study'. *Journal of Loss Prevention in the Process Industries* 55, 2018, pp. 267-282.

[2] United Kingdom Health and Safety Executive. *Causal Factors in construction accidents*. HSE Books, Norwich, 2003.

consequence management for not following a Life-Saving Rule to be sure that the person deliberately intended not to follow a Rule despite being given all enabling conditions and the leadership and supervisory support to do so.

Continued engagement and integration

The introduction of the Life-Saving Rules to a workforce is not by itself sufficient to produce the tangible benefits of standardisation. An ongoing effort is required to drive integration and conformance with a dynamic global workforce. Organisations should use the tools available within their existing management systems to continuously improve conformance to the Life-Saving Rules. Examples may include:

- Awareness campaigns
- Refresher training
- Leadership site visits
- Positive recognition of conformance and interventions
- Internal and external feedback for improvement of compliance
- Integration into contractual agreements
- Use of IOGP engagement resources

Further reading

Please refer to the following published technical papers for case studies on implementing the Life-Saving Rules, refreshing the programme, and a comparative study of various companies' programs and implementation approaches:

- SPE-157465-MS: A Major Oil Company's Approach to Significantly Reduce Fatal Incidents
- SPE-179289-MS: Re-Energising the Life-Saving Rules
- The APPEA Journal 2017, 57, 41–48: Golden safety rules: are they keeping us safe?

3.3 The Life-Saving Rules as part of a system

As noted in the introduction to this document, the Life-Saving Rules are intended to support existing company management systems and, in fact, rely on them being in place. The following table provides some explanatory guidance and relevant industry references.

Life-Saving Rule	Additional Guidance & References
Bypassing Safety Controls **Obtain authorisation before overriding or disabling safety controls**  • I understand and use safety-critical equipment and procedures which apply to my task • I obtain authorisation before: – disabling or overriding safety equipment – deviating from procedures – crossing a barrier	Safety-critical controls include: • Equipment (such as fire and explosion protection and mitigation systems, guards, interlocks, alarms and safety-critical monitoring equipment) whose purpose is to prevent a fatality or other major accident, limit the consequences of a major accident, or whose failure could cause or contribute substantially to a fatality or other major accident. • Procedures that if not performed correctly or at the right time could result in a fatality or other major accident.
Confined Space **Obtain authorisation before entering a confined space**  • I confirm energy sources are isolated • I confirm the atmosphere has been tested and is monitored • I check and use my breathing apparatus when required • I confirm there is an attendant standing by • I confirm a rescue plan is in place • I obtain authorisation to enter	A confined space, such as a vessel, tank, pipe, cellar or excavation, can contain explosive gas, toxic or asphyxiating atmosphere or other dangers such as energy releases, lack of oxygen, exposure to hazardous chemicals, things that can fall on you or crush you, or that you can fall from. Authorised access keeps you safe. Organisations should determine if any work involving excavations or trenches creates confined space conditions and ensure necessary work authorisation and controls. **Further reading:** • IOGP report 577 – *Fabrication site construction safety practices – Hazardous activities* provides simple requirements for confined space entry. Although developed for construction, these are easily transferable to other operations. • UK Health and Safety Executive (UK HSE): http://www.hse.gov.uk/confinedspace/ • USA Occupational Safety and Health Administration (OSHA): https://www.osha.gov/SLTC/confinedspaces/ • API Recommended Practice for the Design of Offshore Facilities Against Fire and Blast Loading

Life-Saving Rule	Additional Guidance & References
Driving **Follow safe driving rules**  • I always wear a seatbelt • I do not exceed the speed limit, and reduce my speed for road conditions • I do not use phones or operate devices while driving • I am fit, rested and fully alert while driving • I follow journey management requirements	The driver and passengers should take responsibility for each other's safety, including ensuring all occupants are wearing a seatbelt. Fitness for duty means assuring that an individual can complete a task safely and without unacceptable risk to themselves or other. This includes not being under the influence of drugs and alcohol. **Further reading:** • IOGP Report 365 - *Land transportation safety recommended practice* describes how to implement land transportation safety elements in a management system - addressing, among other topics, seatbelt requirements, distracted driving, speeding, fitness and alertness, and journey management. • IOGP Report 470 – *Fitness to Work* provides a structured process for the systematic identification, assessment and management of the risks associated with tasks that place specific demands (physical or psychological) on employees.
Energy Isolation **Verify isolation and zero energy before work begins**  • I have identified all energy sources • I confirm that hazardous energy sources have been isolated, locked, and tagged • I have checked there is zero energy and tested for residual or stored energy	Energy isolation separates people from hazards such as electricity, pressure and energised equipment. Energy isolation also provides protection from potential energy sources e.g. positioning valves to prevent tanks filling with materials due to gravity. Any stored energy (e.g., hydraulic or pneumatic power) should also be dissipated before the work starts. **Further reading:** • IOGP report 577 – *Fabrication site construction safety practices – Hazardous activities* provides simple requirements for energy isolation. Although developed for construction, these are easily transferable to other operations. • OSHA: The Control of Hazardous Energy (Lockout/Tagout), Title 29 Code of Federal Regulations (CFR) Part 1910.147 • UK HSE: The safe isolation of plant and equipment HSG 253

Life-Saving Rule	Additional Guidance & References
Hot Work **Control flammables and ignition sources** • I identify and control ignition sources • Before starting any hot work: – I confirm flammable material has been removed or isolated – I obtain authorisation • Before starting hot work in a hazardous area I confirm: – a gas test has been completed – gas will be monitored continually	Hot work includes any work that creates an ignition source performed in an area which potentially contains hydrocarbons or flammable materials. Ignition sources are open flames or sources of heat that could ignite materials in the work area such as welding, grinding, smoking, torching, (un)loading of hazardous materials, internal combustion engines, chemical reactions, batteries, etc. Hazardous areas are defined in the UK Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) as "any place in which an explosive atmosphere may occur in quantities such as to require special precautions to protect the safety of workers". **Further reading:** • Energy Institute: Model code of safe practice Part 15: Area classification for installations handling flammable fluids • NFPA 70: National Electrical Code

Life-Saving Rule	Additional Guidance & References
Line of Fire **Keep yourself and others out of the line of fire**  • I position myself to avoid: – moving objects – vehicles – pressure releases – dropped objects • I establish and obey barriers and exclusion zones • I take action to secure loose objects and report potential dropped objects	Other rules focus on specific activities, whereas this Rule is intended to raise personal awareness of struck-by and caught-in-between hazards. Line of fire hazards are not always obvious or constant and can be introduced as the task progresses (e.g. underground and overhead powerlines, pipelines, objects under pressure, stored energy, lines under tension, poorly supported excavations, shifting cargo, moving equipment). At all times individuals need to continually monitor their surroundings and position themselves to avoid being in the line of fire. This includes ensuring they are visible to vehicle drivers and equipment operators. Individuals recognise when they create a line of fire hazard and put others or themselves in the line of fire. **Further reading:** • IOGP report 577 – *Fabrication site construction safety practices – Hazardous activities* provides simple requirements on topics that address line of risk hazards, including: – Construction traffic interface – Dropped objects prevention – Housekeeping – Working at height – Lifting Although developed for construction, these are easily transferable to other operations. • DROPS Online: http://www.dropsonline.org/ • OSHA: 29 CFR 1926 Safety and Health Regulations for Construction – Subpart P: Excavations – Subpart CC: Cranes & Derricks in Construction • UK HSE: Structural stability during excavations: http://www.hse.gov.uk/construction/safetytopics/excavations.htm • UK HSE: GS6 – Avoiding Dangers from overhead power lines • The National Institute for Occupational Safety and Health (NIOSH), Construction Equipment Visibility https://www.cdc.gov/niosh/topics/highwayworkzones/default.html • Energy Institute Reflective Learning materials: https://heartsandminds.energyinst.org/toolkit/reflective-lfi

Life-Saving Rule	Additional Guidance & References
Safe Mechanical Lifting **Plan lifting operations and control the area**  • I confirm that the equipment and load have been inspected and are fit for purpose • I only operate equipment that I am qualified to use • I establish and obey barriers and exclusion zones • I never walk under a suspended load	Lifting operations need to be planned and performed by competent personnel using certified equipment. To protect people around suspended loads and any mechanical lifting operation, access should be controlled through physical barriers and exclusion zones. When mechanically lifting people (e.g. manriding, man-baskets, personnel transfer, mobile elevated work platform), organisations should provide equipment which is designed and certified specifically for lifting people. **Further reading:** • IOGP Report 376 – *Lifting & hoisting recommended practice* provides further guidance on essential principles for safe lifting (including personnel), implemented as part of a management system. • IOGP Report 577 – *Fabrication site construction safety practices – Hazardous activities* provides simple requirements for lifting. Although developed for construction, these are easily transferable to other operations.
Work Authorisation **Work with a valid permit when required**  • I have confirmed if a permit is required • I am authorised to perform the work • I understand the permit • I have confirmed that hazards are controlled and it is safe to start • I stop and reassess if conditions change	Work authorisation is more than just a person in charge signing a Permit to Work form: it is seeking and having authorisation to start, resume, or hand-over a task. The person in charge of the work confirms that it is safe to start, that controls are in place and effective, and the task can be performed as planned. **Further reading:** • IOGP Report 189 Guidelines on permit to work systems • IOGP Report 577 – *Fabrication site construction safety practices – Hazardous activities* provides simple requirements for Job Safety Analysis • UK HSE: HSG 250 Guidance on permit-to-work systems: A guide for the petroleum, chemical and allied industries

Life-Saving Rule	Additional Guidance & References
Working at Height **Protect yourself against a fall when working at height**  • I inspect my fall protection equipment before use • I secure tools and work materials to prevent dropped objects • I tie off 100% to approved anchor points while outside a protected area	Working at height outside a protected area (such as an elevated work area not enclosed by hand rails) requires the use of approved fall protection equipment secured to an approved anchor point. Other considerations for working at height include ladders, work over water, rope access, floor openings, access hatches, and inspection pits. Floor openings should be protected with physical barriers to prevent falls. Preventing objects from falling from height and using physical barriers below working area keeps you and people working below you safe. IOGP recommends that companies define working at height as work at or above 1.8m/6ft, unless local legislation requires a lower height. Scaffolds should be properly constructed, inspected and certified. **Further reading:** • IOGP report 577 – *Fabrication site construction safety practices – Hazardous activities* provides simple requirements for working at height and scaffolding. Although developed for construction, these are easily transferable to other operations. • DROPS Online: http://www.dropsonline.org/

3.4 Life-Saving Rules implementation resources

IOGP provides a package of materials to assist companies, available at https://www.iogp.org/life-savingrules/

Note that some materials are only available upon agreeing with The Life-Saving Rules User Agreement (refer to inside cover), which states the conditions under which the Life-Saving Rules icons and accompanying wording are made available.

At time of launch of this report, these materials include:

File type	Description	Audience/Purpose
Zip folder	EPS & PNG files of the icons	For signage and other communication needs
Workcard	PNG file of a 'workcard'	For implementing organisations to print as hardcopy 'workcards' for distribution. Adaptable for use in signage and other communications
Poster	Poster of all 9 Rules	For signage and communications
Presentation	Guidance to clarify the Rules	Introduction and further guidance on each Rule.
Presentation	Leadership engagement	Aimed at leaders, introduces the Rules and describes leadership expectations
Videos	9 Rule in a Minute animations	9 simple animations to introduce each Rule (each approx.1 minute duration)
Videos	5 Reflective learning animated videos	There are 5 videos (Offshore, Road transportation, Manufacturing, Marine, Office), with two animations each. The first animation runs through a work scenario, the second shows the same scenario pausing to highlight Rules being followed or broken. The intent is for these videos to be used in facilitated group settings, where groups discuss what they have seen after the first animation and then see the 'reflection' video.
Translations	4 available at launch	The Rules translated into: Portuguese (Brazilian), Norwegian, French, Arabic

4. Data analysis in the revision of the Life-Saving Rules

In the process of revising the Life-Saving Rules, IOGP analysed the last ten years of fatality data (2008-2017). In that period, there were 710 work related fatalities in 492 fatal incidents reported to IOGP by member companies.

As the Life-Saving Rules are focused on actions within an individual's control, fatal incidents reported as process safety, air transportation, and security events were excluded from further analysis. The remaining 412 fatal incidents resulted in 450 fatalities. A further 38 incidents, resulting in 45 fatalities, were removed from the analysis as there was insufficient information provided by the reporting company to be able to determine the applicability of a Rule.

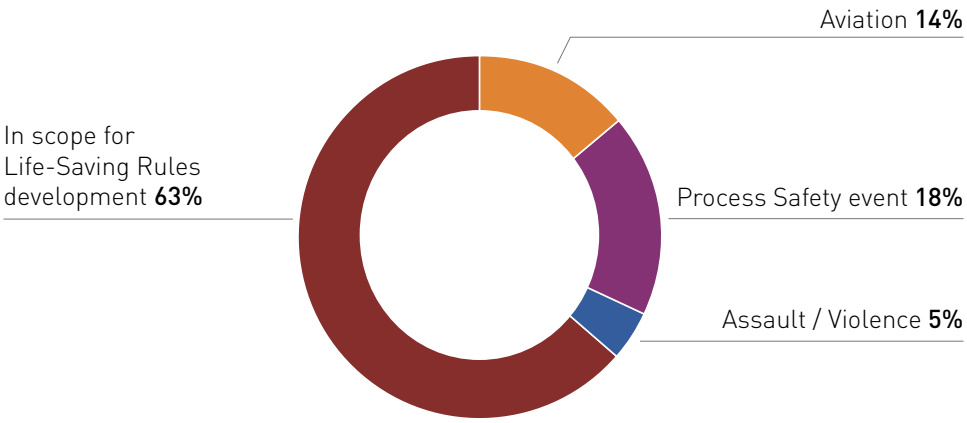
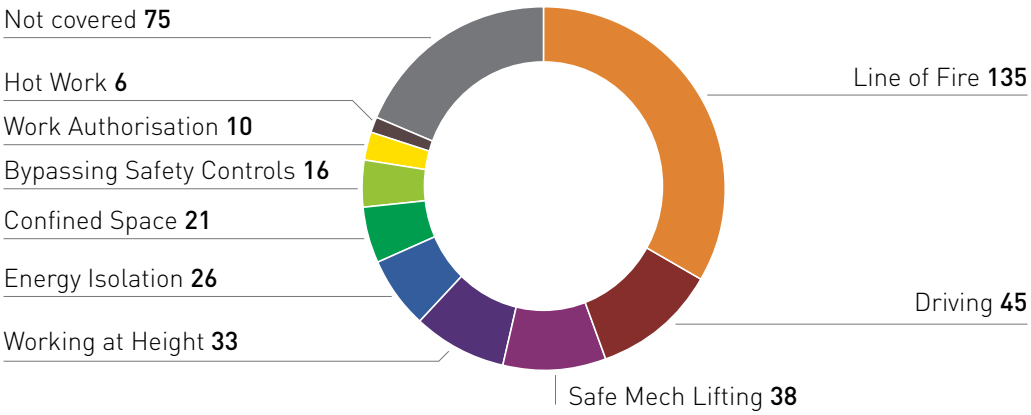


Figure 3: IOGP Reported fatalities (2008-2017) and the selection for continued analysis in the Life-Saving Rules development process

Further analysis of these "personal safety" fatal incidents was conducted with the aim of developing a smaller set of Life-Saving Rules (previously 18) that would either have prevented or mitigated the fatal consequences of these incidents. The resulting set of 9 Life-Saving Rules addressed 330 (81%) of the 405 "personal safety" fatalities.



(Fatalities reported to IOGP 2008-2017, excluding Aviation, Process Safety and Security fatal events, and fatal events with insufficient information to analyse)

Figure 4: Potential lives saved by the revised IOGP Life-Saving Rules

When the Life-Saving Rules were developed, IOGP conducted a further review of the full set of data and discovered that 46 fatalities resulting from Process Safety Events were also addressed by the Rules, particularly by the Rules for Bypassing Safety Controls, Energy Isolation, and Hot Work. From 2008 to 2017, 376 lives could have been saved.

For further information on the original Life-Saving Rules development process, including the data analysis conducted, the following papers published by the Society of Petroleum Engineers can be consulted:

- How the Rules were developed by a comprehensive review of IOGP data (20 years of fatal and High Potential events):
  - SPE-157434-MS: Oil and Gas Producers Association (OGP) Life-Saving Rules
- A follow-up report that looks at Causal Factor data for each Life-Saving Rule:
  - SPE-168375-MS: Continuing the Efforts to Learn from Industry Safety Data
- A comparison of the most recent five years of data (2012-2016) to historical trends:
  - SPE-190545-MS: Industry Safety Data, What Is It Telling Us?

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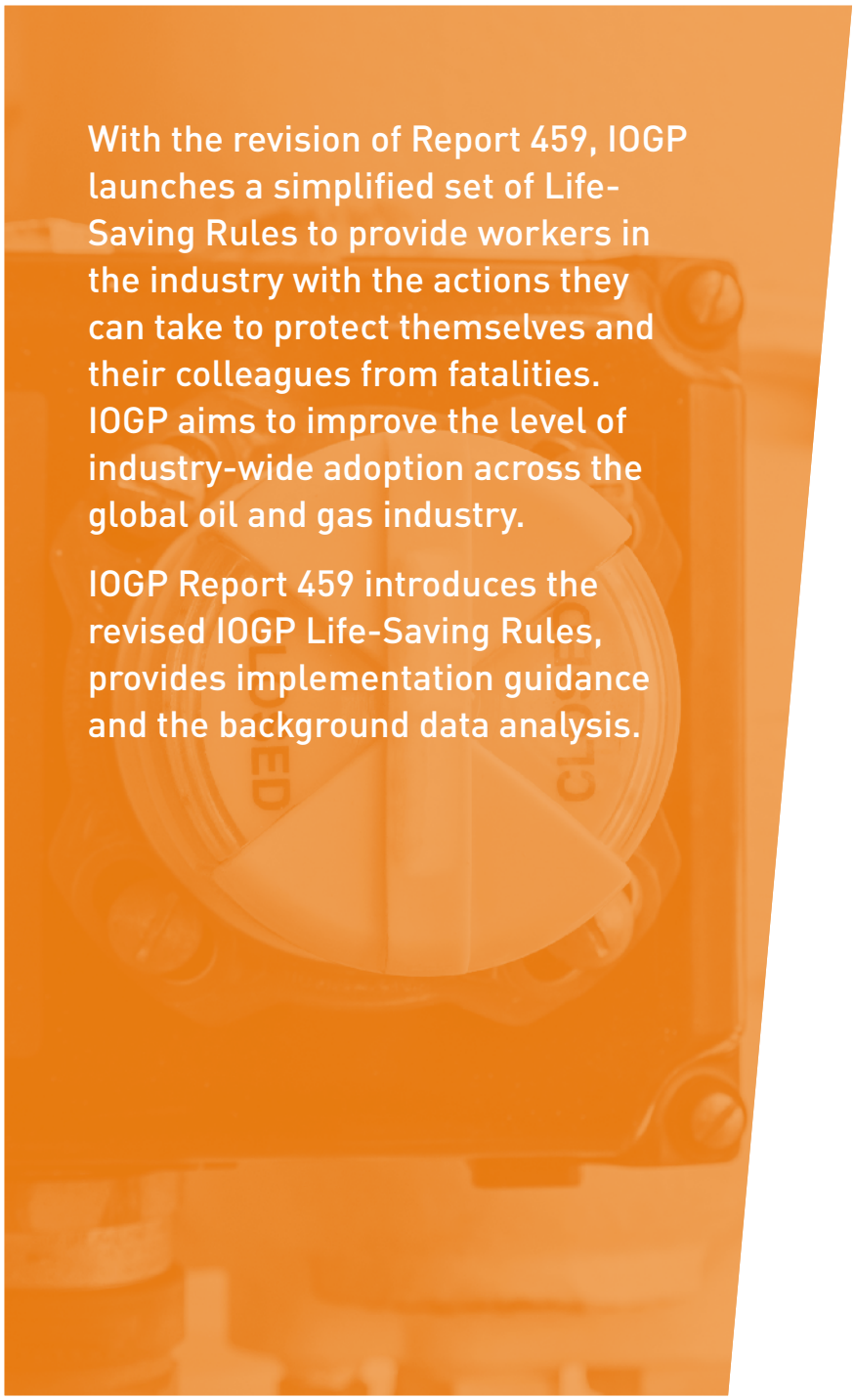

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