



OSA Webinar Learning Series

Introduction to the IOGP Process Safety Fundamentals (PSF)

January 27, 2022

No discussion or agreements, either explicit or implicit, regarding prices of particular products, services, or commodities nor of individual company scenarios, business plans, purchasing plans, or pricing.

ANTITRUST

Presenters

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- ▶ Tricia Grant, Hess
- ▶ Jill Niswonger, Marathon Oil
- ▶ Matthew Novia, Baker Hughes



Introduction

To the Onshore Safety Alliance Program

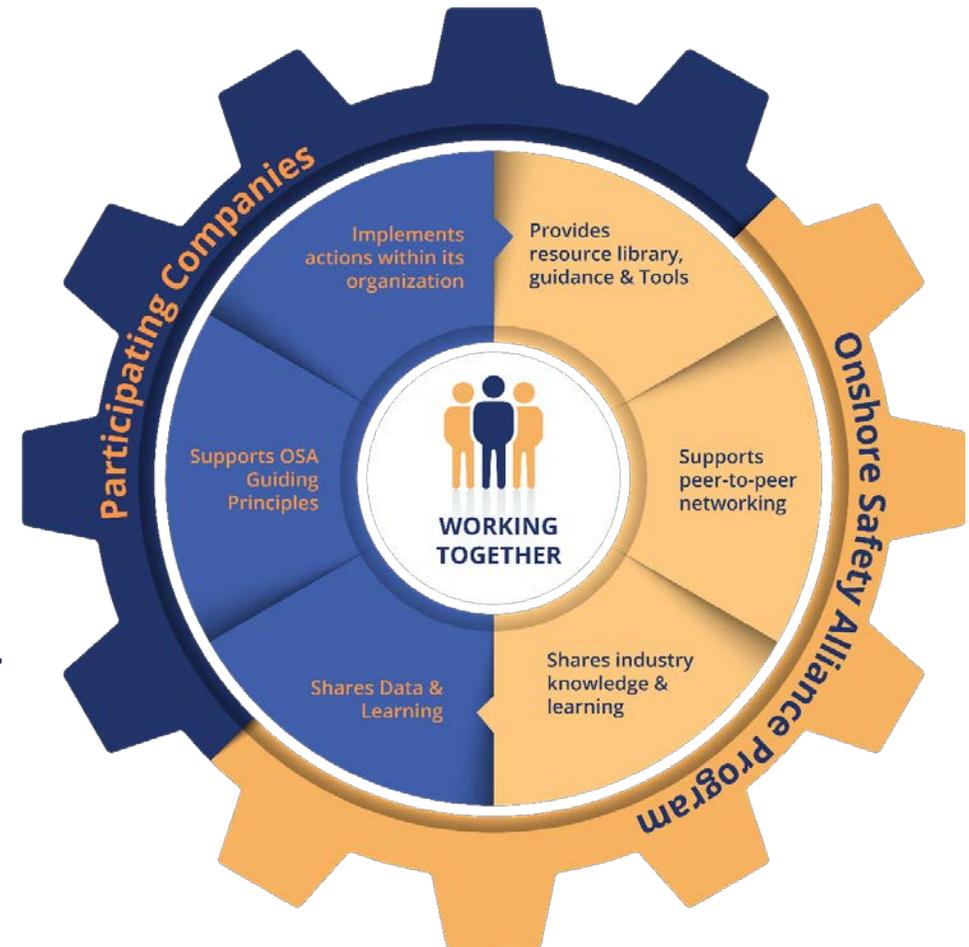
WORKING TOGETHER

to improve safety and reduce serious injuries and fatalities in U.S onshore operations

Companies commit to carry out defined **OSA PARTICIPANT ACTIONS** within their organization and in return, the OSA provides resources, guidance, tools and peer-to-peer **SUPPORT** to help companies implement the actions.

VOLUNTARY TO JOIN. NO DUES REQUIRED.

Through the OSA, companies are raising the **BAR** on safety, together.



BRIDGE

INDUSTRY
KNOWLEDGE

ADVANCE

SAFETY
CULTURES

REDUCE

SERIOUS
INCIDENTS

Safety Share 1: Produced Water Tank Explosion

WHAT HAPPENED?

- Driver arrived between 5:30 and 5:45 am, hooked truck up to tank manifold, and (at some point) ascended catwalk to tanks
- Explosion occurs prior to 6:45 am (February, sunrise at 7:17)
- One tank fails at shell-floor joint, ejected, and thrown 110 feet (34 m)
- One tank fails at shell-roof joint, roof thrown 165 feet (50 m)
- Catwalk damaged and displaced, throwing driver from catwalk and outside tank battery, approximately 30 feet (9 m); fatality.



WHAT WENT WRONG?

- Driver was performing operations before sunrise.
- Investigation indicates that driver likely used lighter, possibly to check tank level

Safety Share 1: Produced Water Tank Explosion

WHY DID IT HAPPEN?

- Separator does not remove “all gas” from the fluid, even when functioning properly and as designed
- Natural convection limits maximum fuel concentration and can bring tank vapor space into flammable range, particularly with a tank which is stagnant for an extended period or with a hatch left open

WHAT AREAS WERE IDENTIFIED FOR IMPROVEMENT?

- Hazard awareness may not be adequate among all personnel working at oil and gas production sites. Workers should assume tank vapor space may be flammable.
- Increase hazard awareness for all personnel working at site
- Measure level at grade to eliminate routine access to most hazardous location (i.e., tank roof)
- Inert tanks using natural gas
- Use a “lead tank” as a secondary separator
- Monitor tank vapor space

Safety Share 2: Pryor Trust Gas Well Blowout

WHAT HAPPENED?

- A blowout and rig fire occurred shortly after drilling crew members removed the drill pipe from the well, resulting in the death of five workers.

WHAT WENT WRONG?

- Rig crew members stopped drilling to remove the drill pipe from the well and change the drill bit. They pumped mud into the well while removing the drill pipe to prevent natural gas from entering the well.
- Mud was continuously circulated in the wellbore to keep the well full by replacing the volume of the drill pipe removed with drilling mud. The driller closed the blind rams on the blow out preventer to isolate the well after the drill pipe and drill bit were completely removed from the well.
- The driller opened the blowout preventer blind rams so that a new piece of drilling equipment called a bottom hole assembly could be lowered into the well. Mud was pumped through the bottom hole assembly to test the new equipment.
- While the rig crew tested the bottom hole assembly equipment, the mud pits gained 107 barrels of mud. Mud pit gains are an indication of a possible natural gas influx into the well. Data indicated that conditions existed that could have allowed a gas influx into the wellbore during the drill pipe removal operation.
- After the bottom hole assembly was tested, it was lifted out of the wellbore and mud and gas blew upwards out of the well, igniting and causing a large fire.



Safety Share 2: Pryor Trust Gas Well Blowout

WHY DID IT HAPPEN?

The cause of the blowout and rig fire was barrier failure:

- Primary barrier—hydrostatic pressure produced by drilling mud
- Secondary barrier—human detection of gas influx and activation of the blowout preventer

WHAT AREAS WERE IDENTIFIED FOR IMPROVEMENT?

- Underbalanced drilling was performed without needed planning, equipment, skills, or procedures
- The driller was not effectively trained in using a new electronic trip sheet, which is used to help monitor for gas influx
- Equipment was aligned differently than normal during the tripping operation, leading to confusion in interpreting the well data which caused rig workers to miss indications of the gas influx
- Surface pressure was not identified two separate times before opening the BOP during operations before the blowout,
- Both the day and night driller chose to turn off the entire alarm system, contributing to both drillers missing critical indications of the gas influx and imminent blowout
- The alarm system was not effectively designed to alert personnel to hazardous conditions during different operating states (e.g., drilling, tripping, circulating, and surface operations) and would have sounded excessive non-critical alarms during the 14 hours leading to the blowout
- Key flow checks to determine if the well was flowing were not performed before the incident
- The drilling contractor did not test its drillers' abilities in detecting indications of gas influx
- The operating company did not specify the barriers required during operations, or how to respond if a barrier was lost

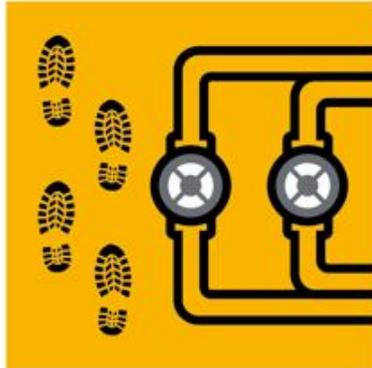


IOGP Process Safety Fundamentals

<https://www.iogp.org/oil-and-gas-safety/process-safety/fundamentals/>



Maintain safe isolation



Walk the line



Apply procedures



Sustain barriers



Control ignition sources



Recognize change



Respect hazards



Stay within operating limits



Stop if the unexpected occurs



Watch for weak signals

What Makes an Effective PSF?



Support frontline workers



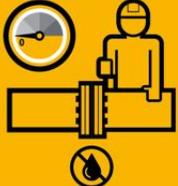
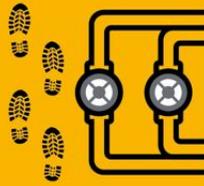
Clear, simple, task-level



Day-to-day activities

PSFs Complement Life Saving Actions

IOGP Process Safety Fundamentals

				
Maintain safe isolation	Walk the line	Apply procedures	Sustain barriers	Control ignition sources
				
Recognize change	Respect hazards	Stay within operating limits	Stop if the unexpected occurs	Watch for weak signals



IOGP Life Saving Rules

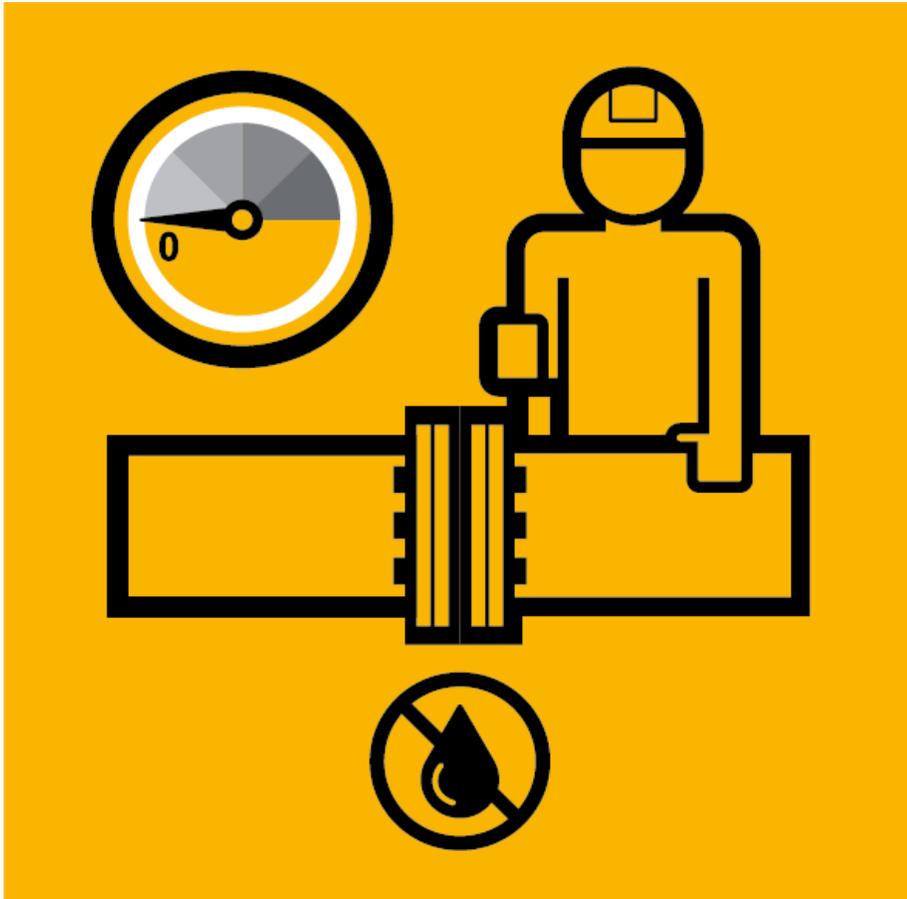
Bypassing Safety Controls  Obtain authorisation before overriding or disabling safety controls <ul style="list-style-type: none"> I understand and use safety-critical equipment and procedures which apply to my task I obtain authorisation before: <ul style="list-style-type: none"> disabling or overriding safety equipment deviating from procedures crossing a barrier 	Confined Space  Obtain authorisation before entering a confined space <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> I identify and control ignition sources Before starting any hot work: <ul style="list-style-type: none"> I confirm flammable material has been removed or isolated I obtain authorisation Before starting hot work in a hazardous area I confirm: <ul style="list-style-type: none"> a gas test has been completed gas will be monitored continually 	Line of Fire  Keep yourself and others out of the line of fire <ul style="list-style-type: none"> I position myself to avoid: <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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

Process Safety Fundamentals 1-4



- ▶ Maintain Safe Isolation
- ▶ Walk the Line
- ▶ Apply Procedures
- ▶ Sustain Barriers

PSF 1 – Maintain Safe Isolation



We use isolation plans for the specific task, based on up-to-date information.

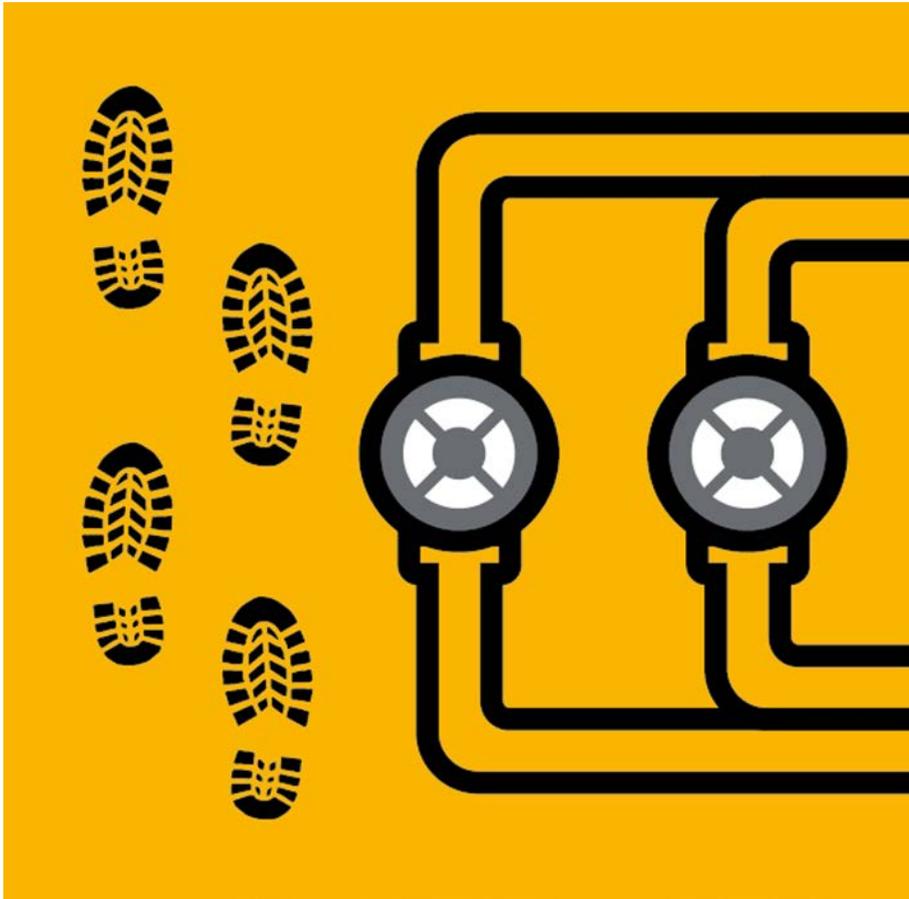
We raise isolation concerns before the task starts and challenge when isolation plans cannot be executed.

We check for residual pressure or process material before breaking containment.

We monitor the integrity of isolations regularly and stop to reassess when change could affect an isolation integrity.

We confirm leak-tightness before, during, and after reinstating equipment.

PSF 2 – Walk the Line



We use up to date documentation (e.g., Piping and Instrumentation Diagrams, or P&IDs) that accurately reflect installed systems and equipment.

We physically confirm the system is ready for the intended activity (e.g., valve positions, line up of relief devices, etc.).

We alert supervision to identified documentation and readiness issues before operation.

PSF 3 – Apply Procedures



We use operating and maintenance procedures, even if we are familiar with the task.

We discuss the key steps within a critical procedure before starting it.

We pause before key steps and check readiness to progress.

We stop, inform supervision, and avoid workarounds if procedures are missing, unclear, unsafe, or cannot be followed.

We take time to become familiar with, and practice, emergency procedures.

PSF 4 – Sustain Barriers



We discuss the purpose of hardware and human barriers at our location.

We evaluate how our tasks could impact process safety barriers.

We speak up when barriers don't feel adequate.

We perform our roles in maintaining barrier health and alert supervision to our concerns.

We use an approval process for operations with degraded barriers.

Process Safety Fundamentals 5-7



- ▶ Control Ignition Sources
- ▶ Recognize Change
- ▶ Respect Hazards

PSF 5 – Control Ignition Sources



We identify, eliminate, or control the full range of potential ignition sources during task risk assessments and during job preparation and execution.

We minimise and challenge ignition sources even in “non-hazardous” areas.

We eliminate ignition sources during breaking containment and start-up and shutdown operations.

PSF 6 – Recognize Change



We look for and speak up about change.

We discuss changes and involve others to identify the need for management of change (MOC).

We review the MOC process for guidance on what triggers an MOC.

We discuss and seek advice on change that occurs gradually over time.

PSF 7 – Respect Hazards



We improve our understanding of process safety hazards at our location and our roles in controlling them.

We are vigilant about the potential impacts of uncontrolled process safety hazards.

We discuss process safety hazards before starting a task.

We bring forward process safety hazards to be included in activity risk assessments.

Process Safety Fundamentals 8-10



- ▶ Stay within Operating Limits
- ▶ Stop if the Unexpected Occurs
- ▶ Watch for Weak Signals

PSF 8 – Stay within Operating Limits



We discuss and use the approved operating limits for our location.

We escalate where we cannot work within operating limits.

We alert supervision if an alarm response action is unclear or the time to respond is inadequate.

We obtain formal approval before changing operating limits.

We confirm that potential for overpressure from temporary pressure sources has been addressed.

PSF 9 – Stop if the Unexpected Occurs



We discuss the work plan and what signals would tell us it is proceeding as expected.

We pause and ask questions when signals and conditions are not as expected.

We stop and alert supervision if the activity is not proceeding as expected.

PSF 10 – Watch for Weak Signals



We proactively look for indicators or signals that suggest future problems.

We speak up about potential issues even if we are not sure they are important.

We persistently explore the causes of changing indicators or unusual situations.

Produced Water Tank Explosion with PSF Knowledge



Respect Hazards

- We improve our understanding of process safety hazards at our location and our roles in controlling them.
- We are vigilant about the potential impacts of uncontrolled process safety hazards.



Control Ignition Sources

- We minimise and challenge ignition sources even in “non-hazardous” areas.
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Pryor Trust Gas Well Blowout with PSF Knowledge

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Sustain Barriers

- We speak up when barriers don't feel adequate.
- We perform our roles in maintaining barrier health and alert supervision to our concerns.
- We use an approval process for operations with degraded barriers.



Apply Procedures

- We pause before key steps and check readiness to progress.
- We stop, inform supervision, and avoid workarounds if procedures are missing, unclear, unsafe, or cannot be followed.

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Recognize Change

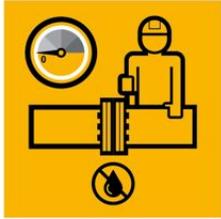
- We discuss and seek advice on change that occurs gradually over time.



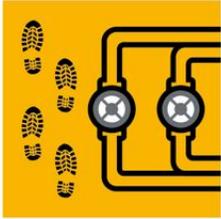
Stop if the Unexpected Occurs

- We pause and ask questions when signals and conditions are not as expected.
- We stop and alert supervision if the activity is not proceeding as expected.

Incorporating IOGP PSFs within Everyday Operations



Maintain safe isolation



Walk the line



Apply procedures



Sustain barriers



Control ignition sources



Recognize change



Respect hazards



Stay within operating limits



Stop if the unexpected occurs



Watch for weak signals



How to Use the IOGP PSFs?



Toolbox talks
& safety
meetings



Pre-job
planning



Last minute
risk
assessment



Post-job
reviews



Observations
& walk-
abouts



Intervention

IOGP PSF Resources & Tools

Visit our website for...

www.iogp.org/oil-and-gas-safety/process-safety/fundamentals/



Videos



Posters



Presentations



External resources

Get in touch!

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Become an OSA Participant!

The OSA welcomes participation from both companies and trade associations.

Voluntary to join, and no dues required.

For additional information, contact:

- **Emily Hague – manager@onshoresafetyalliance.org**

onshoresafetyalliance.org



Thank You!