

ARE YOU IN THE “LINE OF FIRE?”

Pressure Releases Activity Package



SETTING THE STANDARD IN OIL AND GAS SAFETY

ENERGY
SAFETY
CANADA



PRESSURE RELEASES – ARE YOU IN THE “LINE OF FIRE?” INJURY REDUCTION CAMPAIGN

You are in the line of fire when you are at risk of coming into contact with a force your body cannot endure.

Pressure release awareness is:



Stored Energy

Contact with stored energy
Includes pressure releases



Striking Hazards

Struck by or striking against an object
Includes dropped objects



Crushing Hazards

Caught in, on or between an object
Includes hand injuries



LINE OF FIRE LIFE SAVING RULE

This overview includes materials that relate to the Line of Fire Life Saving Rule and some that do not. The Life Saving Rule focuses on body positioning.

This rule indicates:

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





ENERGY ISOLATION - LIFE SAVING RULE

Pressure releases also relate to the Energy Isolation Life Saving Rule.

This rule indicates:

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





OTHER RELATED LIFE SAVING RULES



FIT FOR DURY



HOT WORK



**BYPASSING
SAFETY
CONTROLS**



**CONFINED
SPACE**



WHAT IS A PRESSURE RELEASE?

The intentional or unintentional release of either pneumatic (gas) or hydraulic (liquid) pressure.

Need to consider:

- The risks with the pressure present
- How to verify pressure no longer exists
- How solids like ice could be involved and trap pressure
- Bleed-down discharge points
- Exclusion zones (no-go zones)
- Other barrier strategies like whip-checks and temporary pipe restraints
- Secondary hazards such as chemical exposures





EXAMPLE OF A PRESSURE INCIDENT

Insert your company example here:



HOW MUCH PRESSURE DOES IT TAKE TO HURT YOU?

Only a few pounds of pressure is needed to break the skin and 50 pounds to fracture larger bones if that pressure is focused on a small area.

For example, think of a metal ruler. If you were to tap your hand with the flat side of a metal ruler so the force is dispersed versus the edge which concentrates the force, the discomfort you feel will be very different.

Flat



Vs.

On Edge



How might this impact risk if there is a pressure release?



UNDERSTANDING PRESSURE

A 10-inch diameter pipe with 150 psi (pounds per square inch) of water can release a force of 11,775 lbs.

To put this in perspective, this is similar to a 200-pound person travelling at 68 km/hour coming to an immediate stop against the steering wheel, such as with an animal strike.



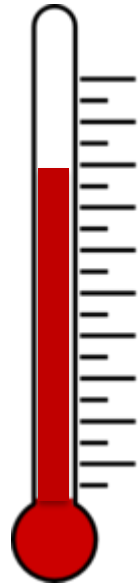


WHAT KINDS OF PRESSURE ARE OUT THERE?

Even low pressure can be deadly. Review the following industry pressures and pressures in your work sites.

Oil and Gas Pressure Thermometer

- Hydraulic fracturing, 10,000-13,000 psi (70,000-90,000 KPa)
- Drilling mud pressures, 1,000-6,000 psi (7,000-41,000 KPa)
- Bradley nail gun compressed air hose, 100-300 psi (700-2,100 KPa)
- Airline of a pneumatic air hammer seismic drill, 100-150 psi (700-1,000 KPa)
- Trucking hose, 70-100 psi (500-700 KPa)
- Home water line, 50 psi (345 KPa)
- Bicycle tire, 40 psi (280 KPa)
- Pressure vessel (one atmosphere or greater) > or = 14.7 psi (100 KPa)
- Home natural gas line, 5 psi (34 KPa)





WHAT KINDS OF PRESSURE ARE OUT THERE?

Can low pressure, like 5 psi in a home gas line, hurt you?

Take your home gas meter. Let's assume a failure of the internals and that all bolts are missing from the exterior. With a front surface area of 80 square inches and a pressure of 5 psi, there could be 400 lbs of force on the outer plate. If this plate blows off and hits you, the result could be deadly. This does not include the force from the expansion of the gas, which would make the result even more hazardous.



Even low pressure has the potential to be deadly!

Always verify zero energy.



COMPRESSIBLE AND NON-COMPRESSIBLE MATERIALS

Compressible: Gas is a compressible material. As pressure is applied, the gas molecules can be squeezed closer together. When a compressible material is released it expands, resulting in a pressure wave that makes the release much more violent.

Non-compressible: Liquids like water are generally non-compressible and, as a result, when they are released they do not expand. Therefore, the energy released is only from the pressure they are under and not from the expansion that occurs after they are released.



Gas piping prior to explosion



Gas piping after explosion



TOP CAUSES OF PRESSURE RELEASES

Safety alerts and incident reports show these recurring causes continue to result in pressure releases:

1. **Inadequate risk assessment** - failure to identify pressure hazards, isolate energy (LOTO) and verify zero pressure.
2. **Human factors** - fit for duty, body positioning, operator error.
3. **Inadequate repair and maintenance** - ignoring unsafe conditions.
4. **Failed valves and fittings** - corrosion, vibration, poor design, and selection or improper installation.
5. **Inadequate procedures** - bad planning, and no management of change.
6. **Inadequate inspection** - inspections are either inadequate or missing.
7. **Training** - training is either missing or inadequate.



PREVENTION

Everyone has a responsibility to prevent pressure releases through:

- **Observation and intervention** - being aware of the hazard, associated risks, and prepared to stop work if conditions or actions are unsafe.
- **Reporting** - recording all potential and actual incidents in accordance with company policy.
- **Elimination** - stay out of exclusion zones, position body when opening valves to not be in the line of fire.
- **Control** - ensuring you never exceed the maximum allowable working pressure, ensure whip checks and exclusion zones are present when appropriate. Consider labelling equipment where line of fire is a concern.
- **Design and procurement** - seek engineering support when equipment design does not support safe operation.
- **Inspection** - regular and periodic work site inspections of all high-risk items. Pay attention to tasks where people interact with equipment and materials.



EXCLUSION ZONES – NO-GO ZONES

Establishing and adhering to exclusion zones is critical for managing line of fire in relation to moving objects. Do you know where/when the no-go zones exist in your operations? Consider how routine, maintenance and upset conditions impact these zones.





SECONDARY STORED ENERGY HAZARDS

Pressure releases can involve exposure to a variety of other types of energy such as:



Chemical

Flammable vapours and gases, combustibles, pyrophorics, toxic compounds, corrosives, oxygen-deficient atmospheres, welding fumes and dusts.



Sound

Equipment noise, vibration, high-pressure releases and the impact of noise to communication.



Radiation

Lighting issues, solar rays, welding arcs, microwaves, lasers, x-rays and NORM.



Temperature

Ignition sources, hot or cold surfaces or materials, steam, friction and weather.



Biological

Bacteria, viruses, fungi, parasites, insects, poisonous plants and animals.



EXAMPLES FOR DISCUSSION

Discuss within the group the following:

- Hydraulic fluid in a track hoe (~5,000 psi), how could a pinhole release impact you?



- A hydrate or ice plug in a section of process piping, how could this impact you?



- Is there equipment in your operations with no way to verify proper depressurization before opening? Discuss this and take action.





EXAMPLES FOR DISCUSSION

Discuss the following within the group:

- How do you know the maximum allowable operating pressure of the equipment you work with?
- Why should you never make adjustments to a piece of equipment that is pressurized?
- Under what conditions are the whip checks and pipe restraints not adequate?
- Do we have any equipment that creates line of fire hazards that are difficult to manage? Think about blow down vents...





WHAT CAN EACH OF US DO?

- Don't be fooled, all pressure can injure or kill.
- Verify zero energy before starting work.

REMEMBER

This . . .



can turn into this



Let's work together and position ourselves and others to avoid line of fire pressure releases.