

ATKINS

Overpressure Safety Management in Oil and Gas Industry

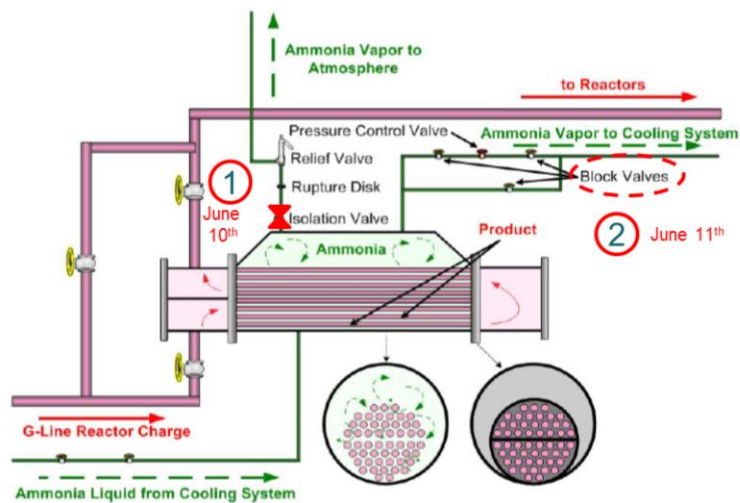
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16 October 2015



Review an Overpressure Protection Incident

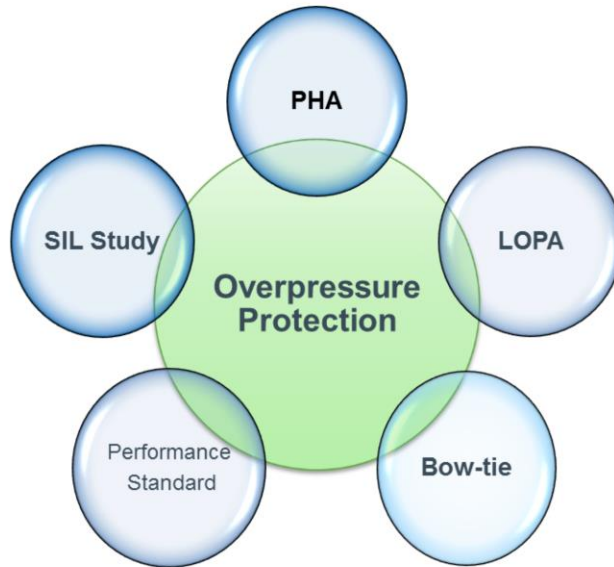


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Reference: Chemical Safety Board Report



Overpressure Protection-PSM Relation



Cause of Overpressure

- External Fire
- Ambient Effect
- Operator Error
- Instrument or Control system Failure
- Utilities or Process upset
- Valve Mechanical Failure or Fatigue

Overpressure Protection in Alberta

Safety Code Act: Pressure Equipment Safety Regulation

38(1) An owner of pressure equipment must ensure it has overpressure protection that is

- (a) a pressure relief valve that meets the requirements of the ASME Code, or*
- (b) other means of overpressure protection acceptable to the Administrator.*

Provincial Requirement

ABSA 525:

*According to the PESR, all pressure equipment must have overpressure protection, and the overpressure protection **system** must be properly designed and operated.*

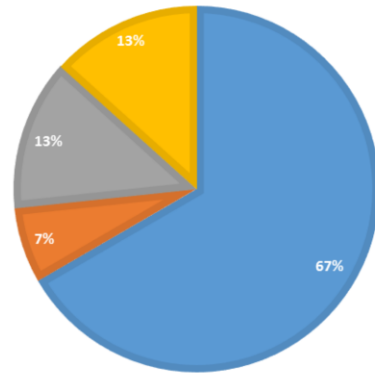
TSASK:

*Pressure vessels shall be provided with a means of overpressure protection. The use of an overpressure protection **device** (rupture disc, pressure relief valve, pressure safety valve) is the preferred and approved standard to safeguard a pressure vessel.*

Underlying Causes of Relief Valve Failure

HSE UK Assessment shows 33% of relief valve failures were a result of **improper operation**.

- Design Inadequate, Material Deficient
- Inadequate Maintenance
- Lack of Training / Inexperience Staff
- Deficiency Quality Assurance Procedure



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Examples of Faulty Design



Insufficient bolts



Long Moment Arm



Noise

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Source: The Safety Relief Valve Handbook (Marc Hellemans) ⁸

Process Safety in Overpressure Protection Design

- Process Hazard Analysis
- Safety Critical Element Identification & Performance Standard
- Noise Assessment Study
- Overpressure Risk Assessment

Using Other Means of Overpressure Protection

When an owner is planning to use other means of overpressure protection in lieu of a PRV, the owner must demonstrate to the Administrator that the proposed overpressure protection system provides an equivalent or greater standard of safety than using a PRV.

- Monitoring Program
- Overpressure Protection by System Design (OPPSD)
- Safety Instrumented System (i.e. HIPPS)

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Overpressure Protection by System Design

- The protection of a pressure vessel against overpressure without the use of a pressure relief device.
- The ASME UG-140 states if pressure vessel is self-limiting and the pressure is less or equal to MAWP at coincidence temperature then PRV is not required.
- Overpressure Risk Assessment (ORA) shall be conducted to justify OPPSD.
- When there is justification of OPPSD then it shall be listed in the safety critical element.

Overpressure Protection Options

	OPPSD Self-Limiting	Relief Valve	HIPPS
Layer of Protection	Primary LoP	5 th LoP	4 th LoP
PFD	10 ⁻⁴	10 ⁻²	10 ⁻³ to 10 ⁻⁴
Advantage	<ul style="list-style-type: none"> Preferred for toxic services Low maintenance cost 	Conventional Design and Operation	<ul style="list-style-type: none"> High Reliability Recommended when environmental and safety is highly concerned
Disadvantage	Requires additional safety margin for design pressure	<ul style="list-style-type: none"> High Maintenance Environmental Concern (toxic) 	<ul style="list-style-type: none"> Cost Complexity Frequent testing

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Overpressure Risk Assessment ASME UG-140 Requirement

- 1- Multi-Disciplinary team review;
- 2- Risk Assessment for various overpressure scenarios;
- 3- Manufacture data report to state the system protected by design;
- 4- Documentation and sign-off

Can We Use HAZOP in Lieu of ORA?

TSASK (Saskatchewan):

A detailed analysis to identify and examine all potential overpressure scenarios must be conducted. A summary of the results from a hazards and operability analysis (HazOp), failure modes, effects and criticality analysis (FMECA), “what-if” analysis or other equivalent methodology is required.

HAZOP

Process, Control and Operations Engineers attend

Don't need a P.Eng. Stamp

Outcome : Recommendations list

Info: Process & control Data

Qualitative Study

Assumed competent operators

ORA

HAZOP participants + Relief SME attend

To be stamped by a P.Eng.

Outcome: SCE list + Recommendations List

Info: Process , Control and Mechanical Data

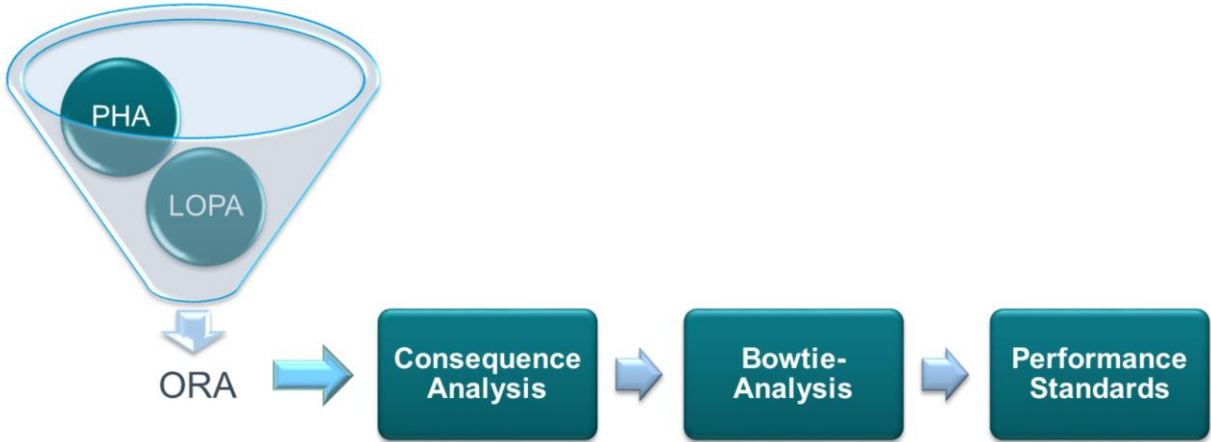
Semi-quantitative study

Inadvertent scenarios

Overpressure Risk Assessment Notes

- HAZOP might not meet regulation's objectives if it is not completed by LOPA to ensure an equivalent or greater standard of safety is designed.
- If relieving is utilized as the means of protection then using HIPPS will just increase CAPEX and OPEX and complication.
- Inadvertent valve operation (e.g. control valves bypasses to be wide open) shall be taken into consideration.
- Accessibility to fire protection system shall be reviewed in fire cases.
- Fire Zoning layout to be available for ORA. If equipment is not located within the fire zone then no need to review the fire case.

Overpressure Protection Safety Management



Recommendations

1- For operating plants, existing PRVs' conditions shall be taken into consideration for PHA revalidation. Also, probability of failure for existing PRVs should be considered.

2- Process Safety engineers needs more contribution during design phase to address safety concerns.

3- Conduct comprehensive ORA and revalidate it as part of MoC.

4- Using a common language for overpressure risk assessment among provinces.

Thank you

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