Some Common Pitfalls in Designing Emergency Pressure Relief Systems

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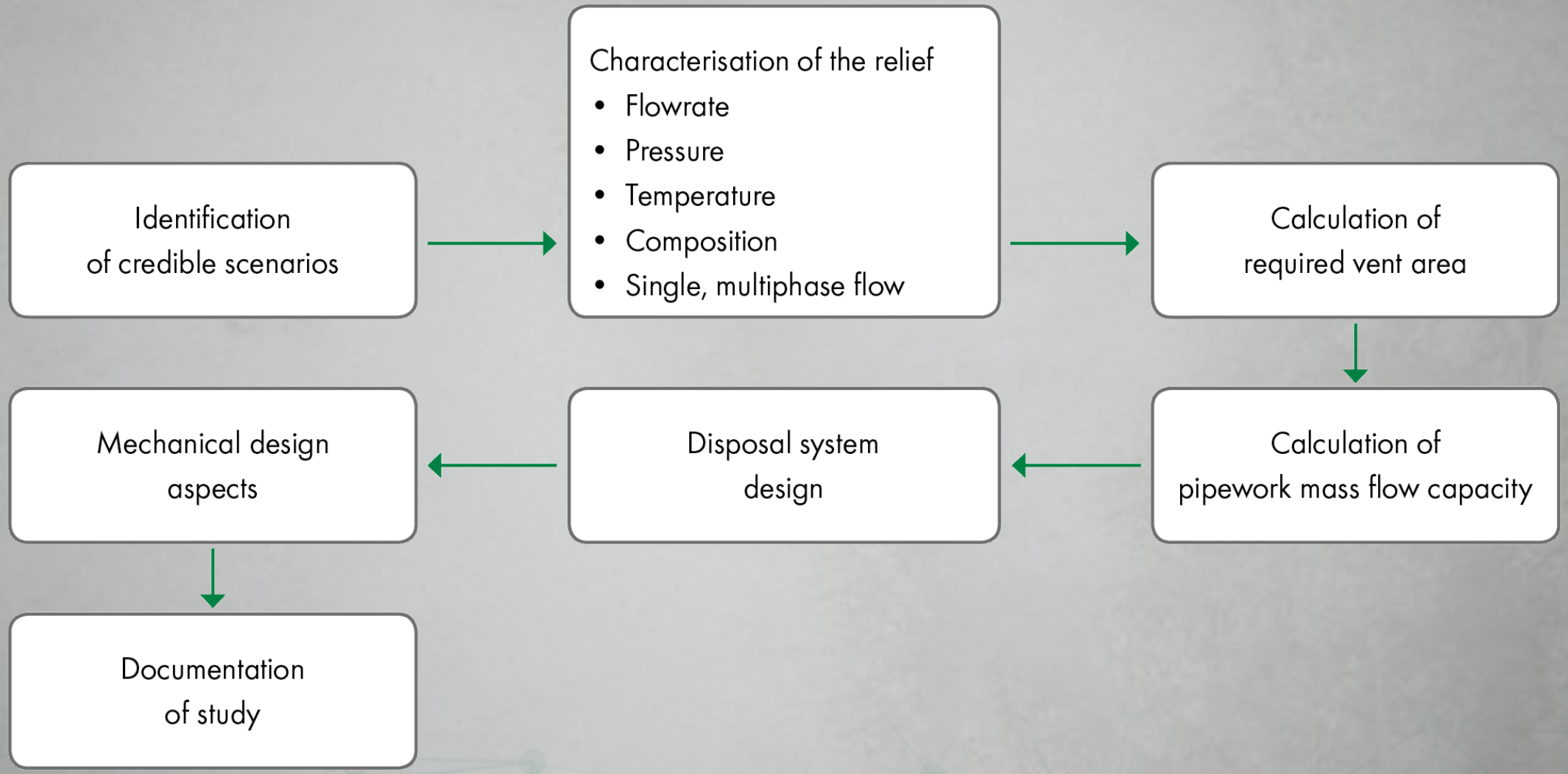
How it should be done



Scenario identification

- No identification at all.
- SV / disc provided by the supplier of the vessel (fire engulfment only), without any consideration for other scenarios (e.g. runaway reaction).
- Scenario identification following standards (e.g. API 520/521, ISO 4162), but without specific scenarios.
- Standard scenarios + specific scenarios (identified during PHA).

Chemical reactions

The release can be:

- A gas (generated by thermal decomposition).
- A vapour (from the solvent or reactant, as temperature increases).
- A liquid (typically solvent) carried over.

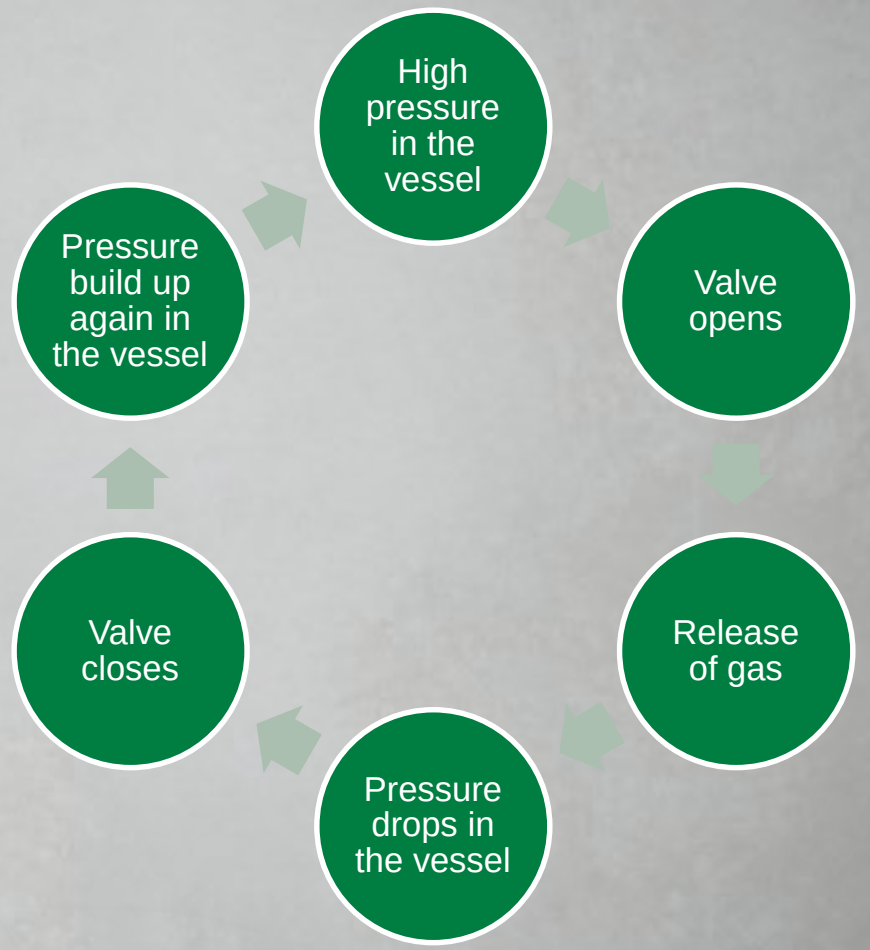
Other considerations:

- Possible thermal decomposition.
- Wrong materials?

Calculation of vent area

Main errors:

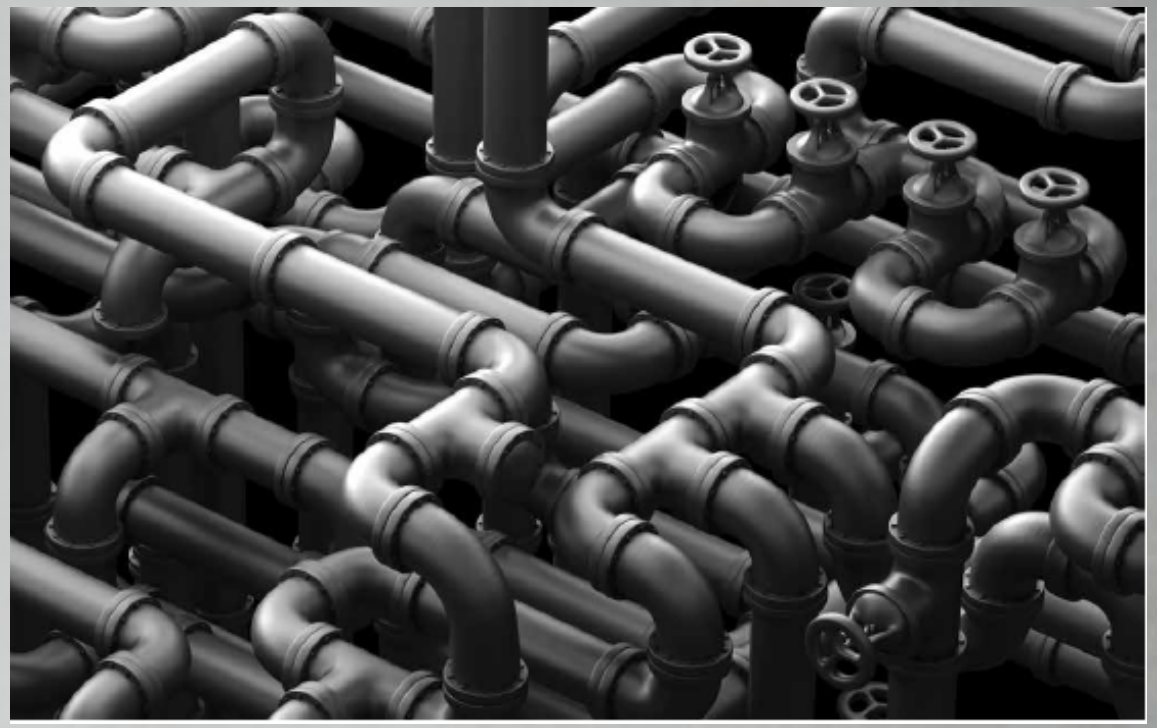
- The calculation is insufficiently supported by chemical reaction data.
- Scenarios with widely different flowrates are safeguarded by the same relief device.
- The calculated conditions of the scenario are unrealistic.



Disposal of release

Typical mistakes / things to take into account:

- Convoluted piping systems upstream or downstream (consider head losses).
- Large head losses upstream / downstream of a safety valve can also lead to chattering.
- Connecting different pressure levels to a common disposal system is normally a bad idea.
- Incompatible chemicals.
- Appropriate disposal of hazardous (e.g. flammable, toxic) liquids and gases.



Documentation

Not critical…unless there is a change. Then how do we know if:

- The changes give rise to new relief scenarios.
- The existing relief scenarios are still valid.
- The relief conditions are still valid.
- The risk associated to the existing scenarios has increased.
- If the system has sufficient capacity and reliability to safeguard any new scenarios, and any changes in the existing scenarios.

Installation

Things to take into account:

- SVs / rupture discs are usually the last layer of protection.
- SVs / rupture discs fail on demand.
- Attention to proper flow direction.
- Supporting!

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Maintenance, inspection and MOC

Periodic testing & inspection is critical to maintain reliability of the system.

Management of change is critical to maintain sufficiency of the system.

Conclusion

A well designed, operated and maintained EPRS is a cost-efficient highly reliable safeguard against unallowable overpressure in process plants. However, there are a number of common mistakes that can render the system inefficient or insufficiently reliable.

Being normally the last layer of protection before a catastrophic failure and release of hazardous materials and energy, special care should be taken along the entire lifecycle of the system. Also, all the auxiliary equipment (pipes, disposal systems…) should be given the same attention as the relief devices (valves, discs) themselves.

Any questions?

Thank you for your attention!

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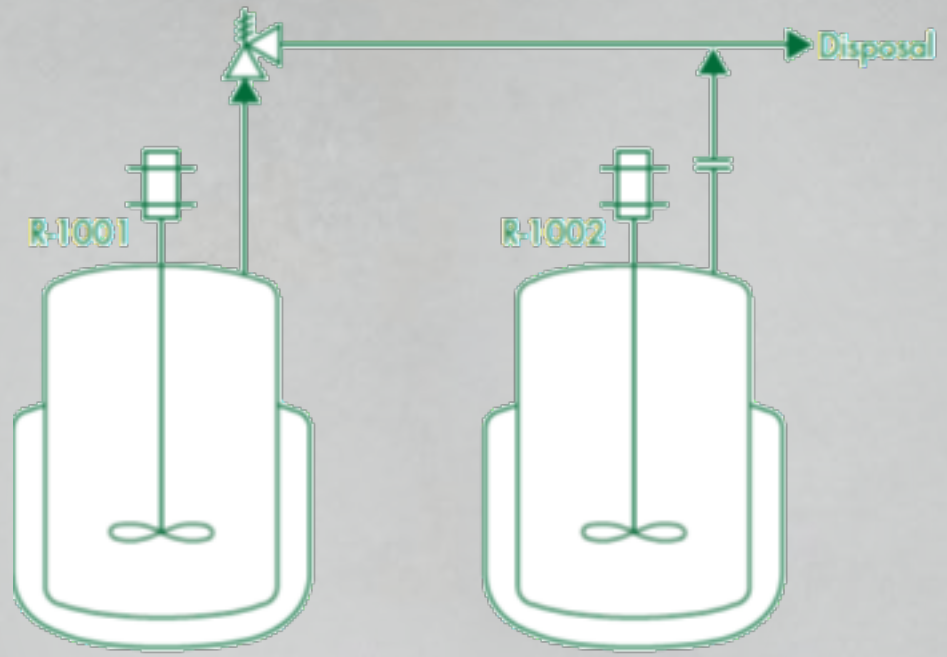
Connecting two different pressure levels



Characteristic	R-1001	R-1002
Design pressure	12 bar	100 mbar
Normal operating pressure	10 bar	50 mbar
Design temperature	200ºC	50ºC
Normal operating temperature	150ºC	Room
Relief system	SV @ 12 bar	Disc @ 100 mbar

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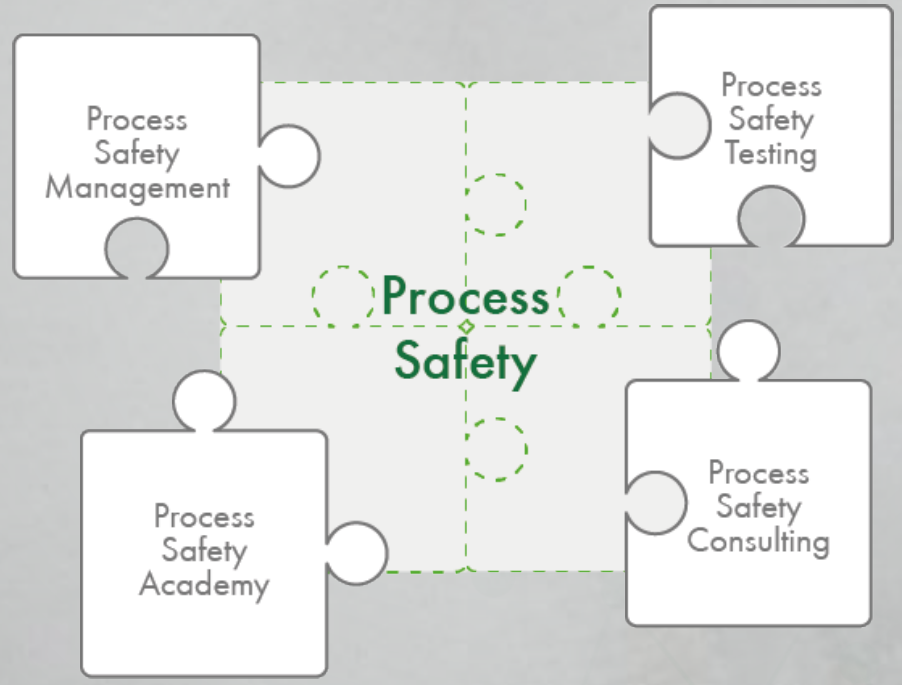

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