



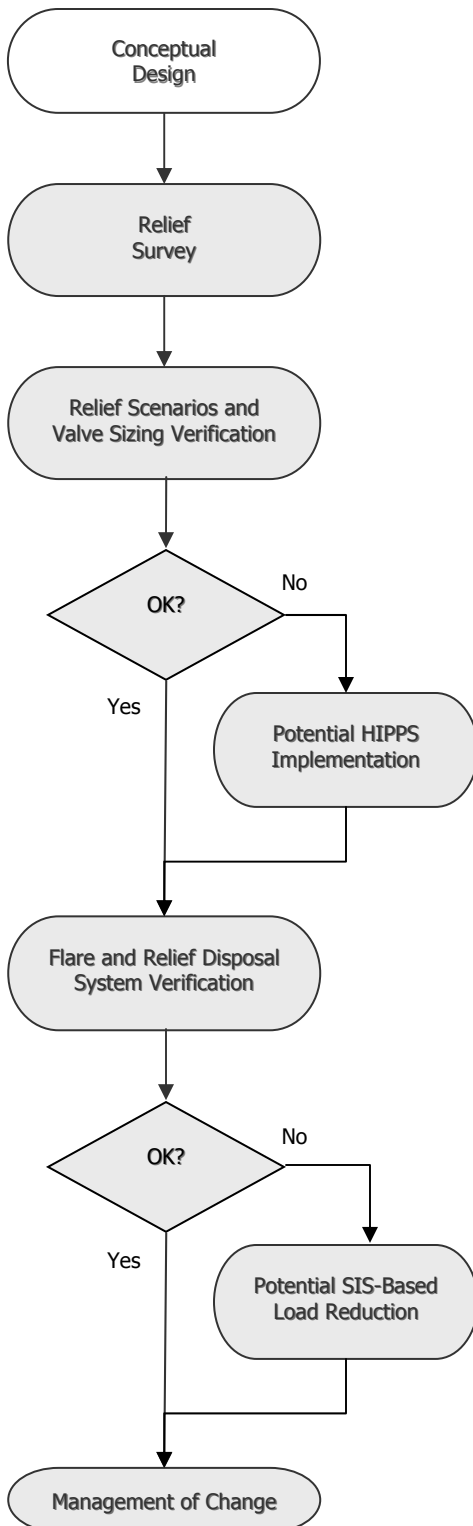
# Relief System Integrity

Engineered safeguards that relieve and safely dispose of materials that can result from excess pressure scenarios in vessels and piping are some of the most common and effective risk reduction measures in the process industries. The ubiquity of relief systems stems not only from their effectiveness but also the degree of adoption of codes and standards that recommend their use, such as the ASME Boiler and Pressure Vessel Code and API relief valve and flare system standards.

While many process plants start with good relief system designs, their effectiveness can degrade over time due to modifications and changes in operating conditions. These changes can leave plants at risk of having insufficient relief capacity or sections of the plant with no relief capability at all. Some of the changes that can result in inadequate relief capacity can include the following:

- ✓ Increases in throughput or inventory that can result in inadequate capacity of individual relief valves due to increased relief rates
- ✓ Addition of block valves that, if left closed, could trap liquid in a heat exchanger or block the path to the relief valve
- ✓ Addition of block valves on heat exchanger tube bundles causing a potential for overpressure of the trapped liquid, without addition of a thermal relief valve
- ✓ Increasing relief valve sizes and capacity without addition of flare header capacity, potentially resulting in insufficient capacity to flare large multiple release scenarios
- ✓ Process piping modifications that result in the loss of relief pathway
- ✓ New process units are added to an existing flare or vent system
- ✓ Existing atmospheric reliefs are routed to an existing flare system in order to reduce hydrocarbon emissions

**The *Kenexis Relief System Integrity Solution*™ helps to ensure the ongoing integrity of your relief and vent systems by reviewing current relief system needs against existing equipment design and proposing innovative solutions for addressing gaps**



✓ **Relief and Vent System Survey**

A good relief and vent system design begins with a survey to ensure that all pressure vessels and pipe segments have a direct and unobstructed path to a relief device that is capable of passing all relief scenarios associated with that equipment. Kenexis assists customers by developing “relief nodes”, which correlate relief devices and their associated protected equipment.

✓ **Relief Scenarios and Sizing**

Each protected equipment item will have several scenarios under which a pressure relief may be necessary. Kenexis can help customer to review their relief scenarios to ensure they are valid and complete, and also to calculate relieving rates generated by these scenario to ensure that the existing relief device sizing is appropriate under current operating conditions.

✓ **Header Adequacy and Atmospheric Reliefs**

After a relief device activates, the vented material is either directed to the atmosphere or a collection and disposal system, such as a flare. Kenexis assists customers by reviewing relief header design to ensure adequacy under single and credible multiple relief scenarios, ensuring that maximum allowable back-pressure limits are not exceed. Kenexis can also analyze atmospheric reliefs, performing dispersion calculations to ensure that the relief location is adequate and will not pose an unacceptable risk of flammable or toxic concentrations that exceed levels of concern.

✓ **HIPPS / SIS Based Load Reduction**

In some cases, relief devices alone may not be able to adequately relieve a pressure upset scenario. In addition, some multiple relief scenarios may exceed the limits of flare system capacity after plant upgrades. In these situations, relief systems may be assisted with High Integrity Pressure Protection Systems (HIPPS) or other pressure reduction safety functions to reduce or eliminate the need for conventional relief, if conventional relief system design is impossible or impractical. Kenexis helps its customers to implement HIPPS and SIS based load reduction systems by establishing and verifying the design basis requirements of these systems in accordance with applicable codes from ISA, API, and ASME.

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