OSHA Published Requirements for Relief Systems Documentation

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Abstract

Relief systems are an important element in the Occupational Safety and Health Association (OSHA) Regulated Process Safety Management (PSM) standard. Yet, industry audits continually report deficiencies in relief system documentation that are manifested from inaccuracies and incompleteness. There is no disagreement concerning how essential these relief systems are to preserving the health of personnel and the integrity of equipment, but misunderstandings, negligence, and improperly recorded modifications render the support documentation of these relief systems obsolete. The standards published by the American Petroleum Institute (API) and OSHA concerning relief system documents go far beyond the scope of the specification sheets that facilities use in lieu of complete records. Compliant documentation is the result of careful evaluation and detailed calculations that are performed with precision and expertise. This paper addresses the required elements of sufficient relief system documentation that is fully compliant with industry-accepted standards.

Introduction

The requirement for relief system documentation falls under OSHA Regulation (Standards–29 CFR) 1910.119: Process safety management of highly hazardous chemicals. Within this standard, OSHA specifies that ". . . the employer shall complete a compilation of written process safety information before conducting any process hazard analysis required by the standard . . . Information pertaining to the equipment in the process shall include . . . Relief system design and design basis" (1910.119[d][3][i][D]).

Though the necessity of relief system documentation is clear, the exact components of this documentation and the information contained therein is less obvious. Surveys across various facilities reveal that many facilities either lack documentation that is sufficiently compliant with OSHA's requirements, or they have expensed time and resources into developing content without fully understanding the scope of these requirements. These situations are generally addressed by providing the facility with a summary of requirements, initiating a full analysis of the facility's systems, and working with the facility to overcome deficiencies, thereby developing content that is fully compliant with industry-accepted standards.

Summary of Requirements

Specification sheets, which typically contain information such as protected equipment; the size, manufacturer, and model of Pressure Relief Device (PRD); and the sizing overpressure scenario, are the most common resource to which facilities defer for relief system information. While spec sheets are excellent tools, they only begin to approach the full scope of API STD 521 6th Edition required content because they fail to include user documentation containing relief system guidance, a comprehensive list of overpressure scenarios, relief load calculations, or the installation document (inlet and outlet isometrics). The "compilation of written process safety information . . . [which] shall include . . . Relief system design and design basis" that OSHA refers to in Standard 1910.119 can be best understood by the list of documentation required in industry standard API STD 521 6th Edition Section 4.7 Relief System Design Documentation:

- Documentation of user relief system design guidance

- Documentation of references used in the relief system study
- Protected equipment or system
- List of overpressure scenarios
- Relief load calculations
- PRD documentation
- Relief devices on vendor supplied packaged equipment
- Installation documentation

API STD 521 6th Edition also requires documentation for disposal systems such as flares; Section 4.8 Flare Header Design Documentation encompasses aspects such as:

- Scenario information and basis
- Flare system schematic and results of the hydraulic model
- List of disposal system loads
- Credits taken to reduce or eliminate disposal system peak loads
- Backpressure limit for each source and the basis for limit
- Acceptance criteria for flare system equipment

From this list, spec sheets are effective examples of PRD documentation alone. However, these sheets fail to address the identification of overpressure scenarios, details of relief device sizing, relief device installation, and speculation processes associated with the results. The facility is not only non-compliant, but also unable to represent an entire history of arduous work and expenditure. Understanding the investment and care required to accrue this information, Smith & Burgess conducts a detailed engineering analysis and compiles a level of system information that further includes:

- Data and assumptions used in the analysis
- Documentation of the calculations performed
- Design and design basis of all relief systems for pressure vessels
- Identification of pressure vessels with required overpressure protection by system design (UG-140)
- Verification that relief devices are adequately sized and appropriate for service
- Verification that rupture disks are installed correctly
- Verification that inlet pressures and backpressures are within PRD manufacturers' requirements
- Identification of excessive vibrations
- Verification that the effluent handling system is 'safe'

Industry Observations

During recent Voluntary Protection Programs (VPP) Site Reapproval Evaluations, auditors expected to receive complete profiles of the design and design basis of pressure relief systems in accordance with OSHA regulations. OSHA's clarification and interpretation of the PSM standard requires detailed information such as:

- Management of Change (MOC) procedures that include the impact on the relief system.

- A Process Hazard Analysis (PHA) review that assesses the adequacy of relief system design.
- A relief device analysis that verifies discharge to safe location.
- Process Safety Information (PSI) that includes code and standards use in the design of the relief system.
- Control measures that prevent inadvertent closure of isolation valves on inlets and outlets of relief devices.
- Control measures that ensure condensate, rain, and ice do not affect the outlet of relief valves.

In some instances where systems have been modified, the old specification profiles remain in place, resulting in discrepancies and misinformation. In other cases, regulations have been updated, and documentation that was compliant is left to atrophy throughout the continual cycles of changes. When facilities expand, improve, and repurpose their systems, the supporting documentation must follow suit or become obsolete.

The prevalence of these deficiencies is evinced by a growing base of resources that have been compiled in response to the critical discrepancies appearing across the industry. These resources stand to show the information that must be gathered and documented during an engineering evaluation of any system. Such reviews must be carefully and thoroughly conducted; anything less will make documentation susceptible to error or absence of essential information.

Engineering Evaluation

The foundation for compliance is a successful engineering evaluation. This evaluation must encompass a methodical review of pressure vessels and pressure relief systems (e.g., relief piping and equipment, effluent handling) in PSM-covered processes to document compliance with industry-accepted standards and practices.

Evaluation Requirements

To validate and build upon relief system documentation, a complete inventory of the system's pressure retaining equipment must be conducted. The evaluation provides an opportunity to assess the status of each system and identify whether any equipment needs reinforcement or special monitoring, such as equipment requiring overpressure protection that may not be provided with adequate pressure relief. Further, the evaluation confirms the accuracy of listed PSI values, providing space for field verification as necessary. The gathered results allow assessors to identify gaps in the information required to document the design and design basis of the relief systems from this research and validation process.

PRD Documentation Requirements

PRD documentation, including specification sheets, is generally the most familiar outcome of an engineering evaluation. These on-site resources are accessible to engineers and system operators alike and serve as essential components within the scope of a much larger documentation portfolio. As such, the importance of having accurate, reliable figures on these sheets cannot be overstated. The evaluation process ensures that proper identification is in place for each type of relief device and that corresponding descriptors are consistent across each type of documentation. The evaluation traces the flow of the system to compile a comprehensive listing of the equipment that will be relieved through the

PRDs. Finally, the design and set pressures of each device are confirmed, ensuring that there are no changes or undetected issues in the system.

System Information

When the evaluation has identified relevant equipment in the system, engineers conduct a thorough assessment to determine the cause of overpressurization. Relief system documentation should include a full list of all potential overpressure scenarios, such as (but not limit to) those listed in API STD 521 6th Edition Section 4.4.

Sizing Information

The adequacy of relief system for overpressure scenarios and potential failure is determined, which enables engineers to design a response plan and mitigation. As part of the engineering evaluation, information is collected concerning the state of material being relieved (e.g. liquid, vapor, liquid-vapor, liquid-vapor-solid) along with an identification of the material which was the basis for the relief device selection. Physical properties of relieved materials (viscosity, specific gravity), flow rate, and relief pressure are determining factors to quantify the PRD capacity and hydraulic calculation.

PHA Requirements

Smith & Burgess begins its approach to the PHA by assessing preventative measures. This assessment first ensures that all necessary administrative controls are in place for isolations valves, followed by an evaluation of all relief devices that feature open vents discharging into the atmosphere. The objective of this evaluation is to ensure that these vents are safe, calculating hypothetical scenarios to predict the potential outcomes of worst case events. This aspect of the PHA analyzes the area surrounding vent devices for dangers presented to employees and equipment that may result in a secondary release of hazardous materials and Highly Hazardous Chemicals (HHC). A list of reasonable assumptions is that depicts all the safety features positioned to support the current system design is generated. The evaluation analyzes the effect on downwind locations (e.g., ground, platforms, pressure vessels, furnace stack) and the effects on employee health and safety when the released material is identified to have a toxic, asphyxiant, corrosive, combustible, or explosive danger associated with it.

To accomplish this, physical features such as vents and relief devices must conform to the correct design standards allowed by the system configuration. Bonnet vents must be positioned so that they discharge to a safe location, minimizing any potential exposure to the released material. Moreover, controls must be properly set to prevent fluid (e.g., rain, ice) from imposing a backpressure or plugging the outlet of the RV.

Disposal System Analysis

As a key feature in any system's safety structure, the disposal system is carefully evaluated. The first check verifies that the flare design and design basis are current with the process configuration and throughput. When alignment of the design and existing structure is confirmed, each relief scenario pertaining to disposal system equipment is assessed to ensure that the flare system is adequate to handle the potential relief load.

If flares are not present, other effective measures or analysis of safe disposure must be present. In the event that the system configuration does not align with the design and design basis, or if the configuration must be modified, the MOC procedure must be scrutinized to accurately reflect these changes.

MOC Check

In the case of modification to an existing system or process, the evaluation ensures point by point compliance with the MOC regulations established by OSHA. Among these, Smith & Burgess ensures that the MOC process fully captures relief system changes, including alterations to relief devices, discharge lines, disposal equipment, or flare system design. The performance of the system is further assessed for differences, such as changes in flow rate, and any pertinent documentation is updated to reflect the new scope of specifications.

Conclusion

In an industry that is propelled by technology, regulatory information is recorded, distributed, adapted, and curated faster than ever. Regulations reside in open resources that are readily accessible to manufacturers, operators, and the public alike; and ignorance of applicable standards is no longer an excuse for failing to meet them. Spec sheets fall short of the necessary detail of proper relief system documentation because they cannot provide the comprehensive design and design basis of equipment. To meet the industry-accepted standards and practices, all such documentation must illustrate the current operation specifications and system design, including descriptions, calculations, and PRD sizing and installation conformation for all potential overpressure scenarios. Where inspections reveal deficiencies, these deficiencies must be documented, written into corrective action plans for resolution, and supplemented by plans to safely operate until the deficiencies are resolved. With exacting scrutiny, experienced engineers, and the highest professionalism, Smith & Burgess can ensure full compliance of process documentation in accordance with API and OSHA PSM and other industry-accepted standards.

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