PIPING NEWS

A Newsletter published by W. M. Huitt Co.
for designers and engineers involved with process piping

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ONLINE TRAINING COURSE FOR INDUSTRIAL PIPING DESIGN/ENGINEERING

The online training course, the one that was expected to be launched in early May, has finally seen the light of day. The first of three sessions was posted the end of June and is available for registration. Session 2 and 3 will be posted in short order.

If interested in downloading a brochure on the course please go to: http://www.wmhuittco.com/. A link to the download, course registration and other information can be found on that opening page.

The above mentioned brochure contains, among other things, the course syllabus, pricing, and other such information.■

DESIGNING FOR HAZARDOUS FLUIDS

The following is an excerpt from an article titled, "Piping Design for Hazardous Fluid Service" that ran in the June 2010 issue of Chemical Engineering Magazine.

Incorporating fire safety into plant design takes on two fundamental goals: to prevent the occurrence of fire and to protect the initially uninvolved piping and equipment long enough for operations personnel to perform their duties and for emergency responders to get the fire under control. While it is impractical to completely eliminate the potential risk of an accidental fire in a complex process-plant facility that is expected to handle and process hazardous chemicals, it is reasonable to assume that certain aspects of design can be incorporated to reduce that risk.

Designing facilities that use and store hazardous chemicals requires a demanding set of requirements, at times beyond what can practically be written into industry codes and standards. It is ultimately the responsibility of the engineer of record (EOR) and the owner to fill in those blanks and to read between the lines of the adopted codes and standards to create a safe operating environment, one that minimizes the opportunity for fire and its uncontrolled spread and damage.

This excerpt will not delve into the various trigger mechanisms of how a fire might get started in a process facility, but will instead discuss containment and control of the fuel component of a fire that resides in piping systems that contain combustible, explosive, or flammable fluids.

In the design of piping systems containing such fluids, there are critical aspects that need additional considerations beyond those involved in the design of piping systems containing non-hazardous fluids. There are two key safety aspects that need to be incorporated into the design, namely system integrity and fire safety.

System integrity

System integrity describes an expectation of engineering that is integrated into the design of a piping system in which the selected material of construction (MOC), system joint design, valve selection, examination requirements, design, and installation have all been engineered and performed in a manner that instills the proper degree of integrity into a piping system. While this approach is certainly needed for the piping design of so-called normal fluid service it is absolutely critical for hazardous fluid systems.

The design of any piping system, hazardous or non-hazardous, is based, in large part, on regulations and industry accepted standards published by such organizations as the American Society of Mechanical Engineers (ASME) and the American Petroleum Institute (API). The standards published by these organizations include tables that establish joint-pressure ratings based on MOC and temperature. Where the joint-design consideration for hazardous fluid services departs from that of non-hazardous fluid services is in gasket and seal material specifications.

This is due to the need for sealing material to contain hazardous chemicals for as long as possible while surrounded by a fire or in close proximity to a fire. The effect of heat from a fire on an otherwise uninvolved piping system can only be delayed for a relatively short period of time. And the first thing to fail will be the mechanical type joints. Depending on the type of fire and whether the piping is directly in the fire or in close proximity, the window of opportunity, prior to joint seal failure, for an emergency response team to get the fire under control is anywhere from a few hours to less than 30 minutes. As you will see, a number of factors dictate the extent of that duration in time.

A system in which the gasket material is selected on the basis of material compatibility, design pressure, and design temperature may only require a solid fluoropolymer. In a fire, this non-metallic material would readily allowing the contents of the pipe to discharge from the joint once sealed by the gasket. Specifying a gasket that is better suited to hold up in a fire for a longer period of time gives the emergency responders time to bring the initial fire under control, making it quite possible to avoid a major catastrophe.

Fire-safe system

Preventing the potential for a fire requires operational due diligence as well as a proper piping-material specification. However, controlling and restricting the spread of fire goes beyond that. Results of the assessment reports of catastrophic events coming from the U. S. Chemical Safety and Hazard Investigation Board (CSB; Washington, D.C.) have shown that many of the occurrences of catastrophic incidents have actually played out through a complex set of circumstances resulting from design flaws, instrumentation problems, pipe modifications, inadequate fire-proofing and human error.

Events, such as a fire, are not necessarily then the result of a hazardous fluid simply escaping through a leaky joint and then coming into contact with an ignition source. There are usually a complex set of events leading up to a fire incident. Its subsequent spread, into a possible catastrophic event, can then be the result of inadequate design requirements that extend beyond the piping itself.

While this discussion touches only on piping issues, know that this is only a part of the overall integration of safety into the design of a facility that handles hazardous fluids. What follows are recommended piping design considerations that are intended to substantially reduce the risk of the onset of fire and its uncontrollable spread throughout a facility. In discussing the spread of fire, it will be necessary to include discussion regarding the needs for disciplines other than piping, namely fire proofing of structural steel.

General codes and standards

From a fire-safety standpoint, some requirements and industry regulations are stipulated in the International Fire Code (IFC)

published by the International Code Conference (ICC) under IFC 3403.2.6.6. There are also requirements by the National Fire Protection Assn. (NFPA) under NFPA 1 and NFPA 30. Test requirements for fire-rated valves can be found under API 607 — "Fire Test for Soft Seated Quarter Turn Valves." Starting with the 4th edition of this API standard, it was added that, among other things, the tested valve has to be operated from fully closed to fully open after the fire test. Prior to the 4th edition a soft-seated fire-rated valve had to only remain sealed when exposed to fire without having to be operated, or rotated. Additional fire test requirements can be found as published by the BSI Group (formerly known as British Standards Institution) as BS-6755-2 "Testing of Valves. Specification for Fire Type-Testing Requirements," and FM Global FM-7440 "Approval Standard for Firesafe Valves."

With exception to the specific requirements covered in the valve testing standards, the codes and standards mentioned above provide generalized requirements that touch on such key aspects of safety as relative equipment location, mass volume versus risk, electrical classifications, valving, and so on. They cannot, and they are not intended to provide criteria and safeguards for every conceivable situation. Designing safety into a particular piping system containing a hazardous liquid goes beyond what should be expected from an industry-wide code or standard and falls to the responsibility of the owner or Engineer of Record (EOR). As ASME B31.3 states in its introduction, "The designer is cautioned that the code is not a design handbook; it does not do away with the need for the designer or for competent engineering judgment."

When designing piping systems to carry hazardous liquids, the design basis of a project or an established protocol for maintenance needs to incorporate a mitigation strategy against two worse-case scenarios: (a) A leak at a pipe joint containing a hazardous liquid, and (b) The rupture or loss of containment during a fire of surrounding hazardous piping systems, not otherwise compromised, that would add fuel to the fire.

The occurrence of those two failures, one initiating the incident and the other perpetuating and sustaining the incident, can be minimized or eliminated by creating a design basis that provides the following:

- Added assurance against the potential for joint failure
- Added assurance of containment and control of a hazardous liquid during a fire
- Safe evacuation of a hazardous liquid from the operating unit under distress■

Next month we will conclude the discussion on "*Designing for Hazardous Fluids*."

ASME B31.3 and BPE MEETINGS

The ASME B31.3 Process Piping Committee meets two times each year and the BPE Committee meets three time each year. This year their Meetings, which are open to the public, will be held as follows:

B31.3 Process Piping Committee Meeting

Fall 2019

September 16-18, 2019 – Monday-Wednesday, with B31 Code Week

Venue & Location:

Lord Baltimore Hotel
http://www.lordbaltimorehotel.com
20 West Baltimore Street
Baltimore, MD, United States

Spring 2020

April 06 2020 08:30 AM - April 08 2020 05:00 PM, Monday - Wednesday

Venue & Location:

Royal Sonesta New Orleans
https://www.reservationcounter.com/hotels/show/6123778/royal-sonesta-new-orleans-new-orleans-la/
300 Bourbon Street
New Orleans LA, United States

ASME B31.3 and BPE MEETINGS

Bioprocessing Equipment (BPE) Committee Meetings

Fall 2019

September 09 2019 08:00 AM to September 12 2019 12:00 PM, Monday - Thursday

Venue & Location:

Lord Baltimore Hotel
http://www.lordbaltimorehotel.com
20 West Baltimore Street
Baltimore, MD, United States

Winter 2020

January (Dates TBD)

Venue & Location:

Caribe' Hilton
https://www.caribehilton.com/
1 San Geronimo Street
San Juan, Puerto Rico 00901

Spring 2020
May 18, 2020 08:00 AM to May 21, 2020 12:00 PM, Monday - Thursday

Venue & Location:

Royal Sonesta New Orleans
https://www.reservationcounter.com/hotels/show/6123778/royal-sonesta-new-orleans-new-orleans-la/
300 Bourbon Street
New Orleans, Louisiana, USA

INCIDENTAL, BUT NOT TRIVIAL THINGS

Weld Maps

ASME Boiler and Pressure Vessel Code, Section IX. Para. **QW-301.3 Identification of Welders and Welding Operators**. States that, "Each qualified welder and welding operator shall be assigned an identifying number, letter, or symbol by the organization, which shall be used to identify the work of that welder or welding operator."

ASME Process Piping code B31.3 similarly states, under para. 328.5.1*(b)*, that, "Each qualified welder and welding operator shall be assigned an identification symbol. Unless otherwise specified in the engineering design, each pressure-containing weld or adjacent area shall be marked with the identification symbol of the welder or welding operator. In lieu of marking the weld, appropriate records shall be filed."

B31.3, as stated above, goes further than Section IX by stating that, "In lieu of marking the [actual] weld, appropriate records shall be filed."

ASME does not define what "appropriate records are." However, without marking each specific weld, at or adjacent to the weld, the only other means of identifying and locating each weld is through the use of a weld map. From that standpoint, while there is not a specific requirement for a weld map, such a method is implied.

Am isometric weld map depicts the physical aspects of a piping system, with some degree of proportionality, and identifies each weld with a number. That identifying number provides reference on a Welders Log Sheet, which identifies the welder or welding operating in profiling each weld.

Aside from the above implied requirement of ASME B31.3, Para. 328.5.1*(b)*, the only time a weld map is actually mentioned, with regard to required documentation, is in the ASME Bioprocessing Equipment (BPE) standard.

ASME BPE para. **GR-5.2.1.1.1 Turnover Package Documentation, subparagraph** *(c)* states the following: "Weld Documentation (not required for standard fittings, valves, and components unless specifically required by the owner/user)

(1) weld maps
(2) weld logs
(3) weld examination and inspection logs
(4) coupon logs

ASME BPE requirements apply to all wetted surfaces that contact either the product, raw materials, or product intermediates during

process development, manufacturing, or scale-up; and all equipment or systems that are a critical part of product manufacture, such as Water-For-Injection (WFI), clean steam, ultrafiltration, intermediate product storage, and centrifuges.

The weld map can be created utilizing fabrication isometrics (spool drawings), or by creating a system isometric. In using fabrication isometrics the fabricator would use as-built fabrication isometrics, renumber them and identify them as weld maps.

In creating a system isometric, an entire, as-built, piping system would be drawn on one large drawing or continued on multiple drawings if necessary. This type of drawing can fulfill two requirements. One requirement is to provide a weld map. The second requirement is to provide documentation of the system configuration. While this is not a Code requirement it is certainly documentation the FDA indicates in their "Guide to Inspection of High Purity Water Systems" as being necessary to perform a proper validation.

FDA's "Guide to Inspection of High Purity Water Systems" is a document used as a guideline by investigators and other FDA personnel in their review and evaluation of high purity (hygienic) water systems. While not all inclusive, it does provide the essence of expectation requirements for the FDA investigator, and should be considered an added resource for design, construction and validation requirements.

In it the guideline states, in part, under Section II-System Validation: "In the review of a validation report, or in the validation of a high purity water system, there are several aspects that should be considered. Documentation should include a description of the system along with a print. The drawing needs to show all equipment in the system from the water feed to points of use. It should also show all sampling points and their designations. If a system has no print, it is usually considered an objectionable condition. The thinking is, if there is no print, then how can the system be validated? How can a quality control manager or microbiologist know where to sample? In those facilities observed without updated prints, serious problems were identified in these systems. The print should be compared to the actual system annually to insure its accuracy, to detect unreported changes and confirm reported changes to the system".

Points made in this letter:

1. With non-hygienic piping the choice can be made in ASME to either place a mark at each weld identifying the welder or welder operator, and/or provide a weld map. While a weld map is not specifically required, it is implied as an alternative.

2. With piping that falls within the scope of ASME BPE, as described above, weld maps are required.

3. While not stipulated in either Title 29 CFR Part 210 – "Current good manufacturing practice in manufacturing, processing, packing, or holding of drugs; general", or Part 211 – "Current good manufacturing practice for finished pharmaceuticals", FDA inspectors expect system drawings to be available for review depicting all equipment, piping and sample points. These same drawings can be utilized as weld maps.

Weld map documentation should be considered applicable, not only for all hygienic piping, but also for ASME B31.3 Category M piping, high-pressure piping, and severe cyclic piping. Such critical fluid service systems should garner the added consideration and control.■

QUESTION OR COMMENTS

If you would like us to address a specific topic or simply answer a question, related or unrelated to the content of this Newsletter, please contact us at: staff@wmhuittco.com. In the subject line of the email please enter “Newsletter Question/Comment.”

If you no longer wish to receive this Newsletter please contact us at: staff@wmhuittco.com. In the subject line of the email please enter “Cancel Newsletter.” We do respect your right to privacy.

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