NFPA 55 TIA, Cleaning and Purging of gas piping systems

- IMG TC discussion July 20, 2012
- Background
- Comparison of selected requirements
- Task Group appointment and review
- Modifications of DRAFT document
- Presentation of revised draft
- Conclusion

Larry Fluer, Principal representing the Compressed Gas Association
Evolution of NFPA 56 PS, Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems
In February 2010 US Chemical Safety Board (CSB) issued an urgent request to NFPA to develop requirements for the “safe conduct of fuel gas piping cleaning operations.”

In response, the NFPA Standards Council established the Technical Committee on Gas Process Safety tasking the committee with developing a standard to address piping system cleaning and purging operations.
Background – NFPA Journal

- Background behind the development of NFPA 56PS can be found as published in the November/December edition of the *NFPA Journal*. The article can be viewed online through the following link:

NFPA Staff Request to Standards Council

- September 1, 2010 NFPA Staff request for new committee and document on gas process safety results in notification of the then affected Technical Committees requesting comments on two options:
  http://www.nfpa.org/Assets/files/AboutTheCodes/56PS/10-8-38.pdf
  - Expanding the scope of NFPA 54, *National Fuel Gas Code*
  - The IMG-AAA TC was not identified as a stakeholder in the process as the scope of NFPA 55 does not include *fuel gas*. 
Gas Process Safety TC Established

- The Council directed staff to publish a call for committee members, and to solicit membership interest from the identified stakeholders.
- The IMG TC was not identified as a stakeholder as the document was focused on *fuel gas*, and the TC was not notified accordingly.
Committee Scope - fuel gas


- The initial scope of the document was limited to fuel gas piping systems having a normal operating pressure of greater than 2 psig.
Document Development

- The GPS TC met to consider proposals on three occasions during meetings identified as ROP meetings including:
  - April 5-7, 2011
  - May 10-12, 2011
  - June 9-10, 2011
- There was no ROC process involved as the process was declared to be a *provisional process* under the ANSI rules.
As reflected in the meeting of April 5-7, 2011 the committee voted to revise the scope of the document to include all flammable gases as follows:

A. Committee Scope. The committee reviewed the scope as commissioned by the NFPA Standards Council and VOTED to request the following modifications:

GPS-AAA Scope: This committee shall have primary responsibility for documents on the commissioning and maintenance of fuel flammable gas piping systems having normal operating pressures of greater than 2 psig used in commercial, industrial, and power plant applications, extending from the point of delivery to the equipment isolation or shutoff valve except for those already covered by the NFPA National Fuel Gas Technical Committee and/or the NFPA Hydrogen Technologies Technical Committee.
An E-mail message was sent from the GPS-AAA TC Staff Liaison on April 8, 2011 to members of the IMG-AAA TC notifying members that there had been a change in scope with comments, if any, requested by May 6, 2011.

On May 16, 2011 the Staff Liaison for the GPS-AAA TC forwarded a copy of the May draft of NFPA 56PS to the IMG-AAA TC requesting comments, if any, no later than June 6, 2011.

CGA submitted comments on June 6, 2011.
The minutes of the June 9-10, 2011 meeting of the GPS TC reflect the following:

- **Review of Written Comments.** NFPA Staff reminded the committee that ANSI Annex B does not require solicitation or resolution of public comments. The committee briefly reviewed the written comments and did not recommend any further modifications to the document.

- **On June 24, 2011** the Staff Liaison for GPS-AAA TC notified CGA that the TC had met and decided that no changes would be made to the document.
Process Continues

- The draft *provisional standard* was sent to the GPS TC for ballot receiving the required 2/3 majority vote with the final ballot issued on July 25, 2011. [http://www.nfpa.org/Assets/files/AboutTheCodes/56PS/56(PS)_ballotfinal.pdf](http://www.nfpa.org/Assets/files/AboutTheCodes/56PS/56(PS)_ballotfinal.pdf)

- The document scope was revised by the Standards Council at their meeting of August 8-11, 2011 to correlate the scope of NFPA 56PS with the balloted draft thereby broadening the scope of the document to include all flammable gases.
NFPA 56 PS Published

- NFPA 56PS, *Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems* was approved and issued by the Standards Council effective August 11, 2011.
- NFPA 56 expands on the initial Chemical Safety Board (CSB) recommendations by including cleaning and purging of all flammable gas piping systems at any inlet pressure for electric-generating plants and industrial, commercial and institutional applications.
A brief comparison of selected elements of NFPA 56 PS to the NFPA 55 TIA

(Where revisions have been made during the ROP phase in the current code cycle for NFPA 56 they have been included in the comparison where appropriate. Where reference is made to sections of NFPA 55 outside of the new material added by the TIA the reference is to the staff draft soon to be released as the 2013 Edition.)
Piping System Defined

NFPA 56 PS

§ 1.2.1 For the purposes of this document, a piping system shall be understood to mean a complete piping system, including valves, regulators and other appurtenances, and any segment thereof that can be isolated from the system.

NFPA 55

§ 3.3.77* Piping System. Interconnected piping consisting of mechanical components suitable for joining or assembly into pressure-tight fluid-containing system. Components include pipe, tubing, fittings, flanges, bolting, valves, and devices such as expansion joints, flexible joints, pressure hoses, in-line portions of instruments, and wetted components other than individual pieces or stages of equipment.
Retroactivity

NFPA 56PS

- The retroactively provisions of § 1.3.1 are applied to all flammable gas piping systems.
  - Unless otherwise specified, the provisions of this standard shall apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard.

NFPA 55 TIA

- The retroactivity provisions of § 1.4.1 are applied to all gas systems.
  - Unless otherwise specified, the provisions of this code shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the code. Where specified, the provisions of this code shall be retroactive.
Construction Exempt from Retroactive Provisions

**NFPA 56 ROP**

- ROP Item 56PS-28 Log#CP2 removes the retroactivity provisions in § 4.1 for materials of construction and standards of design, construction, inspection and testing used for existing piping systems. The standards of design including NFPA 55 were included in 56PS-26 Log#21. All other provisions are applied retroactively.

**NFPA 55 TIA**

- The provisions for construction have not been modified. Just as in the case of NFPA 1, *Fire Code*, and NFPA 5000 *Building Code*, or NFPA 400 *Hazardous Materials Code* NFPA 55 has not been designed to be applied retroactively code subject to the approval of the AHJ.
Cleaning

NFPA 56PS

- Cleaning is never required, however, a cleaning method must be addressed by the written procedures: § 4.3.1(1)(a).
- Chapter 7 establishes requirements for purging into service.
- Chapter 8 establishes requirements for purging out of service.

NFPA 55 TIA

- § 7.1.19.1.1 Piping systems shall be cleaned and purged in accordance with the requirements of 7.1.19 when one or more of the following conditions exist:
  - (a) Subsequent to installation and prior to being placed into initial service.
  - (b) Prior or subsequent to a change in service.
  - (c)* Subsequent to alterations or repair of the system and prior to returning the system to service, where the alteration or repair involves replacement of parts or addition to the piping system.
  - (d)* Where specified by the design standards or written procedures.
Cleaning

**NFPA 56 PS**

- Other than a statement in § 6.1.1.1 restricting the use of flammable gas from being used for the internal cleaning of piping, the Standard does not specify whether *cleaning* applies to the internal surfaces only or whether exterior surfaces are also included.

**NFPA 55 TIA**

- § 7.1.19.2.1 The internal surfaces of gas piping systems shall be cleaned to ensure that the required standard of cleanliness specified by the design is met prior to placing the gas piping system into service.


Cleaning Technique

**NFPA 56 PS**

- § 6.1.1.1 Flammable gas shall not be used for internal cleaning of piping.

- § 6.5 Pig Cleaning. Pigs shall be permitted to be used to clean piping systems.

**NFPA 55 TIA**

- A.7.1.19.2.2 During construction, visual inspection should be performed on sections of pipe as the piping system is assembled to ensure that no gross contamination is left in the pipe. When the standard of cleanliness is high, fabrication techniques should be utilized that do not introduce contamination into the pipe. Examples of these techniques can include, but are not limited to constant inert gas purging, or assembly in a particulate controlled environment. The use of piping and components with a high quality interior surface finish, and materials of construction all have an effect on the ability to maintain a high degree of cleanliness.

- Cleaning after construction can typically be accomplished by applying one or more of the following methods:
  - pigging
  - mechanical scraping
  - high velocity gas flow
  - liquid washing
  - use of cleaning media
  - application of high vacuum
  - solvent cleaning
  - water washing
  - steam cleaning
Design

NFPA 56PS

- § 4.1 (ROP) Systems are to be designed, constructed, tested and inspected in accordance with standards.

NFPA 55 Existing

- § 7.1.1.1 Design. Compressed gas systems shall be designed for the intended use and shall be designed by persons competent in such design.
- 7.1.1.2 Installation. Installation of bulk compressed gas systems shall be supervised by personnel knowledgeable in the application of the standards for their construction and use.
- 7.3.1.3 Piping Systems. Piping, tubing, fittings, and related components shall be designed, fabricated, and tested in accordance with the requirements of ANSI/ASME B31.3, Process Piping, or other approved standards.
Written Procedures Required

**NFPA 56PS**

- Written procedures are required by § 4.3. The procedures are required to consider and document decisions involving 45 +/- elements before cleaning or purging occurs.
- A written safety validation of the cleaning and purging procedures is required. § 4.4

**NFPA 55 TIA**

- § 7.1.19.1.3* A written cleaning or purging procedure shall be provided to establish the requirements for the cleaning and purging operations to be conducted.
- § 7.1.19.1.3.1* An independent or third party review of the written procedure shall be conducted after the procedure has been written and shall:
  - (1) evaluate hazards, errors, and malfunctions related to each step in the procedure.
  - (2) review the measures prescribed in the procedure for applicability.
  - (3) make recommendations for additional hazard mitigation measures if deemed to be necessary.
### Purging Defined

<table>
<thead>
<tr>
<th>NFPA 56 PS</th>
<th>NFPA 55 TIA</th>
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<tr>
<td>3.3.7 Purge. To free a gas conduit of air or gas, or a mixture of gas and air. [54, 2012]</td>
<td>3.3.xx Purging. A method used to free the internal volume of a piping system of unwanted contents that results in the existing contents being removed or replaced.</td>
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<tr>
<td>3.3.7.1 Purge into Service. The act of replacing the air or inert gas in a closed system by a flammable gas.</td>
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<tr>
<td>3.3.7.2 Purge out of Service. The act of replacing the normal flammable content of a closed system by inert gas, air or water.</td>
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Purging

NFPA 56PS

- § 7.1.1 Where gas piping containing air is placed in operation, the air in the piping first shall be displaced with an inert gas, which shall then be displaced with flammable gas in accordance with Section 7.2.

- § 7.1.2* If the plant is owned or operated by the serving natural gas supplier, natural gas piping between the point of delivery and the plant shall be permitted to be purged into service in accordance with the serving natural gas supplier’s written procedures.

NFPA 55 TIA

- § 7.1.19.3* Purging. Piping systems used to contain gases with a physical or health hazard in any of the categories specified by Section 5.1 shall be purged prior to being placed into service for initial use.

  - Physical hazards, which shall include:
    - (a) Flammable gas
    - (b) Flammable cryogenic fluid
    - (c) Inert gas
    - (d) Inert cryogenic fluid
    - (e) Oxidizing gas
    - (f) Oxidizing cryogenic fluid
    - (g) Pyrophoric gas
    - (h) Unstable reactive (detonable) gas, Class 3 or 4
    - (i) Unstable reactive (nondetonable) gas, Class 3
    - (j) Unstable reactive gas, Class 1 or Class 2

  - Health hazards, which shall include:
    - (a) Corrosive gas
    - (b) Cryogenic fluids
    - (c) Highly toxic gas
    - (d) Toxic gas
The vent discharge from a piping system being purged into service shall discharge directly to a safe outdoor location as determined by the written purge procedure. to a specified unconfined outdoor location determined by the written procedure, or shall be captured or further processed before release.

A.7.1.19.3 Purging. Purging can be accomplished by continuous media or gas flow, evacuation or vacuum, or repeated pressurizing and venting cycles commonly referred to as pulse or cycle purging. In some cases purge procedures can involve more than one type of purging technique. Purging can be accomplished by manual or automatic means. The use of automated purge panels or manifold systems operated by a programmable logic controller is common as a means to enhance the results of a purging process where high purity gas delivery systems are employed.
Release of Health Hazard Gases

**NFPA 56 PS ROP**
- 4.3.1(1)(f)* Mitigation or capture strategies
- A.4.3.1(1)(f) Gases that have hazards other than flammability could be subject to mitigation strategies such as scrubbing, flaring, afterburning, thermal oxidizing, or capture.

**NFPA 55 TIA**
- 7.1.19.3.2.1 The release of purged gases or mixtures containing any quantity of corrosive, toxic or highly toxic gases shall be through a treatment system in accordance with the applicable requirements of Section 7.5.3.4 or 7.9.3.
- The existing provisions of 7.5.3.4 and 7.9.3 are detailed and specific for corrosive, toxic or highly toxic gases.
Release of Purged Gases

NFPA 56 PS ROP

- Vent Pipe Termination. The discharge from a piping system being purged into service shall discharge directly to a specified unconfined outdoor location determined by the written procedure, or shall be captured or further processed before release.
- 4.3.1(1)(f) Mitigation or capture strategies
- A.4.3.1(1)(f) Gases that have hazards other than flammability could be subject to mitigation strategies such as scrubbing, flaring, afterburning, thermal oxidizing, or capture.

NFPA 55 TIA

- 7.1.19.3.2.2 The termination point for the release of purged gases resultant from the purging of piping systems out of service, other than those in accordance with Section 7.1.19.3.2.1, shall not be required to be in accordance with Section 6.15 where the contained volume of the piping system when released to indoor areas does not result in a concentration in the room or area that exceeds any of the following limits or that will reduce the oxygen concentration in the room or area below a level of 19.5%:
  - (1) Ceiling Limit
  - (2) Permissible Exposure Limit
  - (3) Short Term Exposure Limit
  - (4) 25% of the Lower Flammable
Gas Piping Regulated

NFPA 56 PS

- Exempts GH₂ (gaseous hydrogen) or LH₂ (liquid hydrogen) in concentrations >95% as regulated by NFPA 2.
- No requirements for:
  - Nonflammable, toxic or corrosive, or inert cryogenic fluid piping systems
  - Gas generation systems
  - Gas systems with a hazard other than flammability

NFPA 55 TIA

- Includes both GH₂ and LH₂ and acting as a source document would include requirements as extract into NFPA 2.
- The following systems in addition to those specified by 55:5.1 are included by reference:
  - Cryogenic fluids including inert gases
  - Oxygen systems
  - Gas Generation Systems
  - Ethylene oxide used in sterilization
  - Acetylene piping system at charging plants
Task Group Review

- Task Group review by committee members appointed by Chairman St. Clair: Chuck Henrici, David DeFina.
- Comments to DRAFT incorporated.
- Discussion.