USDOT PHMSA Update

2016 API – AGA Joint Committee
Oil & Gas Pipeline Welding Practices

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Current Rulemakings in Process

- Notice of Proposed Rulemaking (NPRM)
  - Hazardous Liquid
  - Gas Transmission
  - Excess Flow Valve
  - Plastic Pipe
  - Operator Qualification & Cost Recovery
  - Rupture Detection & Automatic Shutoff Valve

- Standards Update
- Final Rule (FR)
  - Excavation Damage
  - Miscellaneous
  - Maximum Penalty (Direct Final Rule)

- Liquefied Natural Gas (LNG) - NPRM
The question everyone is asking.....

Adoption of the 21st edition

- Notice of Proposed Rulemaking (NPRM) anticipated Fall 2016
  - 60 day public comment period
  - Resolve comments
- Final Rule (FR) anticipated 2017

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Miscellaneous Rule

• Notice of Proposed Rulemaking (NPRM) Initiated November 2011
• Published March 2015
Self-inspection prohibited

§ 192.305 ..... An inspection may not be performed by a person who participated in the construction of that transmission line or main.

§ 195.204 ..... An inspection may not be performed by a person who participated in the installation of the pipe or pipeline systems.
Cracked Weld Story

- Tie-in Weld – Body cut to factory end
- Winter construction in a northern state
- SMAW E6010 root – E8010 hot, fill, and cap
- API 5L X70 – 30” dia. x 0.500” wall thickness
- 250°F preheat required by procedure
- 10 minutes root to hot; 24 hour max
- AUT right after completion
Report
ROSCAN examination

Scan number / Job number

ROSCAN 5.5
Temperature 2/2 °C

36inch x 0.500in (12.7mm)
SMAW V-Bevel

TOFD TR-OL Cap F3 F2 F1 HP R60 R70 U-Par L-Par Root Root L-Par U-Par R70 R60 HP F1 F2 F3 Cap TR-ID

U.S. Department of Transportation
Pipeline and Hazardous Materials Safety Administration
To Protect People and the Environment From the Risks of Hazardous Materials Transportation
<table>
<thead>
<tr>
<th>Targeted Locations</th>
<th>Base Metal</th>
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<tbody>
<tr>
<td>1 211.8 VHN</td>
<td>16 152.3 VHN</td>
</tr>
<tr>
<td>2 203.4 VHN</td>
<td>17 189.7 VHN</td>
</tr>
<tr>
<td>3 199.4 VHN</td>
<td>18 198.1 VHN</td>
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<tr>
<td>4 157.1 VHN</td>
<td>19 192.8 VHN</td>
</tr>
<tr>
<td>5 185.3 VHN</td>
<td>20 224.9 VHN</td>
</tr>
</tbody>
</table>
(Delayed) Hydrogen Cracking

Poor Fit-up – mismatch – body cut
Tie-in alignment
Welders’ KSAs
Welding Inspector’s KSA
AUT technician’s KSAs
Quality Management System Processes
Stress on Pipe
Microstructure
Cellulosic electrodes
Discovered during Hydrotest
NDT timing
PHMSA Response

Concern about all welds in the spread
Concern about all tie-in welds
Concern about inspection process
Concern about the Welding Procedures used and the Welding Procedure Qualifications
Concern about AUT Procedure and AUT Procedure Qualification
Concern about AUT in the field
Metallurgical investigation
Root cause investigation
Need for additional NDT
Ongoing integrity assessment during construction
Development of Pipeline Integrity Management System
Girth Weld Crack Management Process
My Comments

PHMSA involvement did not have to happen. This failure was preventable.

Quality Management System = “Don’t worry it passed AUT”

Sound all-encompassing holistic approach to pipeline welding is needed

Risk based approach to hydrogen cracking is needed

Could API 1104 encourage a risk based approach to hydrogen cracking?

The money saved during construction was peanuts compared to the investigation costs, mitigation costs, and ongoing operational costs
Radiography

Volumetric defects tend to be benign

Cracks can be catastrophic
RADIOGRAPHIC IMAGE

RADIOGRAPHIC CONTRAST

SUBJECT CONTRAST
1. ABSORPTION CHARACTERISTICS OF THE MATERIAL
2. RADIATION ENERGY LEVEL
3. CONTROL OF RADIATION SCATTERING PROCESSES
   A. LEAD SCREENS
   B. FILM BACKSCATTER SHIELDS
   C. FILTERS, MASKS, AND DIAPHRAGMS
   D. SOURCE COLLIMATION

FILM CONTRAST
1. FILM TYPE
2. FILM PROCESSING
   A. CYCLE TIME
   B. DEVELOPER TEMPERATURE
   C. PROCESSING CHEMISTRY ACTIVITY
3. FILM DENSITY
4. TYPE OF SCREEN

GEOMETRIC FACTORS
1. FOCAL SPOT SIZE
2. SOURCE-TO-FILM DISTANCE
3. FILM-SPECIMEN CONTACT
4. SPECIMEN CONFIGURATION AND THICKNESS VARIATION
5. FILM-SCREEN CONTACT
6. SOURCE-SPECIMEN-FILM MOVEMENT

FILM GRAININESS
1. FILM TYPE
2. SCREEN TYPE
3. RADIATION ENERGY LEVEL
4. FILM PROCESSING
Could API 1104 encourage radiographic best practices? With a goal of higher POD for cracks? When faced with higher risks of delayed hydrogen cracking perhaps recommend time delays between weld completion and NDT.
Is Gamma radiography good practice for mainline welds with higher cracking risk (E8010 on ¾” wall X70)?

- **Gamma Ray**: (No Delay) → 10% → Increasing Probability of Crack Detection → 98%
- **X-Ray**: (No Delay) → 98%
- **X-Ray AUT**: (24hr Delay)
- **AUT**: (No Delay) and (24hr Delay)

**U.S. Department of Transportation**
**Pipeline and Hazardous Materials Safety Administration**

To Protect People and the Environment From the Risks of Hazardous Materials Transportation
§ 192.227 Qualification of welders and welding operators.
(a) Except as provided in paragraph (b) of this section, each welder or welding operator must be qualified in accordance with section 6, 12, or 13 of API 1104 or section IX of the ASME....

§ 195.222 Welding: Qualification of welders and welding operators.
(a) Each welder or welding operator must be qualified in accordance with sections 6, 12, or 13 of API 1104 or section IX of the ASME....
Welding Procedures

192.225 - 195.214 similar

• (a) Welding must be performed by a qualified welder or welding operator in accordance with welding procedures qualified under section 5, section 12, or Appendix A of API Std 1104 (incorporated by reference, see §192.7) or section IX ASME Boiler and Pressure Vessel Code (BPVC) (incorporated by reference, see §192.7), to produce welds which meet the requirements of this subpart. The quality of the test welds used to qualify welding procedures must be determined by destructive testing in accordance with the referenced welding standard(s).

• (b) Each welding procedure must be recorded in detail, including the results of the qualifying tests. This record must be retained and followed whenever the procedure is used.
Industry Trend

Utilizing Mechanized Welding without using Appendix A

PHMSA likes the use of Mechanized Welding and low hydrogen processes

Working towards improvements to Section 12
• 12.5.1 General
A welding procedure must be re-established as a new procedure specification and must be completely requalified when any of the essential variables listed in 12.5.2 are changed. Changes other than those listed in 12.5.2 may be made in the procedure without the need for requalification, provided the procedure specification is revised to show the changes.
5.4.2.13 Pre-heat
A decrease in the specified minimum pre-heat temperature constitutes an essential variable.

12.5.2.13 Pre- and Post-heat Treatment Requirements
A change in pre- or post-heat treatment requirements constitutes an essential variable.
Construction Quality

• Continues to be focus of PHMSA
• A final report for the research project “Improving Quality Management Systems (QMS) for Pipeline Construction Activities” has been published.
Thank You!