Safety of Gas Transmission and Gathering Pipelines

RIN: 2137-AE72

Docket: PHMSA - 2011 – 0023

Gas Pipeline Advisory Committee Meeting

March 26 - 28, 2018

Recap of January 11 - 12, 2017 Meetings

Topic	Result
6-month Grace Period for 7 calendar year Reassessment Intervals § 192.939(b)	Vote: Passed
Safety Features on ILI Launchers/Receivers § 192.750	
Seismicity § 192.917	
Inspections Following Extreme Events § 192.613	
Management of Change § 192.911	
Corrosion Control	**Discussed and Deferred to June 2017 Mtg. (Slide 3)**
Records	
IM Clarifications	

Recap of June 6 - 7, 2017 Meetings

Topic	Result
Corrosion Control; §§ 192.319, 192.461, 192.465, 192.473, 192.478, 192.935(f) & (g), Appendix D	Vote: Passed
Records; §§ 192.5(d), 192.227(c), 192.285(e)	
IM Clarifications; §§ 192.917(a), (b), (c), (d), & (e)(2), 192.935(a)	
MAOP Exceedances; §§ 191.1, 191.23, 191.25, 191.29	
Records; §§ 192.13(e), 192.67, 192.127, 192.205, 192.619(f)	**Discussed: Vote Postponed**
IM Clarifications; §§ 192.917 (e)(3) & (e)(4)	
Material Documentation; § 192.607	

Recap of December 14 - 15, 2017 Meetings

Topic	Result
Material Documentation; § 192.607	Vote: Passed
Strengthened Assessment Requirements (ICDA, 192.937)	
Strengthened Assessment Requirements (SCCDA, 192.939)	
Strengthened Assessment Requirements (Guided Wave Ultrasonics, Appendix F)	
Strengthened Assessment Requirements (Passage of ILI Devices, 192.150)	
MAOP Reconfirmation (192.624)	**Discussed: Vote Postponed**
Strengthened Assessment Requirements (192.493, 192.506, & 192.921)	

Recap of March 2, 2018 Meeting

Topic	Result
Strengthened Assessment Requirements (ILI Standards, 192.493)	Vote: Passed
Strengthened Assessment Requirements (Spike pressure test, 192.506)	
Strengthened Assessment Requirements (HCA assessment requirements, 192.921(a))	
Assessments Outside of HCAs (192.3 (MCA definition); 192.710)	
Records (192.13(e); 192.67; 192.127; 192.205; Appendix A)	
Repair Criteria (192.711; 192.713; 192.933; 192.485(c))	**Discussed: Vote Postponed**

Agenda for March 26 - 28, 2018 Meetings

1. Gathering (191.23 & 191.25 (reporting); 192.8; 192.9; 192.13)
   Overview of Approach to Address Gas Gathering for the June 2018 Meeting

2. A. MAOP Reconfirmation (192.624(a) – Scope)
   B. MAOP Reconfirmation (192.624(b) – Schedule)
   C. MAOP Reconfirmation (192.624(c) – Methods)
   D. MAOP Reconfirmation (192.624(d) – Fracture Mechanics)
   E. MAOP Reconfirmation (192.624(e) – Notifications)
   F. MAOP Reconfirmation (192.624(f) – Records)

Agenda for March 26 - 28, 2018 Meetings

3. A. MAOP (192.619(e) – 192.624 as official MAOP)
   B. MAOP (192.503 – Conforming edit)
   C. MAOP (192.619(a)(4)) – Require use of 192.607)
   D. MAOP (192.619(a)(2) – Update CL Safety Factors)
   E. MAOP records (192.619(f))
   F. O&M Protection of MAOP (192.605(b)(5))
4. IMP 192.917(e)(3) and (e)(4) – Update to address crack defects in IM (not in 192.624 - MAOP Reconfirmation)
5. Other proposed definitions not previously addressed (192.3)
6. Topics from March 2nd meeting not concluded (192.485(c); 192.711; 192.713; 192.933 – Repair Criteria)

Remaining Agenda Items for Future Meetings (Scheduled: June 12 – 14, 2018)

- Gathering Lines
  - Reporting (Part 191)
  - Definitions related to gas gathering (192.3)
  - Gas gathering safety (192.8; 192.9; other conforming changes)
- Other topics not previously voted upon

1. Gas Gathering Discussion

Overview of Approach to Address Gas Gathering for the June 2018 Meeting

2. MAOP Reconfirmation

A. 192.624(a) – Scope

B. 192.624(b) – Completion Date

C. 192.624(c) – MAOP Reconfirmation Methods

D. 192.624(d) – Fracture Mechanics

E. 192.624(e) – Notifications

F. 192.624(f) – Records

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

- **Public Comments on Applicability (Dec. 2017):**
  - Scope should not include pipe with past failures. Past failures are addressed based on response to the event and integrity management.
  - **PHMSA**: suggests striking 192.624(a)(1) based upon Committee recommendation. Instead, PHMSA suggests including a new 192.917(e)(6) to address failures due to cracks and crack-like defects in HCAs within the integrity management program, as recommended by committee members.
- **Note: At the Dec. 2017 meeting, Committee requested additional information on past incidents caused by crack or material defects to inform this discussion, which is provided on the next slide.**

Reportable Onshore Steel GT Incidents Caused by Crack or Material Defects (2010 - Nov. 2017)

- **112 Total Incidents**
  - **Breakdown by manufacture date**
    - 71 Manufactured before 1971.
    - 21 Manufactured 1971 or later.
    - 20 Year of manufacture not reported.
  - **Breakdown by Cause**
    - 19 were SCC
    - 65 were construction defects
    - 28 were latent manufacturing defects
- **45 Incidents (39%) occurred after a post-construction pressure test (Average TTF~29 years after test)**
- **14 incidents occurred <30% SMYS (10 leaks, 4 ruptures)**

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

- **Public Comments on Applicability (Dec. 2017):**
  - Delete "legacy" definitions from 192.3 and put into 624, using joint factor less than 1 specifically applicable to the MAOP reconfirmation (and avoid implications to distribution). Also, clarify that intent of the dresser coupling is to address mechanical non-restraint or sealed-only type.
  - **PHMSA**: If the Committee votes to strike 192.624(a)(1), these definitions would not be needed, in which case PHMSA would suggest to withdraw these definitions (i.e., *legacy construction techniques*, *legacy pipe*, and *modern pipe*).

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

- **Public Comments on Applicability (Dec. 2017):**
  - Exempt low pressure lines, based on low risk and questionable cost-benefit and to comply with the statutory mandate. Limit scope of 192.624 segments with MAOP ≥ 30% of SMYS.

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

- **Public Comments on Applicability (Dec.2017):**
  - **PHMSA**: For pipe without records, the statutory requirement at 49 USC 60139(a) through (c) would not allow PHMSA to exclude pipe segments on this basis.
  - All applicable pipe without records in HCAs or Class 3 or 4 locations must reconfirm MAOP. The scope of NPRM 192.624(a)(2) is mandated by statute.
  - PHMSA estimates the mileage to total 4,535 based on mileage reported by operators in 2016 Annual Reports. A breakdown by HCA and class location is shown on the next slide.

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

Class Location	HCA	Non-HCA	Totals
Class 1	94	Not reported	94
Class 2	88	Not reported	88
Class 3	1,846	2,372	4,218
Class 4	116	19	135
TOTALS:	**2,144**	**2,391**	**4,535***

Source: 2016 Operator Annual Reports

* Scope for confirming MAOP of segments without records per 49 USC 60139(c)

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

- **Public Comments on Applicability (Dec.2017):**
  - **PHMSA**: For previously untested pipe (i.e., "grandfathered" pipe), the statutory requirement at 49 USC 60139(d) requires that such pipe be tested if operating at a pressure exceeding 30% of SMYS.
  - Suggests to limit applicability of 192.624(a)(3) to lines with MAOP ≥ 30% SMYS. A table comparing the estimate segment mileage for the proposed 192.624(a)(3) is shown on the next slide.

2. MAOP Reconfirmation

2A. 192.624(a) – Scope

Mileage Est. for Various Scope Criteria: Grandfathered Segments

Criteria Grandfathered Segments	HCA	Non-HCA	Total
HCA w/MAOP ≥ 30% AND Class 3 & 4 (non-HCA) w/MAOP ≥30%	979^	1,235	2,213
HCA (all) AND Class 3 & 4 (all non-HCA)	1,164	1,469	2,633
HCA w/MAOP ≥ 30% AND Class 3 & 4 (non-HCA) w/MAOP ≥ 30% AND MCA Class 1 & 2 w/MAOP ≥ 30%	979^	5,834	6,813*

- 2016 Operator Annual Reports (excludes mileage with inadequate MAOP records)
- House count assumptions: 10% of Class 1, 50% of Class 2, All Class 3+4
- Roadways: From NPRM RIA multiplied by percent of non-HCA miles that are grandfathered
- ^ Minimum scope for testing grandfathered lines per 49 USC 60139(d)
- * Revised scope of 192.624(a)(3) proposed by PHMSA

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

- **Public Comments on Applicability (Dec. 2017):**
  - Clarify that past tests that meet subpart J are acceptable and valid.
  - **PHMSA**: a pipe segment with a past pressure test meeting subpart J in accordance with 192.619(a)(2) and with TVC records that demonstrate compliance with 192.619(a)(2), would not require MAOP Reconfirmation under 192.624(a).

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

- **Committee Comments on Applicability (Dec.2017):**
  - Some committee members desired to remove past crack/seam incidents (since the most recent pressure test) from the applicability criteria (i.e., striking 192.624(a)(1)).
  - Some committee members desired to restrict the scope to segments ≥ 30% SMYS, per the original mandate for previously untested pipe, based on leak-before-rupture concept for lower stress lines. The benefit for addressing low stress lines is disproportional to cost.
  - Other committee members supported retaining the scope proposed in the NPRM to address NTSB recommendations.
  - **PHMSA**: (see next slide)

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

- **Committee Comments on Applicability (Dec. 2017):**
  - **PHMSA Response to Committee Comments on Scope**:

PHMSA: suggests

  - Striking 192.624(a)(1) (cracking criteria) and addressing in Integrity Management (IM)
  - Creating a new 192.917(e)(6) to address segments with crack incident history in IM
  - Limiting 192.624(a)(3) (for grandfathered pipe) to segments with MAOP ≥ 30% SMYS

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

- **Committee Comments on Applicability (Dec. 2017):**
  - **PHMSA Response to Committee Comments on Scope**:

  PHMSA: suggests
  - Retaining scope of 192.624(a)(2) for pipe without records as mandated by statute.
  - Also, PHMSA suggests changing 192.624(a)(2) to refer to MAOP records instead of subpart J pressure test records. Records to establish MAOP are defined in 192.619(a) for post-code pipe and 192.619(c) for grandfathered segments.

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the committee consider:**
  - **3 suggested amendments to the scope of 192.624:**
    - Revise 192.624(a) to strike paragraph (a)(1), which was the proposed criterion related to lines with previous reportable incidents due to crack defects.
    - The new definitions of *modern pipe*, *legacy pipe*, and *legacy construction techniques* would no longer be needed in the rule and PHMSA suggests withdrawing them from the final rule.

2. MAOP Reconfirmation
2A. 192.624(a) - Scope

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the committee consider:**
  - **3 suggested amendments to the scope of 192.624:**
    - Renumber 192.624(a)(2) (for line segments without TVC records) as paragraph (a)(1). Revise to refer to TVC records required by 192.619(a) and (c) instead of pressure test records required by Subpart J, as shown below:

      ~~Pressure test~~ Records necessary to establish maximum allowable operating pressure ~~per subpart J~~ in accordance with § 192.619(a) or (c) for the pipeline segment ...”
    - Renumber 192.624(a)(3) (for grandfathered lines) as paragraph (a)(2). Revise to apply only to lines with MAOP ≥ 30% SMYS.

2. MAOP Reconfirmation
2B. 192.624(b) – Completion Date

- **Committee Comments on 192.624(b) – Completion Date (Dec. 2017):**
  - No Comments.

2. MAOP Reconfirmation
2B. 192.624(b) – Completion Date

- **At the Dec. 2017 meeting, in response to public NPRM comments, PHMSA suggested the Committee consider the following (reiterated below):**
  - **PHMSA**: revise proposed 192.624(b) as indicated in the PHMSA response to public comments.
    - Revised 192.624(b) to address how the completion plan and completion dates required by 192.624(b) would apply to pipelines that are not currently applicable under 624(a) but may become applicable in the future (e.g., located in a future HCA or Class 3 or 4 location). PHMSA suggests revising 192.624(b)(3) as follows:

      (3) The operator must complete all actions required by this section on 100% of the pipeline mileage ~~of locations~~ that meet the conditions of § 192.624(a) by [insert date that is 15 years after the effective date of rule] or two years after the segment first meets the conditions of § 192.624(a), whichever is later.

2. MAOP Reconfirmation
2A. 192.624(a) - Scope
2B. 192.624(b) – Completion Date

Public Comments

2. MAOP Reconfirmation

2A. 192.624(a) - Scope

2B. 192.624(b) – Completion Date

GPAC Discussion

Committee Voting Slides

2. MAOP Reconfirmation
2C. 192.624(c)(1) – Method 1

- **At the Dec. 2017 meeting, in response to public NPRM comments, PHMSA suggested the Committee consider the following (reiterated below):**
  - **PHMSA**: suggests revising 192.624 as indicated in the PHMSA response to public comments.
    - Revise 192.624(c)(1) to refer to Subpart J rather than 192.505(c).

2. MAOP Reconfirmation
2C. 192.624(c)(1) – Method 1

- **Public Comments on Method 1 Pressure Test (Dec. 2017):**
  - Do not require spike test for any segment for purpose of MAOP reconfirmation. Spike test is for crack mitigation.
  - One commenter emphasized importance of spike test, and noted that too many failures after ILI.
  - **PHMSA**: If Committee recommends deletion of 192.624(a)(1), then the spike test requirement in Method 1 is not needed;
  - PHMSA suggests that 192.624(c)(1)(ii), legacy pipe, and (iii), pipe susceptible to cracks, be deleted.

2. MAOP Reconfirmation
2C. 192.624(c)(1) – Method 1

- **Committee Comments on Method 1 Pressure Test (Dec. 2017):**
  - Industry representatives expressed opinion that spike test is for crack integrity assessment and is not appropriate for MAOP setting.
  - **PHMSA**: If the Committee votes to support deletion of criterion 192.624(a)(1), lines with crack-like defects, from the scope of 192.624, then the spike test requirement in 192.624(c)(1)(ii) and (iii) would not be needed and could be deleted.
  - Spike test requirements in 192.506 would still be utilized where appropriate in other rule sections.

2. MAOP Reconfirmation
2C. 192.624(c)(1) – Method 1

- **Committee Comments on Method 1 Pressure Test (Dec. 2017):**
  - Some committee members suggested adding language to address material documentation in 192.607 with respect to information needed for a pressure test.
  - **PHMSA**: suggests that the committee consider explicitly requiring that information needed to perform a successful pressure test in accordance with subpart J, not documented in TVC records, must be verified in accordance with 192.607.

2. MAOP Reconfirmation
2C. 192.624(c)(2) – Method 2

- **Committee Comments on Method 2 Pressure Reduction (Dec. 2017):**
  - No Comments.

2. MAOP Reconfirmation
2C. 192.624(c)(2) – Method 2

- **At the Dec. 2017 meeting, in response to public NPRM comments, PHMSA suggested the Committee consider the following (reiterated below):**
  - **PHMSA**: suggest revising 192.624 as indicated in the PHMSA response to public comments.
    - Change the look-back period for Methods 2 (Pressure Reduction) and 5 (Pressure Reduction based on PIR) from 18 months to five (5) years before effective date of the final rule.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Methods 1 & 2

This concludes the PHMSA response to comments on Methods 1 (Pressure Test) and 2 (Pressure Reduction)

The following slides summarize a number of revisions that PHMSA suggests the committee consider to address comments received from NPRM and the March 2, 2018 committee meeting.

2. MAOP Reconfirmation
192.624(c) – Methods 1 & 2

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the Committee consider:**
  - **PHMSA**: suggests revising proposed 192.624(c)(1), *Pressure Test*, as follows:
    - Delete paragraphs (ii) and (iii) to remove spike testing for lines with suspected crack defects. These requirements are not needed if the Committee votes to eliminate 192.624(a)(1), (lines with previous failures due to crack or manufacturing defects) from the scope of 192.624.
    - Add requirement to verify material properties in accordance with 192.607 if information required for a pressure test is not documented in TVC records as discussed in the December 2017 committee meeting.

2. MAOP Reconfirmation
192.624(c) – Methods 1 & 2

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the committee consider:**
  - **PHMSA**: suggests revising 192.624(c)(2), *Pressure Reduction*, as follows:
    - Increase the look-back period from 18 months to five (5) years.
    - Strike the requirement in 192.624(c)(2)(ii) to perform fracture mechanics analysis on segments that confirm MAOP via Method 2 (Pressure Reduction).
    - With respect to TVC records, the NPRM already included a requirement to verify missing material properties per 192.607, if needed to support a notification for an alternative pressure reduction approach using Method 2.

2. MAOP Reconfirmation
2C. 192.624(c)(1) – Method 1
2C. 192.624(c)(2) – Method 2

Public Comments

2. MAOP Reconfirmation

2C. 192.624(c)(1) – Method 1

2C. 192.624(c)(2) – Method 2

GPAC Discussion

Committee Voting Slides

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3

- **Public Comments on Method 3 Engineering Critical Assessment (Dec. 2017):**
  - Remove requirements from ECA that relate to O&M or IMP, which are not pertinent to MAOP. Put fracture mechanics in different section.
  - Supports fracture mechanics but requires lot of data not always available. Rule should clarify when fracture mechanics is required.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3

- **Public Comments on Method 3 Engineering Critical Assessment (Dec. 2017):**
  - **PHMSA**: suggests striking requirements related to addressing pipe segments with crack incident history from 192.624 and addressing in a new paragraph under IMP, 192.917(e)(6).
  - PHMSA suggests moving the fracture mechanics methodology out of 192.624 and into a new stand-alone section 192.712. The new 192.712 would be limited to the procedure for performing fracture mechanics, but would not specify when, or for which pipeline segments, fracture mechanics would be required. (cont. on next slide)

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3

- **Committee Comments on Method 3 Engineering Critical Assessment (Dec 2017):**
  - **PHMSA**: PHMSA would clarify when fracture mechanics is required in other code sections by referencing 192.712. For MAOP reconfirmation, fracture mechanics (192.712) would be required only when performing ECA (method 3), and for "other technology" notifications, on pipe segments that have cracks and crack-like defects remaining in the pipe.
  - In Method 3 reference 192.712, as needed for fracture mechanics. PHMSA suggests revising 192.624(c)(3)(i)(B) to read as follows:

    (B) The ECA must analyze any cracks or crack-like defects remaining in the pipe, or that could remain in the pipe, to determine the predicted failure pressure (PFP) of each injurious defect in accordance with 192.712. (cont.)

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3

- **Committee Comments on Method 3 Engineering Critical Assessment (Dec. 2017):**
  - **PHMSA**: suggests the following:
  - Specific technical requirements for fracture mechanics including default Charpy values would be deleted from 192.624, and only addressed in 192.712.
  - Add requirement to verify material properties in accordance with 192.607 if information needed for a successful ECA is not documented in TVC records, as discussed in the December 2017 committee meeting.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **With regard to the fracture mechanics requirements - In response to public NPRM comments, committee comments, and research that was completed after the NPRM was published, PHMSA suggests:**
  - **PHMSA**: suggests amending the fracture mechanics procedure:
    - Revise 192.624(d)(1) to strike language that specifies when, or for which segments, fracture mechanics analysis is required. Replace with language which clarifies that 192.712 only addresses the purpose and procedure for performing fracture mechanics analysis.
    - Strike 192.624(d)(1)(iii) [sensitivity analysis] and replace with requirement that operators account for model inaccuracies and tolerances.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **With regard to the fracture mechanics requirements - In response to public NPRM comments and research that was completed after the NPRM was published, PHMSA suggests:**
  - **PHMSA**: suggests amending the fracture mechanics procedure:
    - Strike references to 192.624 [MAOP reconfirmation]
    - Strike reference to 192.506 [spike pressure test]
    - Add a paragraph to require records be retained (since the records requirement for MAOP reconfirmation at 192.624(f) would no longer apply)
    - Re-write remaining requirements to be more performance based and restructured according to the outline:
      - (a) applicability; (b) modeling; (c) fatigue analysis and remaining life; (d) SME review; and (e) records.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **Public Comments on fracture mechanics methodology (Dec. 2017). Industry reps. on the committee agreed.**
- Industry commented that default Charpy values proposed by PHMSA are too conservative and suggested using 13 ft-lb (body) and 4 ft-lb (LF-ERW weld seam).
  - **PHMSA**: established default values of 5 ft-lb (body) and 1 ft-lb (seam) based on research documented in Final Report – Task 4.5 - Comprehensive Study to Understand Longitudinal ERW Seam Failures – Phase One (DOT Contract No. DTPH56-11-T-000003/Battelle Project No. G006084), 10/23/2013.
  - Study was based on 569 actual failures from the Keifner/DNV (280) and Battelle (289) databases.
  - Some important conclusions summarized on the next slides.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **Public Comments on fracture mechanics methodology (Dec 2017). Industry reps. on the committee agreed.**
- **PHMSA**: Conclusions from ERW Seam Failure Research
  - Use of failure predictive models in the IM process can be effective if the gaps that lead to issues in predicting failure are bridged.
  - Toughness must be quantified for the seam type/manufacturer involved, and must be determined relative to the location of the defect – otherwise significant predictive errors can be anticipated.
  - Likewise, the defect size must be reasonably quantified, with care taken where adjacent features can interact axially.
  - Feature shapes and sizes must be reasonably represented by the idealizations that underlie the fracture analysis. (cont.)

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **Public Comments on fracture mechanics methodology (Dec 2017). Industry representatives on the committee agreed.**
- Industry commented that default Charpy values proposed by PHMSA are too conservative and suggested using 13 ft-lb (body) and 4 ft-lb (seam).
  - **PHMSA**: Conclusions from ERW Seam Failure Research (cont.)
  - Use lower-bound estimates for the failure stress levels of:
    - Cold weld defects and hook cracks with Charpy energy of 4 ft-lb.
    - Selective seam weld corrosion with Charpy energy of 0.4 ft-lb
  - Based on research, PHMSA proposed default values of 5 ft-lb (body) and 1 ft-lb (seam), respectively.
  - Default values would only be required when actual values are unknown. (cont.)

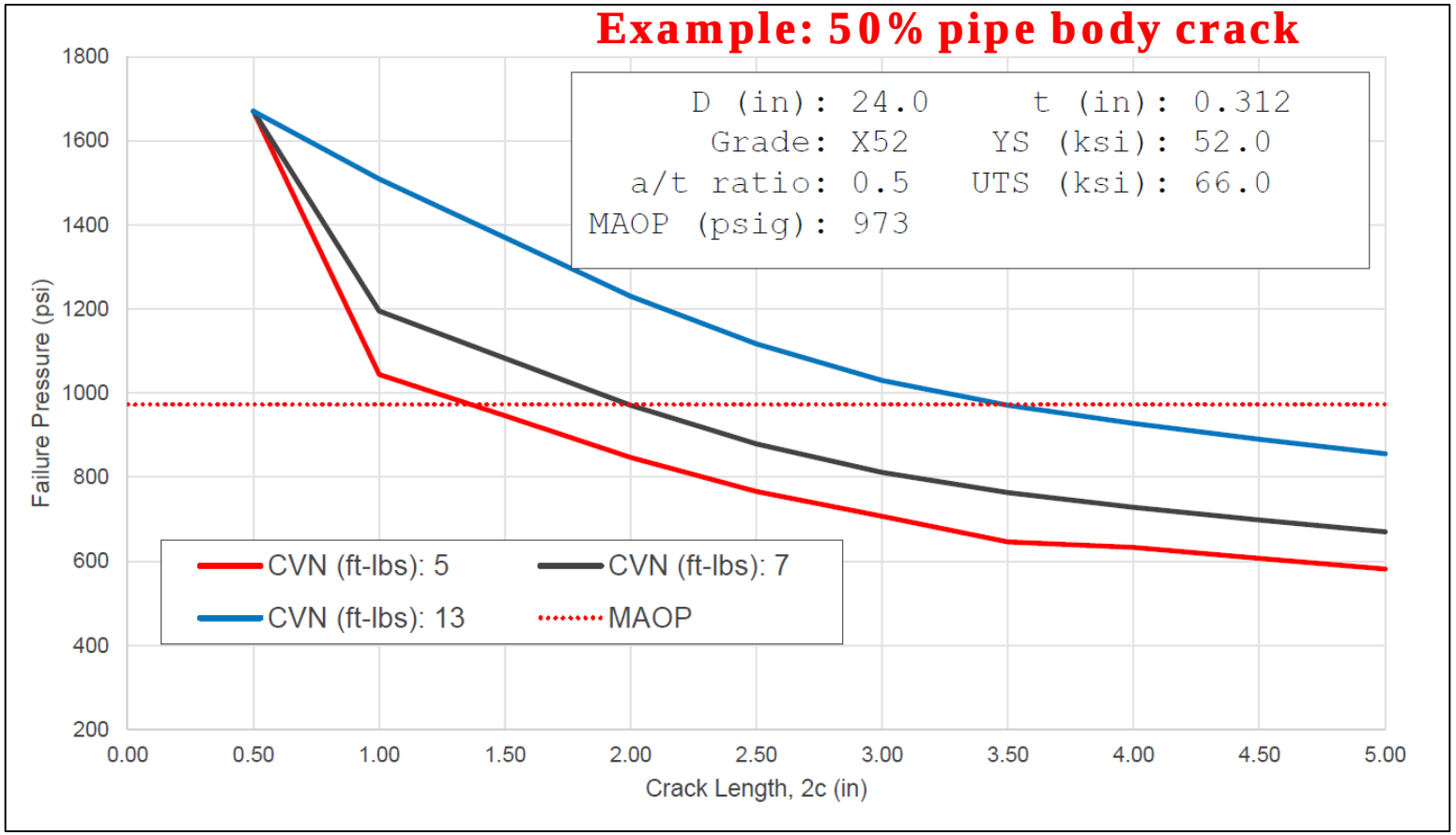
2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **Public Comments on fracture mechanics methodology (Dec 2017). Industry representatives on the committee agreed.**
- Industry commented that default Charpy values proposed by PHMSA are too conservative and suggested using 13 ft-lb (body) and 4 ft-lb (seam).
  - **PHMSA**: (cont.)
  - Default values of 5 ft-lb (body) and 1 ft-lb (seam) would only apply for pre-1970s pipe, post-1970s pipe with unknown or suspected low toughness properties, or where vintage material, technology, or other technical publications are not available or not applicable.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **Public Comments on fracture mechanics methodology (Dec 2017). Industry representatives on the committee agreed.**
- Industry commented that default Charpy values proposed by PHMSA are too conservative and suggested using 13 ft-lb (body) and 4 ft-lb (seam).
  - **PHMSA**: (cont.)
  - Operators must use known values or values obtained through pipe properties testing whenever available, and would only use default values if actual values are unknown.
  - Example calculations illustrating the effect of raising the default Charpy values on predicted failure pressure are shown on the next 4 slides.

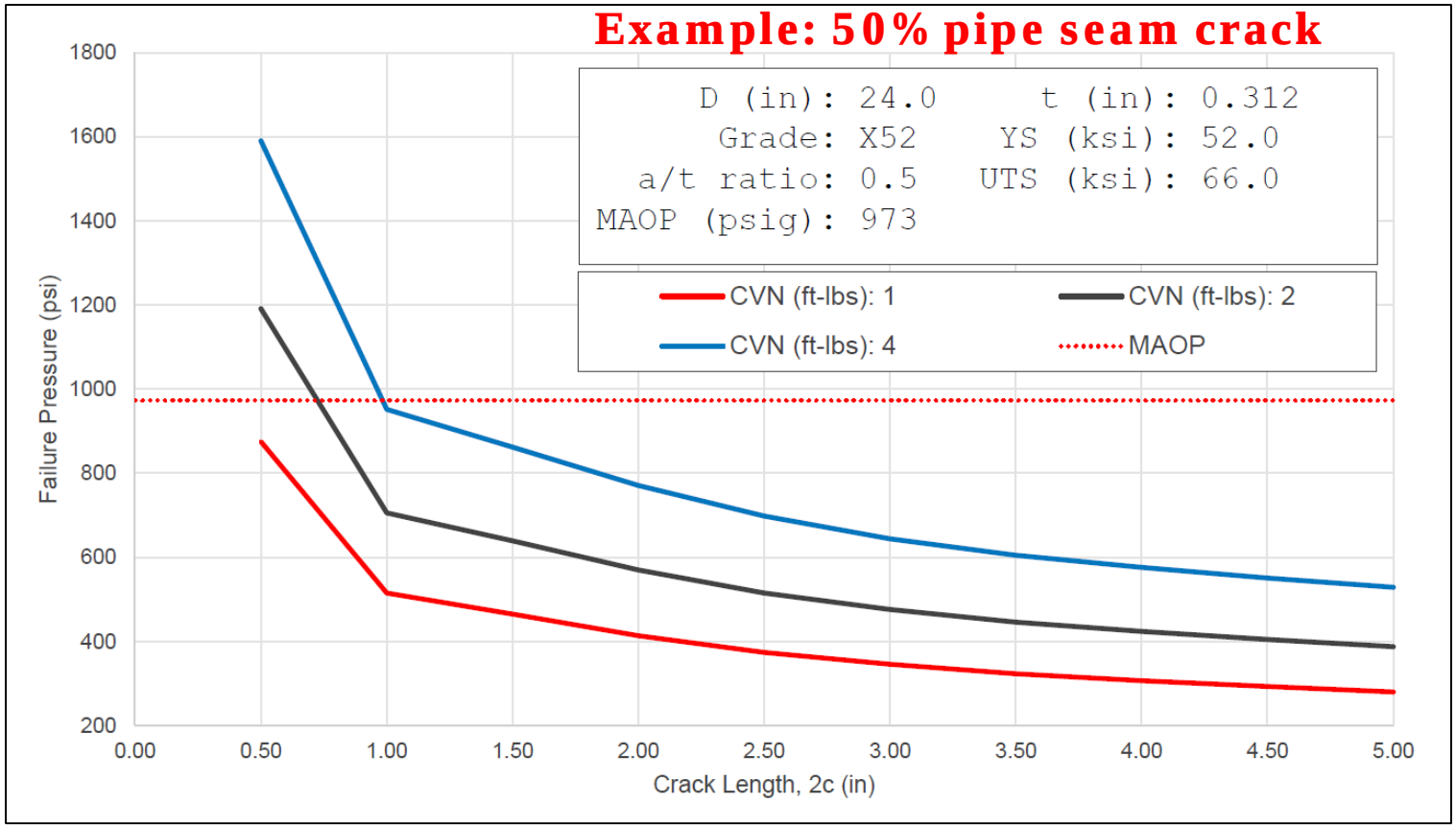
2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics



Effect of changing CVN on PFP of crack in Pipe Body

(Class 1/MAOP = 973)

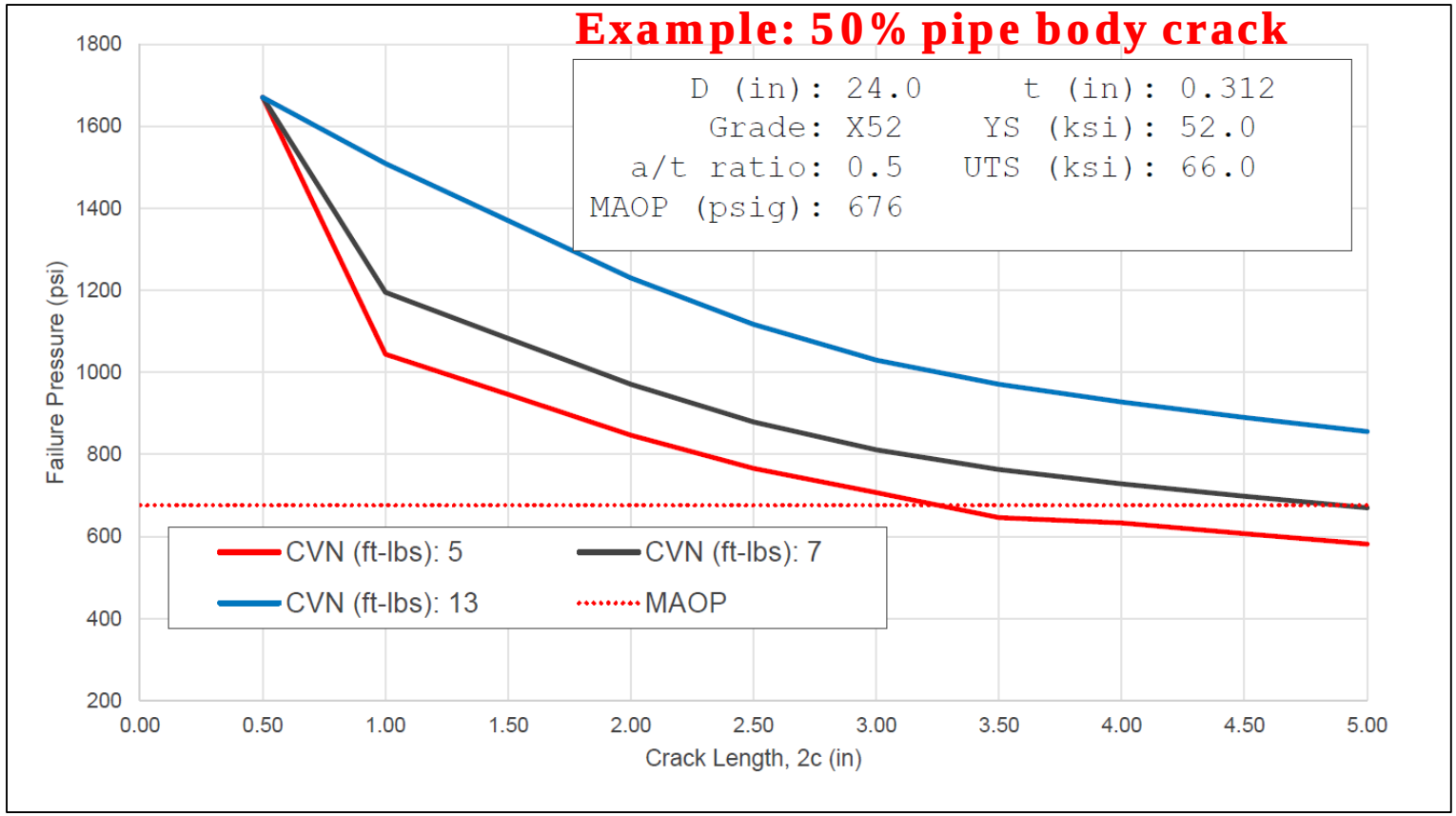
2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics



Effect of changing CVN on PFP of crack in Pipe Seam

(Class 1/MAOP = 973)

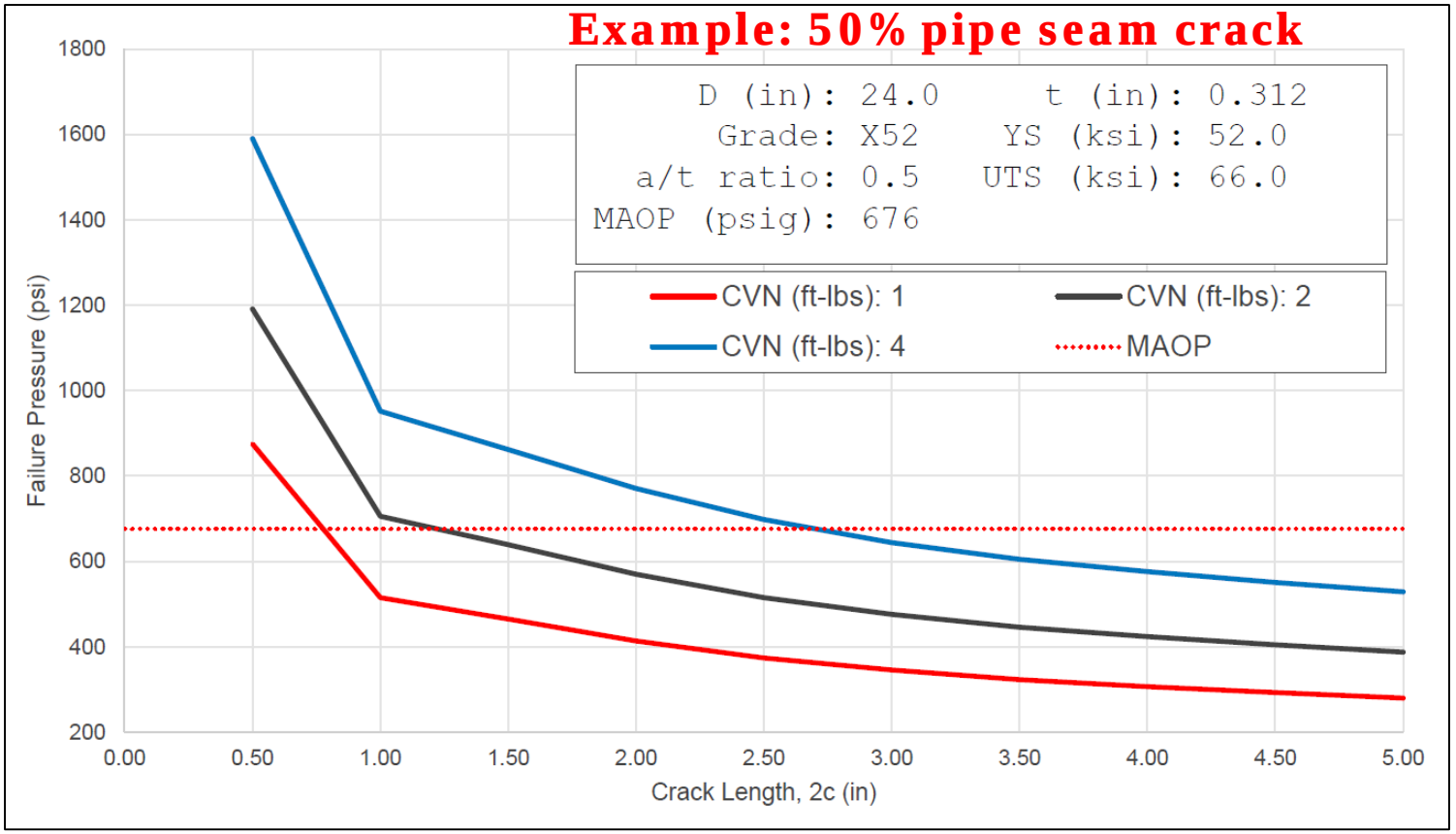
2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics



Effect of changing CVN on PFP of crack in Pipe Body

(Class 3/MAOP = 676)

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics



Effect of changing CVN on PFP of crack in Pipe Seam

(Class 3/MAOP = 676)

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **Public Comments on fracture mechanics methodology (Dec 2017). Industry representatives on the committee agreed.**
- Industry commented default Charpy values PHMSA proposed are too conservative and suggested using 13 ft-lb (body) and 4 ft-lb (seam).
  - **PHMSA**: (cont.) INGAA commissioned a statistical study of Charpy values, which was submitted to the docket. [Structural Integrity Associates, Inc., *Statistical Evaluation of Charpy Toughness Levels for Gas Transmission Pipelines*, Report No. 1600513.401, Revision –0, July 7, 2016]
  - Study suggested using 13 ft-lb (body) and 4 ft-lb (seam) based on a 90% confidence level that the values would be conservative.
  - INGAA study pointed out that the values proposed by PHMSA represent a 99% confidence level that the values would be conservative.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **Public Comments on fracture mechanics methodology (Dec 2017). Industry representatives on the committee agreed.**
- Industry commented that default Charpy values proposed by PHMSA are too conservative and suggested using 13 ft-lb (body) and 4 ft-lb (seam).
  - **PHMSA**: (c0nt.)
  - INGAA study notes that the conservative values may result in excavations that, in the final analysis, may be proved to have been unnecessary.
  - PHMSA acknowledges that using conservative values to assure safety, in the absence of knowledge about the pipeline, may result in excavations for cracking anomalies (pipe body or seam).
  - PHMSA desires that industry make greater efforts to know the physical characteristics of in-service pipe when records are not available.

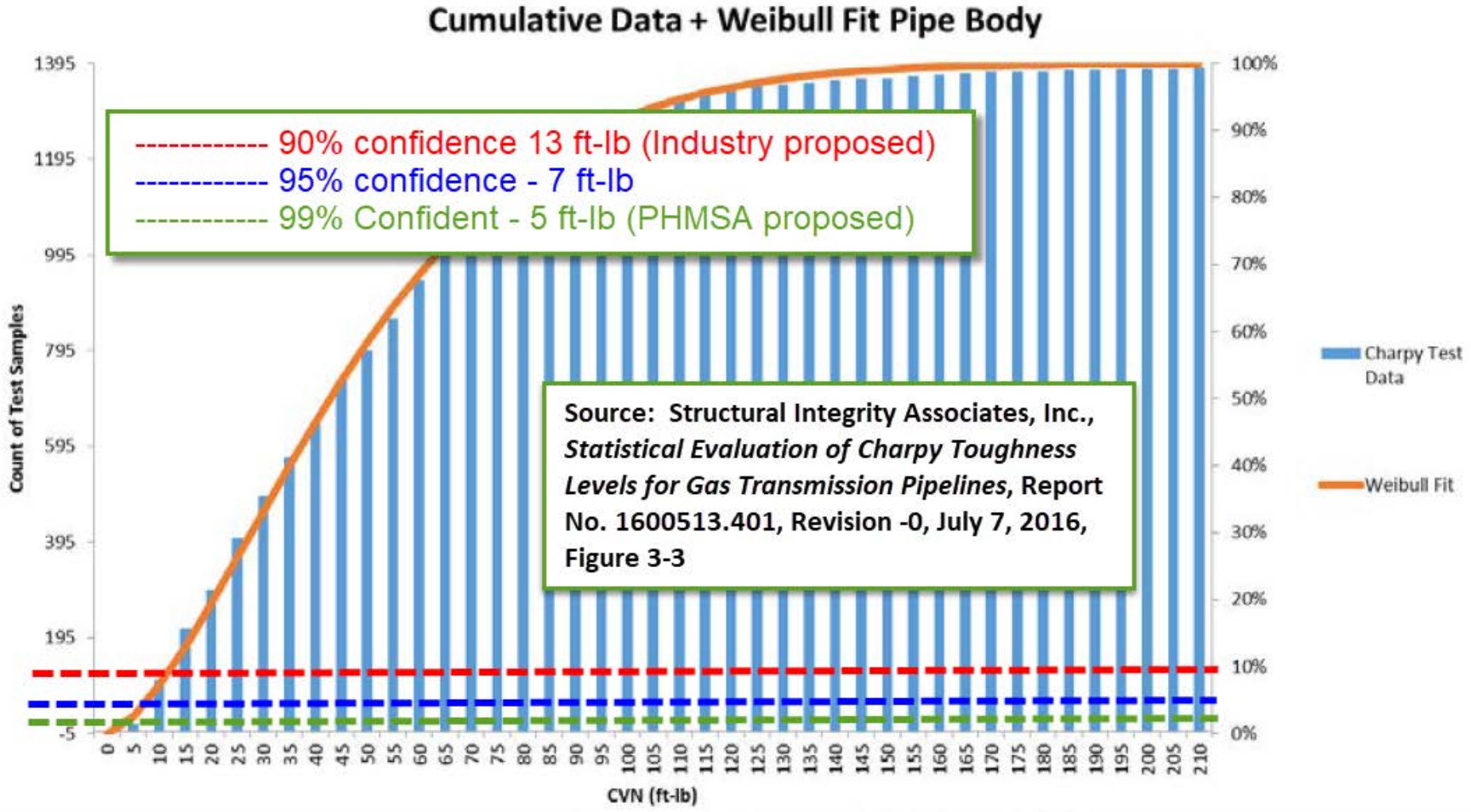
2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **Public Comments on fracture mechanics methodology (Dec 2017). Industry representatives on the committee agreed.**
- Industry commented that default Charpy values proposed by PHMSA are too conservative and suggested using 13 ft-lb (body) and 4 ft-lb (seam).
  - **PHMSA**: (cont.)
    - Encourages more excavations (testing of material properties both pipe body and seam) of pipe without records, at which time operators may verify the physical characteristics using the procedure established under 192.607.

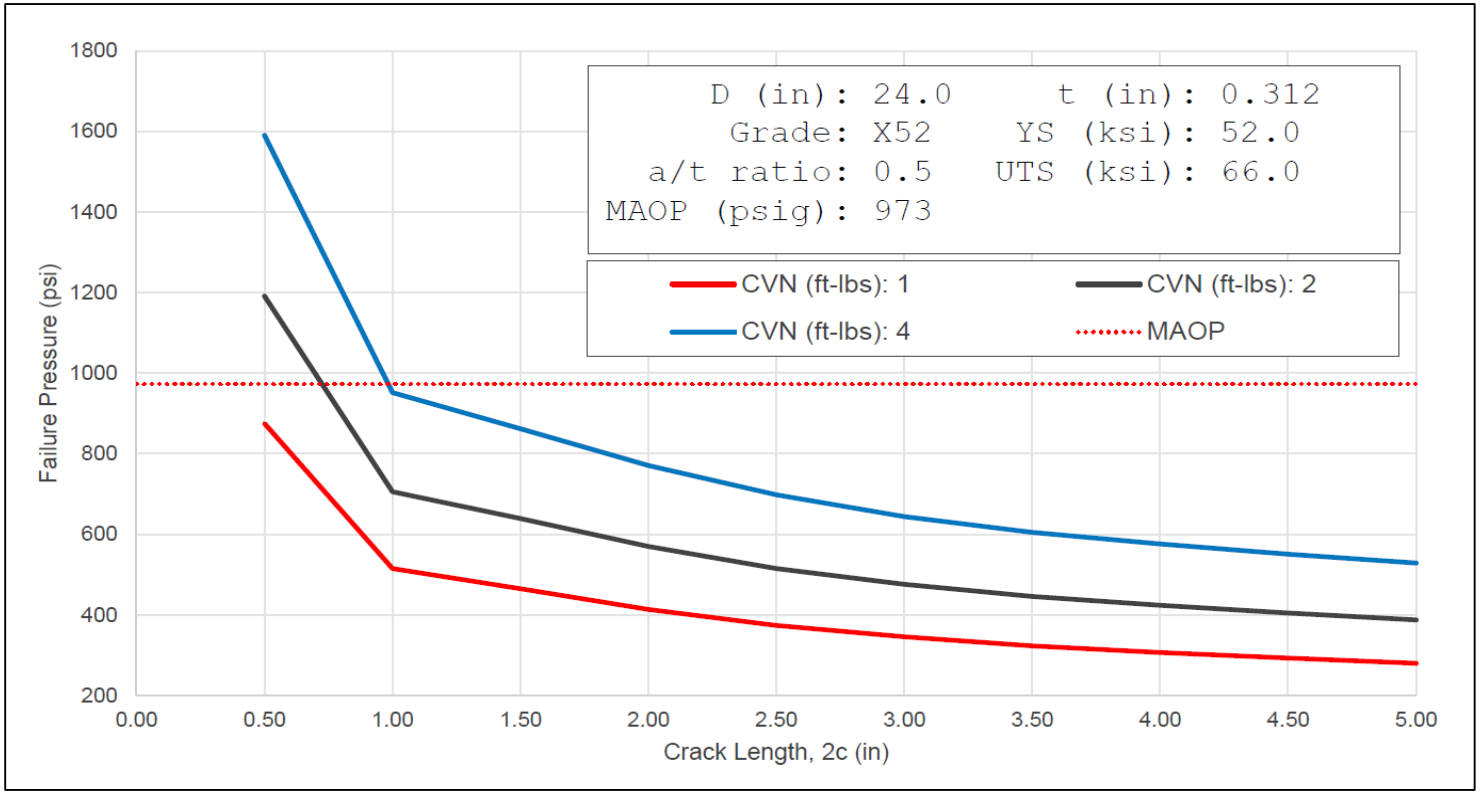
2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **Public Comments on fracture mechanics methodology (Dec 2017). Industry representatives on the committee agreed.**
- Industry commented that default Charpy values proposed by PHMSA are too conservative and suggested using 13 ft-lb (body) and 4 ft-lb (seam).
  - **PHMSA**: (cont.)
    - Weibull probability distribution curves developed in the INGAA statistical study show the effect of small differences in assumed Charpy toughness on statistical confidence in predicted failure pressure, as illustrated on the next slide.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics



2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics



Why does PHMSA propose 1ft-lb for pipe seam?

Effect of changing CVN on PFP of crack in Seam
(Class 1/MAOP = 973)

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **Public Comments on fracture mechanics methodology (Dec 2017). Industry representatives on the committee agreed.**
- Industry commented that default Charpy values proposed by PHMSA are too conservative and suggested using 13 ft-lb (body) and 4 ft-lb (seam).
  - **PHMSA**: (c0nt.)
    - To address cases where default Charpy values may be too conservative, PHMSA suggests allowing operators to use differing values upon submittal of a notification demonstrating conservative Charpy values

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

This concludes the PHMSA response to comments on Method 3 (SCA) and Fracture Mechanics.

The following slides summarize a number of revisions that PHMSA suggests the committee consider to address comments received from NPRM and the March 2, 2018 committee meeting.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the Committee consider:**
  - **PHMSA**: suggests revising 192.624(c)(3), *Engineering Critical Assessment*, and 192.624(d), *Fracture Mechanics*, as follows:
  - Since crack defects would be addressed by IMP and not addressed as part of MAOP reconfirmation in 192.624:
    - Strike 192.624(d) *Fracture mechanics analysis for failure stress and crack growth analysis* and (cont.)

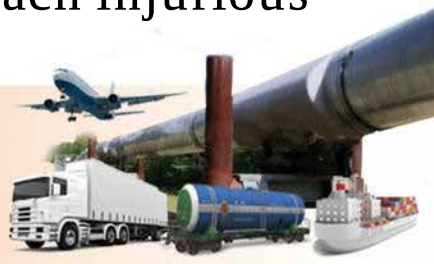
2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the Committee consider:**
  - **PHMSA**: suggests revising 192.624(c)(3), *Engineering Critical Assessment*, and 192.624(d), *Fracture Mechanics*:
    - Move fracture mechanics to a new stand-alone section 192.712.
    - The new 192.712 would not specify when, or for which segments, fracture mechanics analysis would be required. It would be limited to the procedure for performing fracture mechanics analysis when required or allowed by other sections of Part 192.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the Committee consider:**
  - **PHMSA:** suggests revising proposed 192.624(c)(3), *Engineering Critical Assessment*, and 192.624(d), *Fracture Mechanics*, as follows:
  - 192.624 would not contain default Charpy toughness values or other technical fracture mechanics requirements. Requirements to perform fracture mechanics as part of ECA in 192.624(c)(3) would simply refer to new 192.712. PHMSA suggests revising 192.624(c)(3)(i)(B) to read as follows:

    (B) The ECA must analyze any cracks or crack-like defects remaining in the pipe, or that could remain in the pipe, to determine the predicted failure pressure (PFP) of each injurious defect in accordance with 192.712.



2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
192.624(d) – Fracture Mechanics

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the Committee consider:**
  - **PHMSA:** suggests amending the fracture mechanics procedure to address technical comments received from NPRM and committee comments. PHMSA suggests utilizing the fracture mechanics requirements originally proposed for 192.624(d) in the new 192.712, with the following revisions:
    - Strike language [previously proposed in 192.624(d)(1)] that specifies when, or for which segments fracture mechanics analysis is required. Replace with language which clarifies that 192.712 only addresses the purpose and procedure for performing fracture mechanics analysis.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
192.624(d) – Fracture Mechanics

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the committee consider:**
  - **PHMSA:** (cont.)
    - Strike (d)(1)(iii) [sensitivity analysis] and replace with requirement that operators account for model inaccuracies and tolerances
    - Strike references to 192.624 [MAOP reconfirmation]
    - Strike references to 192.506 [spike pressure test]
    - Add a paragraph to require records be retained (since the records requirement for MAOP reconfirmation at 192.624(f) would no longer apply) (cont.)

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
192.624(d) – Fracture Mechanics

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the committee consider:**
  - **PHMSA:** (cont.)
    - Rewrite and restructure according to the following outline for new 192.712:
      - (a) Applicability;
      - (b) Modeling;
      - (c) Fatigue analysis and remaining life; and
      - (d) SME review; and
      - (e) Records.

(cont.)

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
192.624(d) – Fracture Mechanics

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the committee consider:**
  - **PHMSA:** (cont.)
    - Clarify that default Charpy values of 5 ft-lb (body) and 1 ft-lb (seam) only apply to pipe with suspected low-toughness properties or unknown toughness properties
    - Clarify that use of differing default Charpy values may be requested by notification to PHMSA

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

Public Comments

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics

GPAC Discussion

Committee Voting Slides

2. MAOP Reconfirmation
2C. 192.624(c)(4) – Method 4

- **Committee Comments on Method 4 - Pipe Replacement (Dec 2017):**
  - No Comments.

2. MAOP Reconfirmation
2C. 192.624(c)(5) – Method 5

- **Public Comments on Method 5 low stress pressure reduction (Dec 2017):**
  - Even though Method 5 applies to less risky pipe, commenters asserted that it is more onerous than method 2, with many additional requirements related to enhanced patrols, leak surveys, etc. Suggested making method 5 comparable to method 2.
  - Usage of Method 5 should not be limited based on pipe size or MAOP.
  - **PHMSA**: [see next 3 slides]

2. MAOP Reconfirmation
2C. 192.624(c)(5) – Method 5

- **Committee Comments on Method 5 Pressure Reduction for Segments with Small Potential Impact Radius and Diameter (Dec 2017):**
  - Industry representatives supported public comments which questioned the need for some of the compensatory measures such as patrols and leak surveys in addition to the 10% pressure reduction.
  - **PHMSA**: PHMSA suggests changing the compensatory measures associated with a limited 10% pressure reduction as follows:
    - Strike 192.624(c)(5)(ii) – ECDA
    - Strike 192.624(c)(5)(iii) – Crack assessments
    - Revise 192.624(c)(5)(iv) – Change frequency of patrols to 4 per yr
    - Revise 192.624(c)(5)(v) – Change frequency of leak surveys to 4 per yr
    - Strike 192.624(c)(5)(vi) – Odorization
    - Strike 192.624(c)(5)(vi) – Remaining life calculations

2. MAOP Reconfirmation
2C. 192.624(c)(5) – Method 5

- **Committee Comments on Method 5 Pressure Reduction for Segments with Small Potential Impact Radius and Diameter (Dec 2017):**
  - Industry representatives supported public comments which promoted expansion of the applicability of Method 5 (i.e., not limit usage of Method 5 based on pipe size or MAOP).
  - **PHMSA**: suggests changing the applicability of Method 5 by dropping the size and operating pressure limits and utilizing PIR ≤ 150 ft. as a proxy for the combined effect of all risk factors. (See chart on next slide.)
  - In addition, PHMSA would expand the look-back period to 5 years (in response to the same comments as discussed under Method 2).

2. MAOP Reconfirmation

2C. 192.624(c)(5) – Method 5

Table 1, Natural Gas Potential Impact Radius Rounded Up to the Nearest Foot

Maximum Allowable Operating Pressure (PSI)	Nominal Pipe Diameter (Inches)												
	4	6	8	10	12	14	16	18	20	22	24	30	36
50	20	30	40	49	59	69	79	88	98	108	118	147	176
100	28	42	56	69	83	97	111	125	138	152	166	207	249
150	34	51	68	85	102	119	136	153	170	186	203	254	305
200	40	59	79	98	118	137	157	176	196	215	235	293	352
250	44	66	88	110	131	153	175	197	219	241	262	328	393
300	48	72	96	120	144	168	192	216	240	263	287	359	431
350	52	78	104	130	155	181	207	233	259	284	310	388	465
400	56	83	111	138	166	194	221	249	276	304	332	414	497
450	59	88	118	147	176	205	235	264	293	323	352	440	527
500	62	93	124	155	186	217	247	278	309	340	371	463	556
550	65	98	130	162	195	227	259	292	324	357	389	486	583
600	68	102	136	170	203	237	271	305	339	372	406	508	609
650	71	106	141	176	212	247	282	317	352	388	423	528	634
700	74	110	147	183	220	256	293	329	366	402	439	548	658
720	75	112	149	186	223	260	297	334	371	408	445	556	667
750	76	114	152	189	227	265	303	341	378	416	454	567	681
800	79	118	157	196	235	274	313	352	391	430	469	586	703
850	81	121	161	202	242	282	322	363	403	443	483	604	725
900	83	125	166	207	249	290	332	373	414	456	497	621	746
950	86	128	171	213	256	298	341	383	426	468	511	639	766
1000	88	131	175	219	262	306	350	393	437	481	524	655	786
1050	90	135	179	224	269	314	358	403	448	492	537	671	805
1100	92	138	184	229	275	321	367	412	458	504	550	687	824
1150	94	141	188	234	281	328	375	422	468	515	562	702	843
1200	96	144	192	240	287	335	383	431	479	526	574	718	861
1250	98	147	196	244	293	342	391	440	488	537	586	732	879
1300	100	150	200	249	299	349	399	448	498	548	598	747	896
1350	102	153	203	254	305	355	406	457	508	558	609	761	913
1400	104	155	207	259	310	362	414	465	517	568	620	775	930

2. MAOP Reconfirmation
2C. 192.624(c)(6) – Method 6

- **Committee Comments on Method 6 Other Technology (Dec 2017):**
  - For Method 6, Other Technology, committee members commented to adopt the same no objection letter as voted for 192.607.
  - **PHMSA**: suggests inclusion of the same "no objection" language as voted by the Committee for 192.607.

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Methods 4, 5 & 6

This concludes the PHMSA response to comments on Methods 4 (Replacement), 5 (Low Stress), and 6 (Other technology).

The following slides summarize a number of revisions that PHMSA suggests the committee consider to address comments received from NPRM and the March 2, 2018 committee meeting.

2. MAOP Reconfirmation
2C. 192.624(c) – Methods 4, 5 & 6

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the Committee consider:**
  - **PHMSA:** suggests revising proposed 192.624 (c)(5), Method 5, *Pressure Reduction for Segments with Small Potential Impact Radius and Diameter* as follows:
    - Delete the size and pressure criteria. The applicability would be based solely on a PIR of ≤ 150 feet.
    - Strike 192.624(c)(5)(ii) [ECDA], (c)(5)(iii) [Crack Analysis Program], (c)(5)(vi) [odorization], and (c)(5)(vii) [fracture mechanics analysis]
    - Change frequency of patrols and surveys:
      - Class 1 and 2 – 4 times per year
      - Class 3 and 4 – 6 times per year

2. MAOP Reconfirmation
2C. 192.624(c) – Methods 4, 5 & 6

- **In light of committee comments from the December 2017 meeting, PHMSA suggests the Committee consider:**
  - **PHMSA**: suggests revising proposed 192.624(c)(6), *Other Technology*, as follows:
    - Use same 90-day 'no objection' letter language the committee approved for 192.607.

2. MAOP Reconfirmation

2C. 192.624(c)(4) – Method 4

2C. 192.624(c)(5) – Method 5

2C. 192.624(c)(6) – Method 6

Public Comments

2. MAOP Reconfirmation

2C. 192.624(c)(4) – Method 4

2C. 192.624(c)(5) – Method 5

2C. 192.624(c)(6) – Method 6

GPAC Discussion

Committee Voting Slides

2. MAOP Reconfirmation
2E. 192.624(e) – Notification Procedure
2F. 192.624(f) - Records

- **Committee Comments on Notification Procedure (Dec 2017):**
  - No Comments.
- **Committee Comments on Records Requirement (Dec 2017):**
  - No Comments.
- **PHMSA:** suggests retaining the notification procedure as published in the NPRM. PHMSA suggests deleting the word "reliable" from the records requirement (as voted on during the June 2017 meeting). As discussed in the March 2 meeting, PHMSA will provide guidance regarding TVC records in the preamble of the final rule.

2. MAOP Reconfirmation

2E. 192.624(e) – Notification Procedure

2F. 192.624(f) - Records

Public Comments

2. MAOP Reconfirmation
2E. 192.624(e) – Notification Procedure
2F. 192.624(f) - Records

GPAC Discussion

Committee Voting Slides

3. Other Proposed Rule Amendments Related to MAOP

A. 192.619(e) – Require 192.624 for MAOP of Applicable Segments

B. 192.503 – Conforming edit to 192.503 to reference 192.624

C. 192.619(a)(4) – Refer to 192.607, Mat'l Doc.

D. 192.619(a)(2) – Update class 1 pressure test factor

E. 192.619(f) – MAOP Records

F. 192.605(b)(5) – O&M

3A. MAOP 192.619(e); 3B. MAOP 192.503

- **At the Dec. 2017 meeting, in response to public NPRM comments, PHMSA suggested the Committee consider the following (reiterated below):**
  - **PHMSA:** Shorten and clarify 192.619(e) to remove text that duplicates the scope in 192.624(a), to read:
    - "(e) Notwithstanding the requirements in paragraphs (a) through (d) of this section, onshore steel transmission pipelines that meet the criteria specified in 192.624(a) must establish and document the maximum allowable operating pressure in accordance with 192.624."
  - Withdraw the proposed revision to 192.503
    - Not needed since 192.503 already invokes 192.619 which would adequately reference the new requirements in 192.624

3C. MAOP
192.619(a)(4)
NPRM Proposed Referring to Material Verification

- **ISSUE:** As part of responding to the material documentation mandate (voted upon at the December 2017 GPAC meeting [192.607]), establishment of MAOP under 192.619 should rely on TVC records.
- **PHMSA PROPOSED TO:**
  - Require that operators use 192.607 to document missing information as needed under 192.619(a)(4)
- **BASIS:** The Pipeline Act of 2011, Section 23.

3C. MAOP
192.619(a)(4)
NPRM Proposed Referring to Material Verification

NPRM Comments:

- Reference to 192.607 is not appropriate in 192.619(a)(4). Proposal is vague and does not provide sufficient information about what to do if material verification has not been completed and records for some components are not available or how to determine the limiting condition.
- **PHMSA:**
  - The modifications proposed and approved by the GPAC at the December 2017 meeting address this comment.
  - The amended 192.607 would allow operators to verify material properties in specific cases, such as might be needed to establish MAOP, without the need for a long-term sampling program.

3C. MAOP
192.619(a)(4)
NPRM Proposed Referring to Material Verification

- **PHMSA:**
  - Believes that operators should evaluate material properties under 192.619.
  - Included reference to 192.607 so that operators may verify material properties if TVC records are not available.
  - suggests clarifying that 192.607 does not necessarily apply to all segments when determining MAOP by adding “if applicable” after the reference to 192.607 in 192.619(a)(4).

3C. MAOP
192.619(a)(4)
NPRM Proposed Referring to Material Verification

NPRM Comments:

- Clarify if the proposed reference to 192.607 (Material Documentation) in 192.619(a)(4) is addressing only transmission pipelines or both transmission and distribution pipelines.
- **PHMSA:**
  - The scope of 192.607 applies only to transmission pipelines.
  - PHMSA suggests clarifying that 192.607 does not apply to distribution pipelines when determining MAOP by adding "if applicable" after the reference to 192.607 in 192.619(a)(4).

3D. 192.619(a)(2)
Update Class 1 pressure test factor for MAOP

- **ISSUE:** One conclusion of the NTSB investigation of the PG&E accident in San Bruno, CA was that the premise in Title 49 Code of Federal Regulations Part 192 of the Federal pipeline safety regulations that manufacturing- and construction-related defects can be considered stable even when a gas pipeline has not been subjected to a pressure test of at least 1.25 times the maximum allowable operating pressure is not supported by scientific studies.
- **PHMSA PROPOSED TO:**

  Require that MAOP pressure limitation specified in 192.619(a)(2) for new Class 1 pipe segments be based on the subpart J test pressure divided by 1.25 (instead of 1.1)
- **BASIS:** - NTSB Recommendation P-11-15;

  - Gas Research Institute (GRI) report GRI-04/0178;

  - Evaluating the Stability of Manufacturing and Construction Defects in Natural Gas Pipelines, No. 05-12R, 2007

3D. 192.619(a)(2)
Increase the Class Location factor for pressure testing of steel pipe located in Class 1 areas installed after publication of the final rule.

NPRM Comments:

- Clarify that MAOP is to be based on the highest pressure to which the segment was tested after construction.
- **PHMSA:**
  - For pipe segments installed on or after the effective date of the rule, the MAOP limitation of 192.619(a)(2) is based on the test pressure of a successful subpart J pressure test divided by the applicable class location factor.

3D. 192.619(a)(2) Increase the Class Location factor for pressure testing of steel pipe located in Class 1 areas installed after publication of the final rule.

NPRM Comments:

- Clarify that 192.619(a)(3) in cases where past operating pressure records are not available, but pressure test records are available.
- **PHMSA**: (Cont.)
  - Per existing code requirements in 192.619(a)(3), the pressure restriction in 192.619(a)(3) based on past operating pressure does not apply if the segment was tested according to the requirements in paragraph 192.619(a)(2).

3D. 192.619(a)(2)
Increase the Class Location factor for pressure testing of steel pipe located in Class 1 areas installed after publication of the final rule.

NPRM Comments:

- Effective dates proposed for revised Factors being applied, the Date of New Rule and Date of New Rule minus 1 Day, is seen to cause uncertainty - recommends that effective dates for new class 1 test factor be 180 days after the effective date of the rule.
- **PHMSA:**
  - New pipelines cannot be operated unless pressure tested.
  - Existing 192.505 prohibits operation of a pipeline (≥30% SMYS) if there is a building intended for human occupancy within 300 feet of a pipeline, unless that segment has had a hydrostatic test of at least 125 percent of MAOP.
  - The proposed rule would extend this requirement, which is already in effect today, to all class 1 pipe.

3E. 192.619(f) – MAOP Records

- **ISSUE:** In response to the PG&E accident at San Bruno, CA, the Pipeline Safety, Regulatory Certainty, and Job Creation Act of 2011 mandated that operators report pipe segments for which records could not be verified that accurately reflect the physical and operational characteristics of the pipelines and confirm MAOP.
- **PHMSA PROPOSED TO:**
  - PHMSA proposed to add a new paragraph 192.619(f) to more clearly specify that operators must have records to substantiate MAOP
- **BASIS:** PSA of 2011 §23(a); 49 USC 60139(a) & (b)

3E. 192.619(f) – MAOP Records

NPRM Comments:

- The proposed rule as written would apply to distribution, gathering, offshore, and plastic pipelines.
- **PHMSA:** suggests clarifying that the MAOP records requirements proposed in 192.619(f) would apply only to onshore, steel, gas transmission pipelines.

- The proposed 192.619(f) should clarify that it applies only to records needed to establish and document MAOP.
- **PHMSA:** suggests revising 192.619(f) to clarify that it only applies to records needed to demonstrate compliance with 192.619(a) – (e).

3E. 192.619(f) – MAOP Records

NPRM Comments:

- Industry commenters advocated that new MAOP records requirements only be applied prospectively beginning one year after the effective date of the rule.
- **PHMSA:** similar to the proposal that the committee voted on at the March 2, 2018 meeting, PHMSA suggests revising 192.619(f) to clarify that MAOP records requirements are not retroactive.
  - Existing records on pre-existing P/L must be retained for P/L life.
  - New pipelines must make and retain records for life of pipeline.
  - Other sections such as 192.624 and 192.917 would require when, and for which pipeline segments, missing MAOP records must be verified in accordance with 192.624 and/or 192.607.
  - MAOP records would be required for any pipeline placed in service after the effective date of the rule.

3F. 192.605(b)(5) – O&M

PHMSA PROPOSED TO:

- Add clarification that the requirement for overpressure protection applied to segments with MAOP established using MAOP reconfirmation (192.624).

NPRM Comments:

- Revised subsection is redundant and unnecessary. PHMSA should retract this proposed revision as duplicative of current requirements (192.605(b)(1)).
- Delete reference to 192.731.
- Clarify if requirement is addressing only Transmission or both Transmission and Distribution.

(cont.)

3F. 192.605(b)(5) – O&M

NPRM Comments: (Cont.)

- PHMSA has not provided justification for imposing this requirement on distribution lines.
- Code has never required operators to include procedures specific for each individual physical control or device in their manual.
- **PHMSA:**
  - Proposed change to 192.605(b)(5) was intended to be a conforming change to clarify that it applies to segments with MAOP determined under 192.624.
  - The proposed change was not intended to introduce any new or substantively different requirement and was intended only to provide clarification.
  - Based on the public comments received and the unintended confusion it might create, PHMSA suggests that the proposed revision to 192.605(b)(5) be withdrawn.

3. MAOP
192.619(a)(2); 192.619(a)(4); 192.619(e); 192.619(f); 192.503; 192.605(b)(5)

Public Comments

3. MAOP
192.619(a)(2); 192.619(a)(4); 192.619(e); 192.619(f); 192.503; 192.605(b)(5)

GPAC Discussion

Committee Voting Slides

4. Integrity Management
§§ 192.917(e)(3) and (e)(4)

- **In light of committee comments from the June 2017 meeting, PHMSA suggests the Committee consider:**
  - **PHMSA**: In conjunction with striking the previously proposed 192.624(a)(1), revise proposed 192.917(e)(3) as follows:
    - In paragraph (e)(3), delete the phrase "*and must reconfirm or reestablish MAOP in accordance with § 192.624(c)*"
    - In paragraph 192.917(e)(3)(i), delete the reference to 192.624(a)(1) and replace with "*the segment has experienced a reportable in-service incident, as defined in § 191.3, since its most recent successful subpart J pressure test, due to an original manufacturing-related defect, or a construction-, installation-, or fabrication-related defect.*"

4. Integrity Management
§§ 192.917(e)(3) and (e)(4)

- **In light of committee comments from the June 2017 meeting, PHMSA suggests the Committee consider:**
  - **PHMSA**: In conjunction with moving the previously proposed 192.624(d) regarding fracture mechanics analysis to a new section 192.712, suggest revising proposed 192.917(e)(4) as follows:
    - In paragraph (e)(4), delete the reference to § 192.624(c) and (d) and replace with 192.712.

4. Integrity Management §§ 192.917(e)(3) and (e)(4)

- **In light of committee comments from the June 2017 meeting, PHMSA suggests the Committee consider:**
  - **PHMSA**: In conjunction with striking the previously proposed 192.624(a)(1), add a new 192.917(e)(6) to address cracking within IMP (as proposed by the committee). This would be similar to corrosion in 192.917(e)(5):
    - (6) *Cracks. If an operator identifies any crack or crack-like defect (including, but not limited to, stress corrosion cracking or other environmentally assisted cracking, unstable seam defects, selective seam weld corrosion, girth weld cracks, hook cracks, and fatigue cracks) on a covered pipeline segment that could adversely affect the integrity of the line, the operator must evaluate and remediate, as necessary, all pipeline segments (both covered and non-covered) with similar material properties and environmental characteristics associated with the crack or crack-like defect. An operator must establish a schedule for evaluating and remediating, as necessary, the similar segments that is consistent with the operator's established operating and maintenance procedures under part 192 for testing and repair.*

4. Integrity Management §§ 192.917(e)(3) and (e)(4)

Public Comments

4. Integrity Management
§§ 192.917(e)(3) and (e)(4)

GPAC Discussion

Committee Voting Slides

5. Definitions
§ 192.3

- **Status of committee comments and votes related to new or revised definitions proposed for 192.3**
  - Definitions previously voted upon at the March 2, 2018 meeting:
    - Moderate consequence area
    - Occupied site

5. Definitions
§ 192.3

- **Status of committee comments and votes related to new or revised definitions proposed for 192.3:**
  - Definitions scheduled for discussion at March 26-28, 2018 meeting:
  - Agenda Item 2, MAOP reconfirmation.
  - **PHMSA**: suggests deleting these 3 proposed definitions in conjunction with changes to the scope of 192.624 - MAOP reconfirmation.
    - *Legacy construction techniques*
    - *Legacy pipe*
    - *Modern pipe*

5. Definitions
§ 192.3

- **Status of committee comments and votes related to new or revised definitions proposed for 192.3:**
  - The following definitions relate to topics previously discussed and voted upon, but the vote did not explicitly include a vote on related definitions. Take up the following definitions at this time:
    - Electrical survey
    - Close interval survey
    - Dry gas or dry natural gas
    - Transmission line
    - Distribution center
    - In-line inspection (ILI)
    - In-line inspection tool or instrumented internal inspection device
    - Pipe segment can accommodate inspection by means of instrumented inline inspection tools (new per NPRM comment)
    - Traceable, verifiable, and complete records (new per NPRM comment)

5. Definitions
§ 192.3

- **Electrical Survey:**
  - **Existing Definition**: *Electrical survey* means a series of closely spaced pipe-to-soil readings over pipelines which are subsequently analyzed to identify locations where a corrosive current is leaving the pipeline.
  - **NPRM Proposed Revision**: *Electrical survey* means a series of closely spaced measurements of the potential difference between two reference electrodes to determine where the current is leaving the pipe on ineffectively coated or bare pipelines.
  - **PHMSA:** suggests the Committee
    - Consider withdrawing the proposed NPRM changes to this definition.
    - The proposed changes were minor technical clarifications proposed in conjunction with proposed changes to Appendix D. During the June 2017 meeting, the Committee voted to withdraw the proposed changes to Appendix D; as a result, the revised definition is not needed.

5. Definitions
§ 192.3

- **Close Interval Survey:**
  - **NPRM Proposed Revision**: *"Close interval survey means a series of closely spaced pipe-to-electrolyte potential measurements taken to assess the adequacy of cathodic protection or to identify locations where a current may be leaving the pipeline that may cause corrosion and for the purpose of quantifying voltage (IR) drops other than those across the structure electrolyte boundary."*
  - **PHMSA:** suggests the Committee
    - Accept the definition, as modified below per comments received in response to the NPRM. (Cont.)

5. Definitions
§ 192.3

- **Close Interval Survey:**
- **PHMSA: (Cont.)**
  - The proposed new definition was based on use of this term in proposed changes to 192.465, external corrosion. During the June 2017 meeting, the committee voted on 192.465. However, the new definition was not explicitly included in the vote.
  - *Close interval survey* means a series of closely and properly spaced pipe-to-electrolyte potential measurements taken over the pipe to assess the adequacy of cathodic protection or to identify locations where a current may be leaving the pipeline that may cause corrosion and for the purpose of quantifying voltage (IR) drops other than those across the structure electrolyte boundary, such as when performed as a current interrupted, depolarized, or native survey.

5. Definitions
§ 192.3

- **Dry gas or dry natural gas :**
  - **NPRM Definition**: *"Dry gas or dry natural gas* means gas with less than 7 pounds of water per million (MM) cubic feet and not subject to excessive upsets allowing electrolytes into the gas stream."
  - **PHMSA:** suggests Committee accept the definition, as modified below per comments received in response to the NPRM.
  - The proposed new definition was based on use of this term in proposed changes to 192.927, internal corrosion direct assessment. During the June 2017 meeting, the Committee voted on 192.927. However, the new definition was not explicitly included in the voting language.
    - *Dry gas or dry natural gas* means gas ~~with less than 7 pounds of water per million (MM) cubic feet and not subject to excessive upsets allowing electrolytes into the gas stream~~ above its dew point and without condensed liquids being formed via pressure reductions.

5. Definitions
§ 192.3

- **Transmission line:**

- **<u>Existing Definition</u>**: *Transmission line* means a pipeline, other than a gathering line, that: (1) Transports gas from a gathering line or storage facility to a distribution center, storage facility, or large volume customer that is not down-stream from a distribution center; (2) operates at a hoop stress of 20 percent or more of SMYS; or (3) transports gas within a storage field. Note: A large volume customer may receive similar volumes of gas as a distribution center, and includes factories, power plants, and institutional users of gas. *(Cont.)*

5. Definitions
§ 192.3

- **Transmission line:**

- **<u>NPRM Proposed Revision</u>**: *Transmission line* means a pipeline, other than a gathering line, that: transports gas from a gathering line or storage facility to a distribution center, storage facility, or large volume customer that is not down-stream from a distribution center; has an MAOP of 20 percent or more of SMYS; or transports gas within a storage field. Note: A large volume customer (factories, power plants, and institutional users of gas) may receive similar volumes of gas as a distribution center. *(Cont.)*

5. Definitions
§ 192.3

- **Transmission line:**
- **PHMSA:** suggests the Committee
  - Accept the definition, as modified below per comments received in response to the NPRM.
  - *Transmission line* means a pipeline or connected series of pipelines, other than a gathering line, that: (1) transports gas from a gathering line or storage facility to a distribution center, storage facility, or large volume customer that is not down-stream from a distribution center; (2) has an MAOP of 20 percent or more of SMYS; ~~or~~ (3) transports gas within a storage field; or (4) is voluntarily designated by the operator as a transmission line.

    Note: A large volume customer may receive similar volumes of gas as a distribution center, and includes factories, power plants, and institutional users of gas.

5. Definitions
§ 192.3

- **Distribution Center:**
- **Existing Definition**: N/A
- **NPRM Proposed Revision**: *Distribution center* means a location where gas volumes are either metered or have pressure or volume reductions prior to delivery to customers through a distribution line.
- **PHMSA:**
  - Since this section of the NPRM is applicable to transmission lines only, and since this definition may significantly impact distribution lines, PHMSA suggests the Committee review withdrawal from the rule.

5. Definitions
§ 192.3

- **In-Line Inspection (ILI):**
- **NPRM Proposed Revision**: *In-line inspection (ILI)* means the inspection of a pipeline from the interior of the pipe using an in-line inspection tool, which is also called intelligent or smart pigging.
- **PHMSA: suggests Committee**
  - Accept the definition, as modified below per API RP 1163 based on comments received in response to the NPRM.
  - *In-line inspection (ILI)* means ~~the~~an inspection of a pipeline from the interior of the pipe using an ~~in-line~~ inspection tool~~;~~, ~~which is~~ also called intelligent or smart pigging.

    NOTE: This definition includes tethered and self-propelled inspection tools.

5. Definitions
§ 192.3

- **In-line inspection tool:**
- **NPRM Proposed Revision**: *In-line inspection tool or instrumented internal inspection device means a device or vehicle that uses a non-destructive testing technique to inspect the pipeline from the inside, which is also called an intelligent or smart pig.*
- **PHMSA: suggests Committee**
  - Accept the definition, as modified below per API RP 1163 and comments received to the NPRM.
  - *In-line inspection tool* or *instrumented internal inspection device* means an instrumented device or vehicle that uses a non-destructive testing technique to inspect the pipeline from the inside in order to identify and characterize flaws to analyze pipeline integrity;~~, which is~~ also known as ~~called~~ an *intelligent* or *smart pig*.

5. Definitions
§ 192.3

- **Pipe segment can accommodate inspection by means of instrumented inline inspection tools:**
  - **NPRM Proposed Revision**: *N/A*
  - **PHMSA:**
    - Plans to include a discussion in the preamble since comments were received in response to the NPRM.
    - *Pipe segment can accommodate inspection by means of an instrumented inline inspection tool* means a pipe segment that can undergo an *in-line inspection* using an *in-line inspection tool* without any permanent physical modification of the pipeline.

5. Definitions
§ 192.3

- **Traceable, verifiable, and complete (TVC) records:**
  - **NPRM Proposed Revision**: *N/A*
  - **PHMSA:** The Committee commented previously that a definition for traceable, verifiable and complete records is needed. Clarity is needed that the TVC standard operators have been applying since 2012 based on the Advisory Bulletin 2012-06 (77 FR 26822) are being retained. PHMSA will explain TVC in the preamble:
  - *Traceable, verifiable, and complete records* means a record or records that:
    - (1) Can be clearly linked to original information about a pipeline segment or facility;
    - (2) Document information confirmed by other complementary, but separate, documentation; and
    - (3) Is finalized as evidenced by a signature, date or other appropriate marking.

5. Definitions
§ 192.3

- **Status of committee comments and votes related to new or revised definitions proposed for 192.3:**
  - The following definitions will be addressed in conjunction with the repair criteria:
  - [Agenda item 6, repair criteria]
    - Significant Seam Cracking
    - Significant Stress Corrosion Cracking
    - Significant Selective Seam Weld Corrosion (new per NPRM comment)
    - Wrinkle bend
    - Hard spot

(cont.)

5. Definitions
§ 192.3

- **Status of committee comments and votes related to new or revised definitions proposed for 192.3:**
  - Discussion of the following definitions relate to the gas gathering topic will be deferred to the next meeting:
  - Revised Definition:
    - Gathering line
  - New Definitions
    - Gas processing plant
    - Gas treatment facility
    - Onshore production facility/operation

5. Definitions
§ 192.3

Public Comments

5. Definitions
§ 192.3

GPAC Discussion

Committee Voting Slides

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

6. Repair Criteria Revisions
192.711, 192.713, 192.933

- **ISSUE:** Greater assurance is needed that injurious anomalies are repaired before they can grow to sizes leading to leaks or ruptures.
- **PHMSA PROPOSED TO:**
  - Modify the repair criteria to include additional anomalies under both the "immediate" and the "one-year" conditions for HCAs.
  - Include criteria for cracks in response to NTSB P-12-3 for HL.
  - Apply the HCA criteria to non-HCAs with a tiered response time for non-immediate conditions. Defects requiring a 1-yr response in HCAs would require a 2-yr response in non-HCAs.
  - Add definitions for significant stress corrosion cracking (pipe body), significant seam cracking (weld seam), wrinkle bend, and hard spot.
- **BASIS:** Inspection experience identified weaknesses in repair decisions in response to ILI data; some injurious anomalies and defects are not identified and remediated in a timely manner commensurate with their seriousness.

6. NPRM Proposed Repair Criteria

Existing Anomaly Type HCA Only	Existing Timing HCA Only	NPRM Anomaly Type Applies to both HCA and Non-HCA	NPRM Timing Applies to both HCA and Non-HCA
Predicted Failure Pressure (PFP) ≤ 1.1 x MAOP	Immediate	PFP ≤ 1.1 x Maximum Allowable Operating Pressure (MAOP) (same for HCA, new for non-HCA)	Immediate
Dent w/Metal Loss (ML), cracking, or stress riser	Immediate	Dent w/ML, cracking, or stress riser (same)	Immediate
Any other anomaly requiring immediate action	Immediate	Any other anomaly requiring immediate action (same)	Immediate
(no current requirement)		Metal loss >80%	Immediate
		Metal loss affecting DC/LF/HF ERW/EFW seam	Immediate
		Significant SCC	Immediate
		Significant SSWC	Immediate

6. NPRM Proposed Repair Criteria

Existing Anomaly Type HCA Only	Existing Timing HCA Only	NPRM Anomaly Type Applies to both HCA and Non-HCA	NPRM Timing Applies to both HCA and Non-HCA
Smooth dent > 6% Top side dent (TSD)	1 year	Smooth dent > 6% (TSD) (same)	1 yr (same for HCA) 2 yr (new for non-HCA)
Dent > 2% at weld	1 year	Dent > 2% at weld (same)	1 yr (same for HCA) 2 yr (new for non-HCA)
(no current requirement)		PFP ≤ 1.25 (Class 1) 1.39 (Class 2) 1.67 (Class 3) 2.00 (Class 4)	1 yr (new for HCA) 2 yr (new for non-HCA)
		General corrosion > 50%	1 yr (new for HCA) 2 yr (new for non-HCA)
		ML > 50% at crossing/circumferential/girth weld	1 yr (new for HCA) 2 yr (new for non-HCA)
		Gouge or groove > 12.5%	1 yr (new for HCA) 2 yr (new for non-HCA)
		Any indication of crack or crack-like defect that is not an immediate condition	1 yr (new for HCA) 2 yr (new for non-HCA)

6. NPRM Proposed Repair Criteria

Existing Anomaly Type HCA Only	Existing Timing HCA Only	NPRM Anomaly Type Applies to both HCA and Non-HCA	NPRM Timing Applies to both HCA and Non-HCA
Bottom Side Dent (BSD) > 6%	Monitored Condition	Same for HCAs; New requirements for non-HCAs	
TSD > 6%; analysis demonstrates critical strain levels not exceeded	Monitored Condition		
Dent > 2% at weld; analysis demonstrates critical strain levels not exceeded.	Monitored Condition	Same for HCAs N/A for non-HCAs	

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- Revise the rule to provide separate requirements for ILI anomaly 'response' and 'repair' ('remediation').
- **PHMSA**: the long-standing integrity management (IM) rule allows operators up to 180 days after completion of the ILI assessment to perform any analysis needed to declare 'discovery' of defects based on ILI anomalies identified.
- The IM rule also requires prompt repair of discovered defects on a defined schedule based on the severity of the discovered defect.
- PHMSA believes 180 days is adequate timeframe for initial response to ILI results.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- Revise the rule to provide separate requirements for ILI anomaly 'response' and 'repair' ('remediation').
- **PHMSA**: In the proposed rule, PHMSA has proposed to revise the IM rule to allow operators to submit a notification to PHMSA when more than 180 days is needed for initial response. The same standard would apply in non-HCAs, except a notification would not be required.
- Once the 'as-called' defect has been declared to be an immediate or one-year condition (i.e., 'discovery'), the defect must be presumed to require repair (based on the best available information and analysis of the ILI data). (cont.)

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- Revise the rule to provide separate requirements for ILI anomaly 'response' and 'repair' ('remediation').
- **PHMSA**: (cont.)
- At the time of discovery, the operator must schedule the anomaly for excavation and repair (also a pressure reduction is put in place for immediate conditions).
- The rule allows operators to re-characterize the defect as one that does not require repair based in-the-ditch direct measures.
- Revising the rule language to address 'response' and 'repair' in different paragraphs would not alter the timeline for discovery, excavation, and repair. This approach has been in place since the inception of the IM rule since 2003.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- Allow sound engineering judgment or conservative assumptions. Requiring 192.607 to verify information without TVC records for all repairs and pressure reductions is impractical. TVC records are appropriate for MAOP reconfirmation but not for repair response decision-making.
- **PHMSA**: Determination of predicted failure pressure (PFP) in response to detection of pipeline defects is closely related to MAOP. If pipe could fail at pressures below or near MAOP, the operational MAOP safety limit to protect the pipeline is compromised. The Act Section 23 requirement to verify records was broader: "*The purpose of the verification shall be to ensure that the records accurately reflect the physical and operational characteristics of the pipelines …*". [emphasis added] (cont.)

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- **PHMSA**: (cont.)
- Calculation of PFP should be based on known physical characteristics, that are substantiated and documented on TVC records.
- However, the intent of the proposed rule is to allow operators to conservatively use material strength for Class A pipe (SMYS of 30,000 psi) if SMYS is unknown.
- PHMSA also recognizes that, in cases where TVC records are not available, operators must have a basis for grading the ILI logs.
- PHMSA suggests allowing operators to use the information upon which the current MAOP is based until properties can be verified using the material documentation process specified in 192.607.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- Use of class location safety factors for calculation of a short term pressure reduction as a safety precaution in response to an immediate condition is too conservative.
- **PHMSA**: suggests modifying 192.713(d)(2) to strike the phrase "the lower of." The effect would be that operators would not always be required to use the class location factors when determining the amount of pressure reduction. Operators may choose to use either:
  - Calculated safe operating pressure based on Class Location,
  - 80% of the operating pressure at the time of discovery, or
  - 1.1 times the predicted failure pressure (based upon situational safety impacts to public/operator personnel).

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Comments on Specific Repair Criteria

DENTS

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- PHMSA should allow operators to use ECA to evaluate dents.
- **PHMSA**: the original repair criteria for dents were developed in the early 2000s timeframe for both HL and gas integrity management rules.
- Both ILI technology and analytical techniques to assess dents have advanced significantly since that time. PHMSA has gained confidence in applying ECA techniques to analyze dent defects through recent application of dent ECA in special permits.
- Consistent with applying proven analytical techniques to evaluate corrosion metal loss and cracking defects, PHMSA suggests including a dent ECA procedure in the final rule as shown on the next slide.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- **PHMSA: Summary of suggested ECA for Denting:**
  - Evaluate potential threats for the pipe segment in the vicinity of the dent including movement, loading, and cathodic protection;
  - Review HR-MFL and HR-Deformation inline inspection data for damage in the dent area and any associated weld region;
  - Perform pipeline curvature-based strain analysis using recent HR-Deformation inspection data;
  - Compare dent profile between the recent and past HR-Deformation inspections to identify significant changes in dent depth and shape; (cont.)

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- **PHMSA**:
  Summary of suggested ECA for Denting (cont.)**:**
  - Identify and quantify all loads acting on the dent for a basis for ECA;
  - Evaluate strain level associated with dent and any welds using Finite Element Analysis (FEA), and calculate the plastic strain limit damage factors to infer the possibility of a crack;
  - Estimate the fatigue life of the dent using FEA with the operational pressure data and different fatigue life prediction models, which must have reassessment safety factor of 2.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- PHMSA should allow operators to use ECA to evaluate dents.
- **PHMSA**: (cont.)
  PHMSA suggests that operators be allowed (but not required) to use ECA analysis for the following dent-related repair criteria:
  - Dent with indication of metal loss, cracking, or stress riser
  - Smooth topside dent > 6% diameter (or 0.50 in. deep for D<NPS12)
  - Dent > 2% diameter (or >0.25 in. deep for D<NPS12) that affects pipe curvature at a girth weld or seam weld
- Dents analyzed by ECA, but shown to not exceed critical strain levels would be included in the repair criteria as Monitored Conditions.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- Repair criteria for dents with metal loss should distinguish between topside and bottom-side dents (similar to the repair criteria for smooth dents).
- **PHMSA**:
  - The dent with metal loss criterion was part of the original integrity management (IM) rule (2003).
  - PHMSA recognizes that topside dents represent the need for a more urgent response than bottom-dents. Some existing HCA dent repair criteria already make this distinction.
  - PHMSA suggests applying this concept to dents with metal loss in non-HCA locations (similar to smooth dents). (cont.)

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- Repair criteria for dents with metal loss should distinguish between topside and bottom-side dents (similar to the repair criteria for smooth dents). (cont.)
- **PHMSA**: (cont.) Also, to reduce unnecessary excavations, PMSA suggests revising this immediate condition as follows:
  - Allow engineering critical assessment (ECA) to analyze dent anomalies with indications of metal loss, cracking or stress riser, and prioritize repair criteria as follows:
  - Immediate: topside defects that exceed critical strain levels,
  - 2 Year: bottom-side that exceed critical strain levels, and
  - Monitored: defects that do not exceed critical strain levels.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- Industry commented that the proposed criterion of a gouge or groove greater than 12.5% of nominal wall thickness is duplicative and addressed by the dent with metal loss and cracking criteria.
- **PHMSA**: acknowledges that the proposed criteria using engineering critical assessment to analyze dents and cracks would adequately address gouges and grooves and suggests deleting this repair criterion on that basis.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Comments on Specific Repair Criteria

CRACKS

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- Delete the definitions of significant crack defects and use the alternative cracking criterion (exclusively) that was proposed by PHMSA at the March 2, 2018 meeting, which is much more practical.
- **PHMSA**: agrees that having the originally proposed definition and an 'alternative' repair criteria could be confusing. To address crack defects, PHMSA suggests:
  - Delete the two definitions (*significant stress corrosion cracking* and *significant seam cracks*) and drop the suggestion to define *significant selective seam weld corrosion*,
  - Consolidate all cracking related repair criteria into a single repair criterion that applies any crack-like defect. (cont.)

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

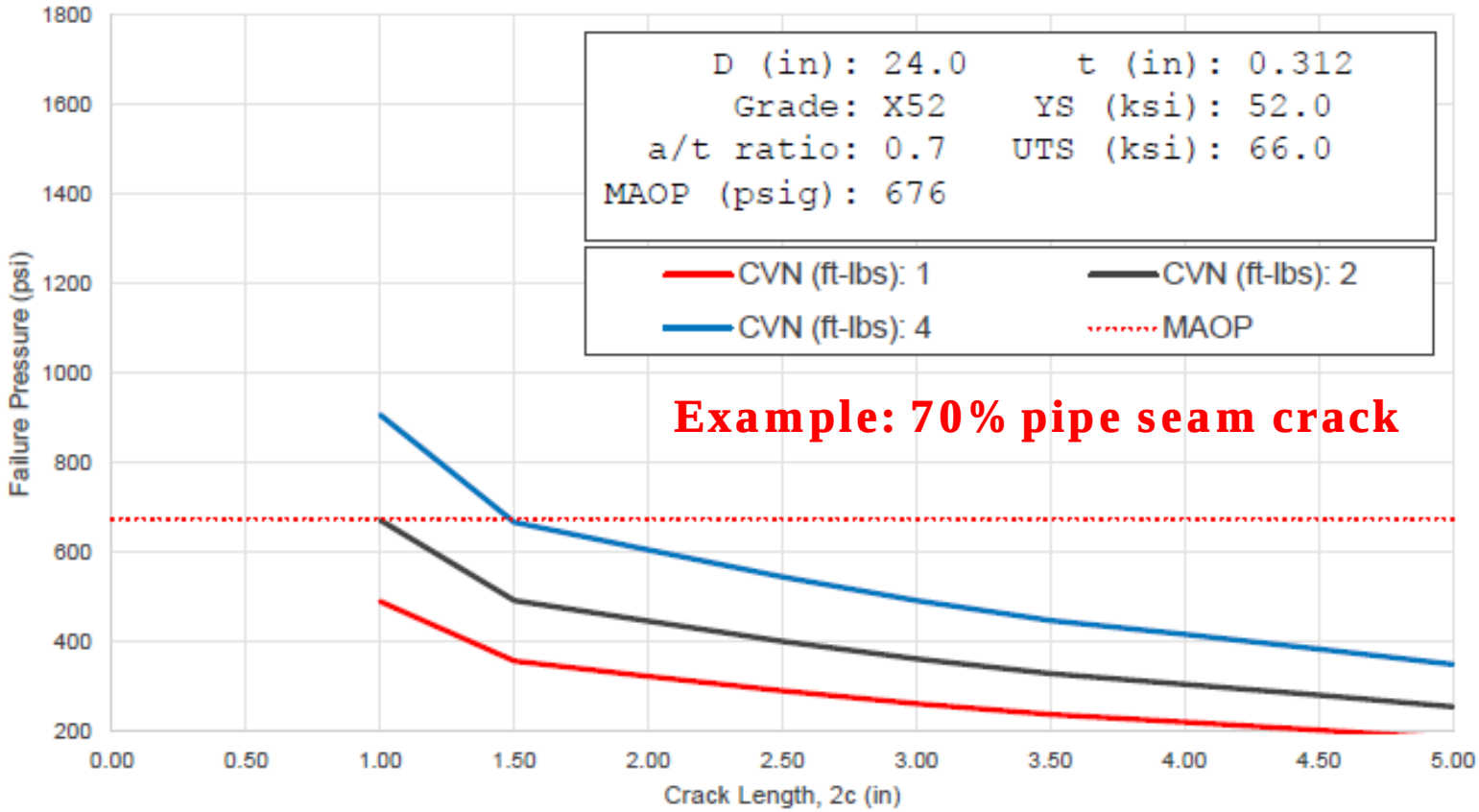
Public/Committee Comments on Repair Criteria (3/2/18):

- Delete the definitions of significant crack defects and use the alternative cracking criterion (exclusively) that was proposed by PHMSA at the March 2, 2018 meeting, which is much more practical.
- **PHMSA**: (cont.)
  - Utilize the alternative criterion PHMSA introduced at the 3/2/18 meeting (which would allow ECA analysis of crack defects).

6. Repair Criteria Revisions
192.485(c); 192.711, 192.713, 192.933

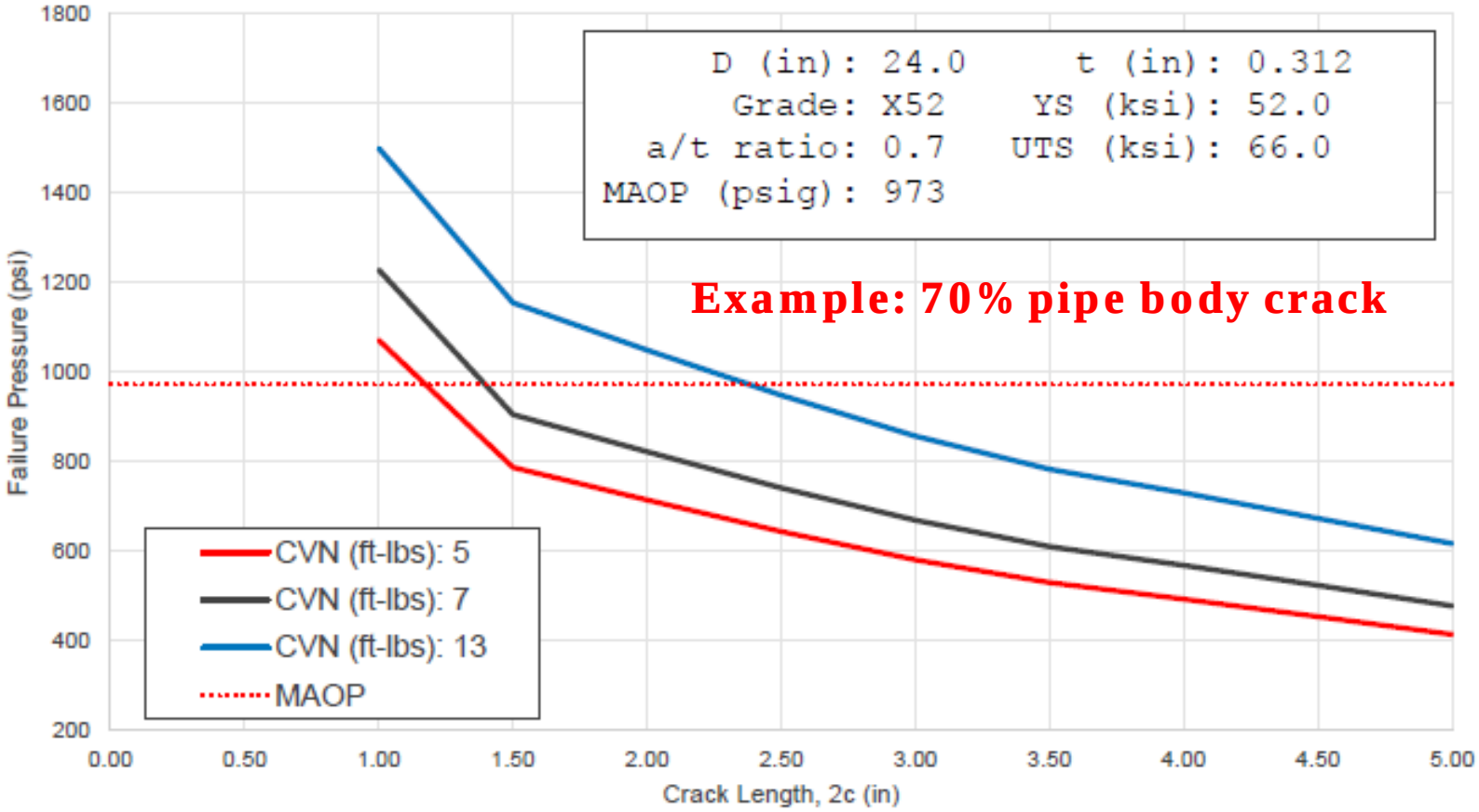
- **Public/Committee Comments on Repair Criteria (3/2/18):**
- Industry commented that PHMSA's proposed criteria for immediate repair of crack defects was too conservative and suggested 70% crack depth or predicted failure pressure of less than 1.1 x MAOP.
- **PHMSA**: based the proposed immediate repair criteria for cracks on successful application of comparable criteria in special permits.
- PHMSA believes 70% and 1.1 x MAOP do not provide an adequate safety margin.
  - ILI tools for detection of cracks do not have the precision needed to allow through wall cracks slightly < 70% or a calculated PFP slightly > 1.1 x MAOP to be treated as 1-yr (HCA)/2-yr (non-HCA) conditions.
  - Cracks can grow very rapidly.
  - Material properties can have a dramatic affect on safe pressures, as illustrated on the next slide.

6. Repair Criteria Revisions
192.485(c); 192.711, 192.713, 192.933



Effect of changing CVN on PFP of crack in Pipe Seam
(Class 3/MAOP = 676 psig)

2. MAOP Reconfirmation
2C. 192.624(c)(3) – Method 3
2D. 192.624(d) – Fracture Mechanics



Effect of changing CVN on PFP of crack in Pipe Body

(Class 1/MAOP = 973 psig)

6. Repair Criteria Revisions
192.485(c); 192.711, 192.713, 192.933

- **Public/Committee Comments on Repair Criteria (3/2/18):**
- Industry commented that PHMSA's proposed criteria for immediate repair of crack-like defects was too conservative and suggested 70% crack depth or predicted failure pressure of less than 1.1 x MAOP.
- **PHMSA**: (cont.) Based on successful application of comparable cracking criteria, PHMSA suggests the following crack criterion for an immediate condition:
  - (A) Crack depth plus metal loss > 50% of pipe wall thickness; or
  - (B) Crack depth plus any corrosion is greater than the inspection tool's maximum measurable depth; or
  - (C) The crack anomaly is determined to have (or will have prior to the next assessment) a predicted failure pressure (determined in accordance with the ECA fracture mechanics procedure) that is less than 125% of the MAOP.

6. Repair Criteria Revisions
192.485(c); 192.711, 192.713, 192.933

- **Public/Committee Comments on Repair Criteria (3/2/18):**
- Industry commented that PHMSA's proposed criteria for 1 yr/2 yr repair of crack-like defects was too conservative and suggested 50% crack depth or predicted failure pressure of less than 1.25 x MAOP.
- **PHMSA**: (cont.) Based on successful application of comparable cracking criteria, PHMSA suggests the following crack criterion for a 1 Yr (HCA)/2Yr (non-HCA) condition:
  - (A) Crack depth plus metal loss > 50% of pipe wall thickness; or
  - (B) The crack anomaly is determined to have (or will have prior to the next assessment) a predicted failure pressure (determined in accordance with the ECA fracture mechanics procedure) that is less than 1.39 times MAOP (100% SMYS) for Class 1 locations, or 1.5 times MAOP for Class 2, 3 and 4 locations, as appropriate.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Comments on Specific Repair Criteria

CORROSION METAL LOSS

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **Public/Committee Comments on Repair Criteria (3/2/18):**
- With the new repair criteria in 192.713 for corrosion defects, the corrosion repair requirements in 192.485(c) are duplicative, have the potential to create confusion, and should be deleted.
- **PHMSA**: the longstanding corrosion repair requirements are needed to address the repair of corrosion defects on all transmission lines. The new repair requirements proposed in the NPRM have limited applicability (192.711 & 192.713 only apply to lines ≥ 40% SMYS; and 192.933 only applies to HCA).
  - PHMSA suggests retaining the corrosion repair requirements in 192.485 as proposed in the NPRM. However, PHMSA would also suggest including reference to 192.712 for evaluating corrosion in proximity to cracks or crack-like defects and for operators to make and retain records.

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **Public/Committee Comments on Repair Criteria (3/2/18):**
- The proposed criteria of corrosion >50% of wall thickness is redundant to other repair criteria for evaluating corrosion metal loss defects using accepted analysis techniques (e.g., B31G and RSTRENG).
- **PHMSA**: acknowledges that corrosion metal loss is addressed in other criteria within the 1-yr (HCA)/2-yr (non-HCA) repair criteria and suggests deleting this criterion based on retention of the 1-yr/2-yr repair criterion for corrosion metal loss (addressed later).

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **Public/Committee Comments on Repair Criteria (3/2/18):**
- Industry commented that the proposed criterion below is too conservative and duplicative of other corrosion repair criteria
  - Predicted metal loss greater than 50% of nominal wall that is located at a crossing of another pipeline, or is in an area with widespread circumferential corrosion, or is in an area that could affect a girth weld.
- **PHMSA**: believes this criterion is appropriate as a 1-yr/2-yr condition, because the circumstances described represent higher risk.
  - Crossings with other pipelines are locations at which corrosion can grow faster than expected.
  - Deep corrosion in an area of widespread corrosion is indicative of an active, significant corrosion growth mechanism.
  - Corrosion affecting a girth weld weakens the weld.

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **Public/Committee Comments on Repair Criteria (3/2/18):**
- Industry made the following comments related to the proposed criteria of corrosion metal-loss affecting a detected longitudinal seam, if that seam was formed by direct current or low-frequency or high frequency electric resistance welding or by electric flash welding:
  - The criterion should not apply to high-frequency ERW pipe
  - The criterion should clarify that the corrosion *preferentially* affects the long seam
  - Allow engineering critical assessment to analyze such defects to avoid unnecessary excavations.
- **PHMSA**: (cont.)

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **Public/Committee Comments on Repair Criteria (3/2/18):**
- Industry comments related to the proposed criteria of corrosion metal-loss affecting a longitudinal seam (cont. from previous slide)
- **PHMSA**: suggests allowing (but not requiring) ECA analysis for the evaluation of corrosion metal loss affecting a long seam in 192.712. If PFP is less than 1.25 x MAOP, the anomaly would be an immediate condition.
- Scheduled conditions would be based upon being less than the reciprocal of Class Location Design Factor.
- PHMSA suggests inserting the word 'preferentially' to assure that this criterion would not be applied to small corrosion pits near a long seam. It would only apply to corrosion along the seam that could lead to slotting-type, crack-like defects.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- Use of class location safety factors for 1-yr (HCA) and 2-yr (non-HCA) repair criteria is inconsistent with ASME B31.8S, Figure 4.
- **PHMSA**: PHMSA's goal is to reduce the rate of immediate repair conditions. PHMSA suggests replacing reliance on Figure 4 with the class location based safety factors for one-year conditions (HCAs) and two-year conditions (non-HCAs).
- B31.8S, Section 7, Figure 4, allows operators to not repair scheduled anomalies until the defect has grown to the level of an immediate indication. *"Indications in the scheduled group are suitable for continued operation without immediate response provided they do not grow to critical dimensions prior to the scheduled response."* (cont.)

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public/Committee Comments on Repair Criteria (3/2/18):

- Use of class location safety factors for 1-yr (HCA) and 2-yr (non-HCA) repair criteria is inconsistent with ASME B31.8S, Figure 4.
- **PHMSA**: (cont.) By not repairing anomalies until they grow to critical dimensions for an immediate condition, many anomalies could grow until they use up much of the safety margin and become immediate conditions.
- PHMSA believes this is a contributing factor in explaining why the immediate repair rate has not dropped after completion of baseline assessments - scheduled conditions are allowed to grow until they become an immediate condition.
- This is illustrated on the slides that follow.

ASME B-31.8S - 2004

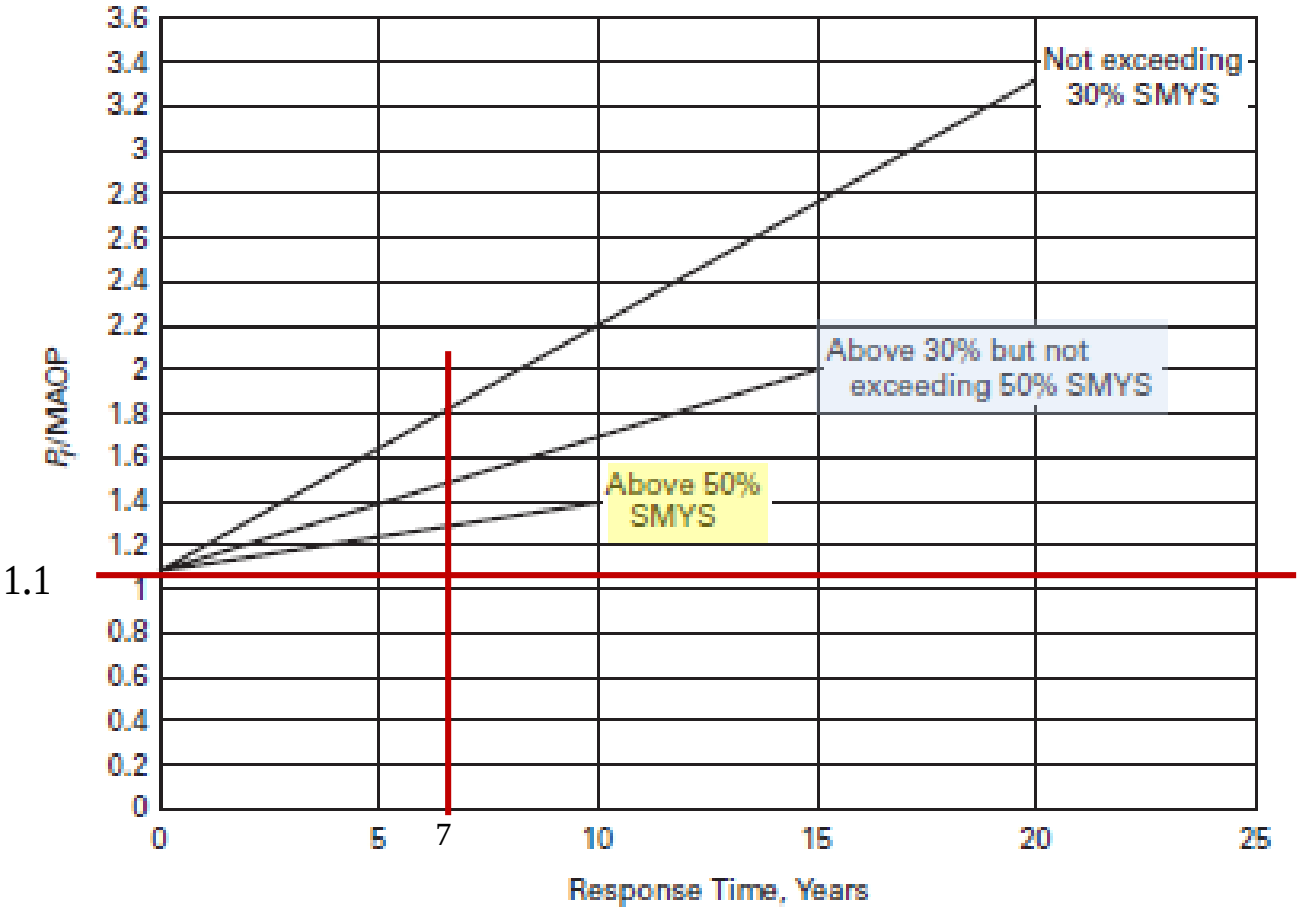


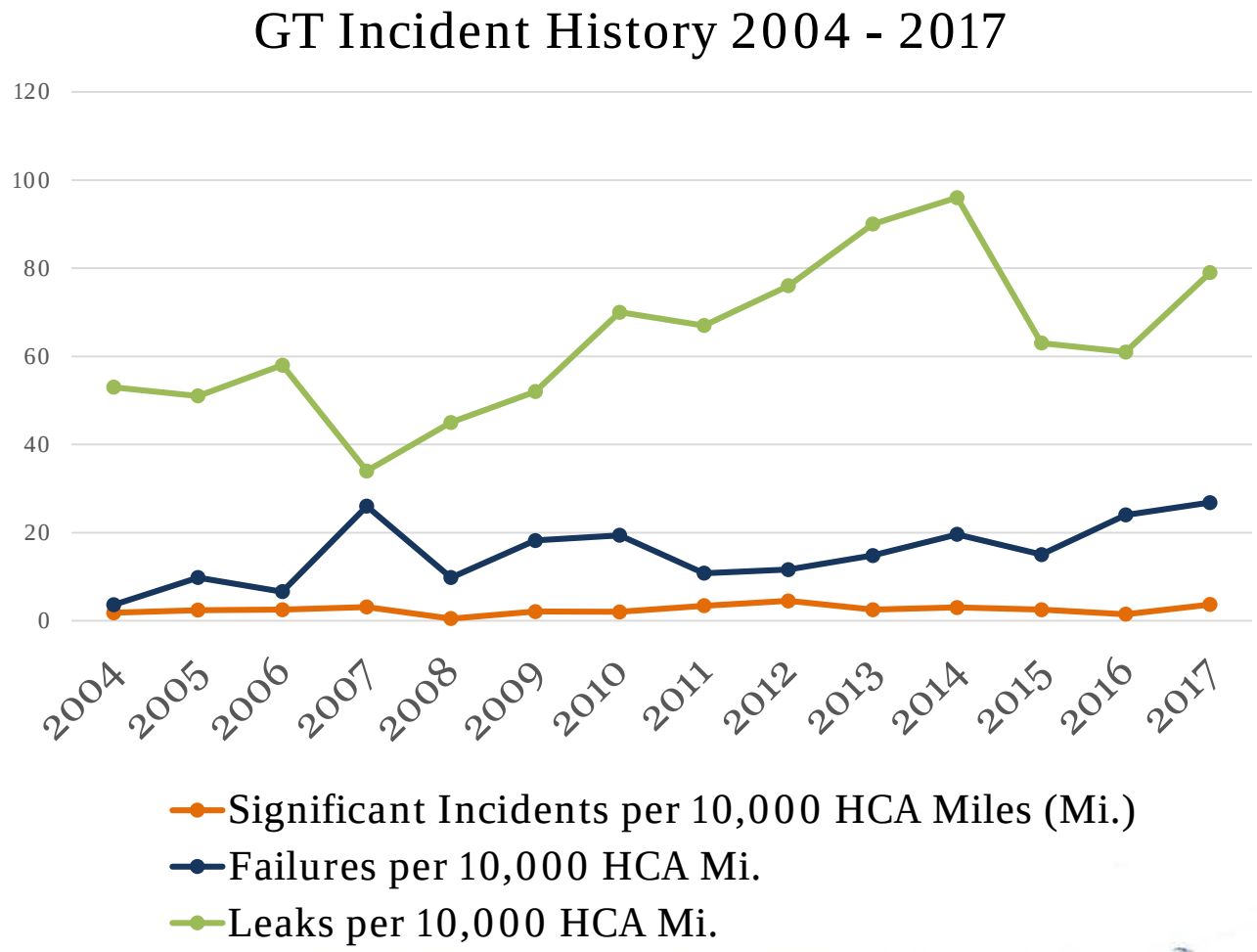
Fig. 4 Timing for Scheduled Responses: Time-Dependent Threats, Prescriptive Integrity Management Plan

6. Repair Criteria Revisions
192.711, 192.713, 192.933

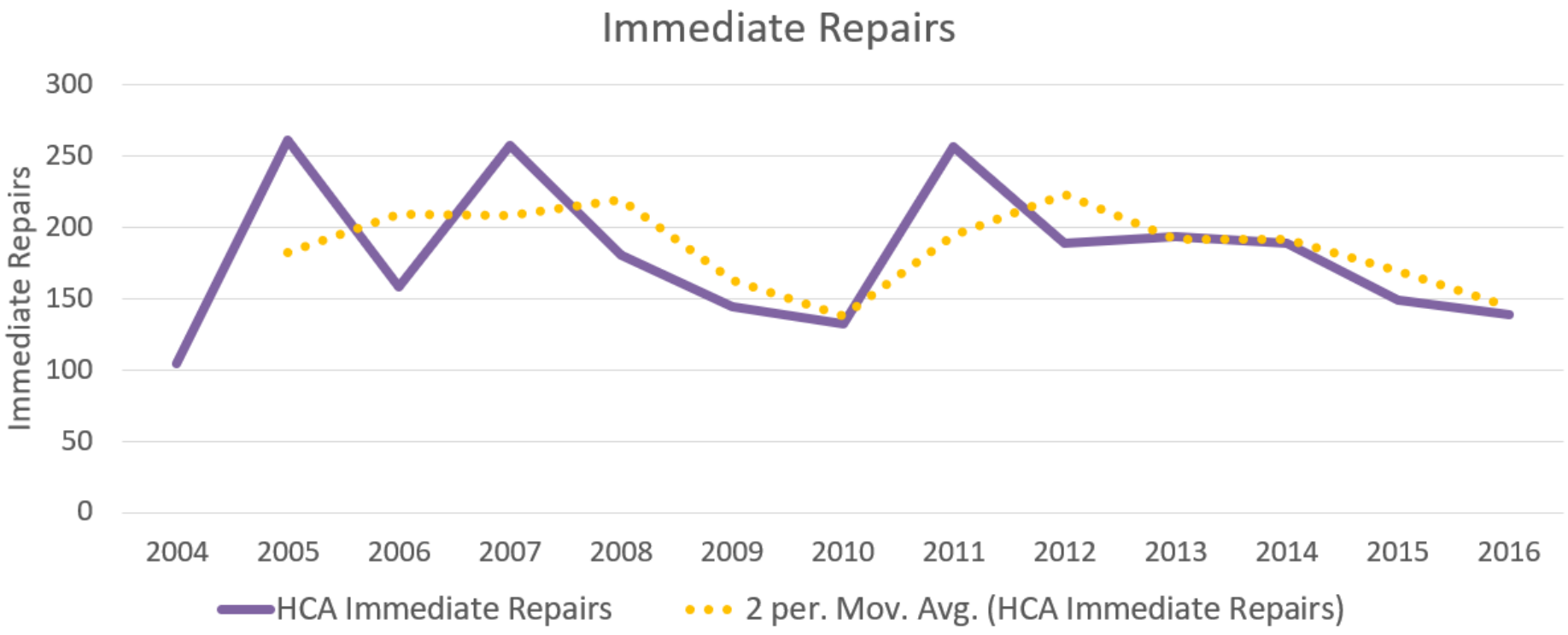
Class Location	Metal Loss Severity (PFP)	Proposed Repair Criterion	Response Time per Fig. 4 (Yr)
Class 1	1.25 x MAOP	1 Yr (HCA) OR 2 Yr (non-HCA)	1.36 – 5.0
Class 2	1.39 x MAOP		2.64 – 9.67
Class 3	1.67 x MAOP		5.18 – 10.0
Class 4	2.00 x MAOP		8.18 – 15.0

- PHMSA, in the NPRM, has proposed criteria that would require an operator, upon running an ILI tool or other assessment technology, to assure that anomalies are repaired before they grow to an immediate condition before the next assessment.

6. Repair Criteria Revisions
192.711, 192.713, 192.933

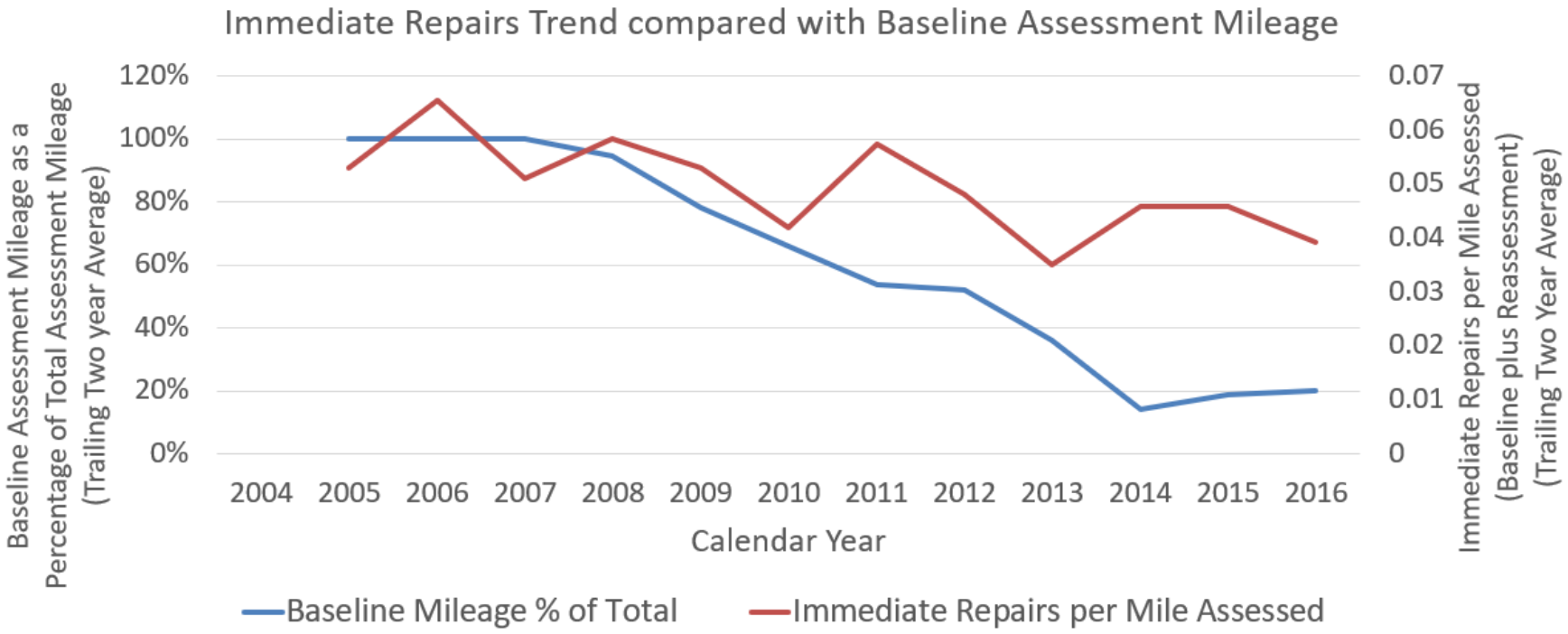


6. Repair Criteria Revisions
192.711, 192.713, 192.933



6. Repair Criteria Revisions
192.711, 192.713, 192.933

- **PHMSA** has also noted that the trend in immediate repairs (red) has not decreased commensurate with the conclusion of the baseline assessments (blue) at the end of 2012.



6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

A summary of the changes PHMSA is proposing to the <u>specific repair criteria</u> is provided on the following slides

6. Proposed Repair Criteria (REVISED)

Proposed Repair Criteria NPRM	Proposed Repair Criteria Revised for Final Rule
Immediate Conditions (HCA & non-HCA)	
PFP ≤ 1.1 x MAOP	PFP ≤ 1.1 x MAOP
Dent w/Metal Loss (ML), cracking, or stress riser	Topside Dent w/ML, cracking, or stress riser unless ECA demonstrates critical strain levels not exceeded
Metal loss >80%	Metal loss >80%
Metal loss affecting DC/LF/HF ERW/EFW seam	Metal loss preferentially affecting DC/LF/HF-ERW/EFW seam unless PFP exceeds 1.25 x MAOP
Significant SCC & Significant Seam Cracking	Crack or Crack-like defect (i) ≥ 50% wt, (ii) exceeds detection limit of ILI tool, or (iii) PFP < 1.25 x MAOP
Any other anomaly requiring immediate action	Any other anomaly requiring immediate action

6. Proposed Repair Criteria (REVISED)

Proposed Repair Criteria NPRM	Proposed Repair Criteria Revised for Final Rule
Scheduled Conditions (HCA - 1 Yr. / Non-HCA – 2 Yr.)	
N/A	Bottom-side Dent w/ML, cracking, or stress riser unless ECA demonstrates critical strain levels not exceeded
Topside smooth dent > 6%	Topside smooth dent > 6% unless ECA demonstrates critical strain levels not exceeded
Dent > 2% at girth or seam weld	Dent > 2% at girth or seam weld unless ECA demonstrates critical strain levels not exceeded
PFP ≤ 1.25 (Class 1); 1.39 (Class 2); 1.67 (Class 3); 2.00 (Class 4)	PFP ≤ 1.25 (Class 1); 1.39 (Class 2); 1.67 (Class 3); 2.00 (Class 4)
N/A	Metal loss preferentially affecting DC/LF/HF ERW/EFW seam if PFP < 1.39 x MAOP (Class 1) or is < (Recip. of Class Location Factor) x MAOP (Class 2, 3, & 4)

6. Proposed Repair Criteria (REVISED)

Proposed Repair Criteria NPRM	Proposed Repair Criteria Revised for Final Rule
Scheduled Conditions (HCA - 1 Yr. / Non-HCA – 2 Yr.) - Continued	
ML > 50% at crossing/ circumferential/girth weld	ML > 50% at crossing/ circumferential/girth weld
Gouge or groove > 12.5%	[Deleted]
General corrosion > 50%	[Deleted]
Any indication of crack or crack-like defect that is not an immediate condition	Crack or Crack-like defect (i) ≥ 50% wt, (ii) PFP < 1.39 x MAOP (Class 1) or 1.5 x MAOP (Class 2, 3, 4)
Monitored Conditions (HCA & non-HCA)	
Bottom Side Dent (BSD) > 6%	Bottom Side Dent (BSD) > 6%
TSD > 6%; analysis demonstrates critical strain levels not exceeded	TSD > 6%; analysis demonstrates critical strain levels not exceeded

6. Proposed Repair Criteria (REVISED)

Proposed Repair Criteria NPRM	Proposed Repair Criteria Revised for Final Rule
Monitored Conditions (HCA & non-HCA) - continued	
Dent > 2% at girth or long seam weld; analysis demonstrates critical strain levels not exceeded.	Dent > 2% at girth or long seam weld; and ECA demonstrates critical strain levels not exceeded. [same for HCA; added for non-HCA]
N/A	A dent that has metal loss, cracking or a stress riser and ECA demonstrates critical strain levels not exceeded.
N/A	Metal loss preferentially affecting DC/LF/HF ERW/EFW seam and PFP ≥ 1.39 x MAOP (Class 1) or (Recip. of Class Location Factor) x MAOP (Class 2, 3, & 4)
N/A	Crack or crack-like anomaly for which fracture mechanics analysis determined a PFP ≥ 1.39 x MAOP (Class 1) or (Recip. of Class Location Factor) x MAOP (Class 2, 3, & 4)

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests that the committee consider a number of revisions to the proposed repair criteria, summarized on the following slides.

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the committee consider:**
- **PHMSA: suggests to Committee**
  - Adding an effective date to 192.711(b)(1) to clarify that 192.713 is not retroactive.
  - In 192.711(a), clarifying that pressure reductions would be required for immediate conditions and in cases where repair schedules cannot be met.

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the committee consider:**

- **PHMSA:** suggests revising 192.711(b):
  - To avoid duplication, refer to 192.713 for repairs and pressure reductions
  - Clarify that 192.713(a) applies to segments not covered under subpart O (i.e., 192.713 applies to non-HCAs)
  - Clarify 192.713(c) to replace the phrase "impairs the serviceability" with reference to the repair criteria in 192.713(d)
  - Revise 192.913(d) to clarify that repair criteria apply to onshore transmission pipelines

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the committee consider:**

- **PHMSA:** suggests revising 192.711(b) to:
  - Revise 192.713(d)(2) to strike "the lower of" and allow pressure reduction to be the calculated safe pressure based on class location or 80% of operating pressure or 1.1 times predicted failure pressure (based upon situational safety to public/operating personnel), and
  - Require that operators document and keep records of the calculations or decisions used to determine the reduced operating pressure, and the implementation of the actual reduced operating pressure for a period of five (5) years.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the committee consider:**
- **PHMSA:** suggests the following revisions
  - When anomalies cannot be repaired in the specified timeframe, clarify that pressure reductions are required comparable to IM requirements (subpart O).
  - Add notification requirements in 192.713 comparable to IM requirements to require that operators notify PHMSA when:
    - It cannot meet the schedule for evaluation and remediation required under §192.713 and cannot provide safety through a temporary reduction in operating pressure or through another action, and
    - A temporary pressure reduction exceeds 365 days.

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the committee consider:**
- **PHMSA**: suggests modifying 192.713(d) and 192.933(d) to require that operators use the following assumed values needed to determine predicted failure pressure (PFP) or pressure reduction, when these values are not known or not documented in TVC records:
  - Specified Minimum Yield Strength (SMYS) – Assume Grade A pipe, or determine material properties under 192.607, or use basis for the current MAOP;
  - Pipe diameter and wall thickness – use basis for current MAOP or determine material properties under 192.607.

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the committee consider:**
  - **PHMSA**: suggests the following:
    - Strike the proposed definitions of *Significant Seam Cracking* and *Significant Stress Corrosion Cracking* in 192.3.
    - Delete the phrase "any indication of" from the repair criteria related to cracking.
    - Combine the repair criteria for stress corrosion cracking and seam cracking.
    - Require that PFP for all time depending cracking anomalies be calculated using the fracture mechanics procedure in 192.712.

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the committee consider:**
- **PHMSA**: suggests adopting the below Cracking Repair Criterion for immediate conditions:
  - Crack depth plus corrosion > 50% of pipe wall thickness;
  - Crack depth plus any corrosion is greater than the inspection tool's maximum measurable depth; or
  - The crack anomaly is determined to have (or will have prior to the next assessment) a predicted failure pressure (PFP) that is less than 1.25 x MAOP

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the Committee consider:**
- **PHMSA**: adopting below Cracking Repair Criterion for 1-yr (HCA) and 2-yr (non-HCA) conditions:
  - Crack depth plus corrosion > 50% of pipe wall thickness
  - The crack anomaly is determined to have (or will have prior to the next assessment) a predicted failure pressure (PFP) that is less than 1.39 times MAOP (for class 1) or 1.50 time MAOP (for classes 2, 3 and 4)
  - Crack anomalies that do not meet either the Immediate or 1-yr/2-yr conditions would be a Monitored Condition.

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the Committee consider:**
- **PHMSA**: suggests allowing (but not requiring) ECA analysis for the following dent-related repair criteria (HCA and non-HCA):
  - Dent with indication of metal loss, cracking, or stress riser
  - Smooth topside dent > 6% diameter (or 0.50 in. deep for D<NPS12)
  - Dent > 2% diameter (or >0.25 in. deep for D<NPS12) that affects pipe curvature at a girth weld or seam weld
  - Dents analyzed by ECA, but shown to not exceed critical strain levels would be Monitored Conditions.

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the Committee consider:**

- **PHMSA**: suggests revising this immediate condition for non-HCAs as follows:
  - Allow engineering critical assessment (ECA) to analyze dent anomalies with indications of metal loss, cracking or stress riser, and prioritize repair criteria as follows:
  - **Immediate**: topside defects that exceed critical strain levels,
  - **2 Year**: bottom-side that exceed critical strain levels, and
  - **Monitored**: defects that do not exceed critical strain levels.

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the Committee consider:**

- **PHMSA:** suggests deleting the following repair criteria (HCAs and non-HCAs):
  - Gouge or groove > 12.5% wt
  - Area of corrosion > 50%

– Revise proposed 192.485(c) to include reference to 192.712 for evaluating corrosion in proximity to cracks or crack-like defects and for operators to make and retain records.

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the committee consider:**
- **PHMSA**: suggests revising the repair criterion for corrosion metal loss affecting a long seam in HCAs and non-HCAs as follows:
  - Allow (but not require) ECA analysis for the evaluation.
  - If PFP < 1.25 x MAOP the anomaly would be an immediate condition
  - If PFP < 1.39 x MAOP (Class 1) or 1.50 x MAOP (Class 2, 3, & 4), the anomaly would be a 1-yr(HCA)/2-yr (non-HCA) condition.
  - If PFP > 1.39 x MAOP (Class 1) or 1.50 x MAOP (Class 2, 3, & 4), the anomaly would be a monitored condition. (cont.)

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the committee consider:**

- **PHMSA**: (cont.) suggests revising the repair criterion for corrosion metal loss affecting a long seam in HCAs and non-HCAs as follows:
  - Insert the word 'preferentially' to assure that this criterion would not be applied to small corrosion pits near a long seam. It would only apply to corrosion along the seam that could lead to slotting-type, crack-like defects.

6. Repair Criteria Revisions
192.485(c); 192.711; 192.713; 192.933

- **In light of public comments received on the NPRM, and committee comments from the March 2, 2018 meeting, PHMSA suggests the Committee consider:**
  - **PHMSA: suggests**
  - Accept the definition of “wrinkle bend”
  - Accept the definition of “hard spot” with minor edits per NPRM comments:
    - *Hard spot* means an area on steel pipe material with a minimum dimension greater than two inches (50.8 mm) in any direction and hardness greater than or equal to Rockwell 35 HRC (Brin~~n~~ell 327 HB or Vickers 345 HV10).

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

Public Comments

6. Repair Criteria
192.485(c); 192.711; 192.713; 192.933

GPAC Discussion

Committee Voting Slides

Meeting Wrap Up

Thank You