Track 4
Anomaly Remediation/Repair

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Attendance Breakdown

Approximate total attendance	**21** persons
Federal Regulators	**1** persons
Pipeline Industry	**8** persons (all Transmission)
Researchers	**9** persons
Other	**3** persons

Top 3 Identified R&D Gaps

Gap #1 – Girth weld repairs of high strength welds: methods to further eliminate cracked girth welds in field situations – type rod usage/welding process, pre-heat, NDE, MFL Tools – [Technology and Consensus Standard]

Gap #2 – Standardized evaluation, selection, installation, and testing of repair methods to improve confidence. [Technology and Consensus Standard]

Gap #3 – Allowable strain limits for dents [Technology]

- What initiates cracks in dents
- What increases SCC susceptibility and fatigue analysis
- Is 2% weld dent really a limit

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Associated Details
(Gap #1)

Girth weld repairs of high strength welds: methods to further eliminate cracked girth welds in field situations – type rod usage/welding process, pre-heat, NDE, MFL Tools

1. New or Improved Technology

a. What pipeline type(s) does the technology target? Steel transmission lines
b. What operating environment(s) would the technology operate? Any high strength weld
c. What are any functionality and or performance requirements? Performance to applicable standards
d. What road blocks or barriers prevent the technology deployment? None
e. What are anticipated targets or timeframes to complete this research? 2-3 years

2. New or Revised Consensus Standards (standards, guidelines or recommend practices)

a. Does the need address safety or specification related consensus standards? Yes
b. Which standard developing organization and which consensus standard name and number is affected? API 1104,
c. What pipeline type(s) does the consensus standard target? Steel transmission
d. What operating environment(s) does the consensus standard target?
e. What technical details are necessary and recommended? See Title
f. Can any targets or timeframes be identified to complete this research? 2-3 years

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Associated Details
(Gap #2)

Standardized evaluation and testing of repair methods to improve confidence.

1. New or Improved Technology

a. What pipeline type(s) does the technology target? All types
b. What operating environment(s) would the technology operate? All
c. What are any functionality and or performance requirements? Permanent restoration of serviceability
d. What road blocks or barriers prevent the technology deployment? Buy-in from vendors; engineering tests & analysis
e. What are anticipated targets or timeframes to complete this research? 1-3 years, depends on repair methods

2. New or Revised Consensus Standards (standards, guidelines or recommend practices)

a. Does the need address safety or specification related consensus standards? Yes
b. Which standard developing organization and which consensus standard name and number is affected? TBD
c. What pipeline type(s) does the consensus standard target? All
d. What operating environment(s) does the consensus standard target? All
e. What technical details are necessary and recommended? Part of development project; address common degradation scenarios
f. Can any targets or timeframes be identified to complete this research? 1-3 years, depends on repair methods

Associated Details
(Gap #3)

Allowable strain limits for dents [Technology]

1. New or Improved Technology

a. What pipeline type(s) does the technology target? Steel transmission

b. What operating environment(s) would the technology operate? All

c. What are any functionality and or performance requirements? Maintenance of pipeline integrity and serviceability

d. What road blocks or barriers prevent the technology deployment? User-friendliness; regulatory requirments

e. What are anticipated targets or timeframes to complete this research? 1-3 years

Additional Identified Gaps

Repair of low toughness seams

- Are concerns for crack initiation in vintage ERW seams under steel sleeves legitimate? [Cat: Alt Rpr]
- Can selective corrosion of seams be repaired by welding? [Cat: Alt Rpr]

Repair of complex shapes [Cat: Alt Rpr, Std Proc]

Reliable methods to repair PE coating damage. [Cat: Alt Rpr]

Additional Identified Gaps

Reliable methods to repair pipeline corrosion and other damage using nonconventional techniques (i.e., not welded sleeve or composite). [Cat: Alt Rpr]

Reliable methods to repair non-PE coating damage. [Cat: Std Proc]

Reinforced Thermoplastic Pipe (RTP) Utilization [Cat: Alt Rpr, Std Proc]

Investigate: materials, connections, fittings, joining methods; shortcomings/failure points; testing, evaluation, standards, approvals for use

Pipeline Rehabilitation Techniques [Cat: Alt Rpr, Std Proc]

new materials – both local and large sections
procedures – pipe splitting, pipe bursting
processes – low cost, environmentally friendly, hard to access

Additional Identified Gaps

Hot tap fittings for large diameter NPS>20, large branch-to-run ratio, high pressure gas or liquid pipelines [Cat: Alt Rpr]

Improved confidence in composite repair methods. [Cat: Std Proc, Alt Rpr]

Develop Data for Composite Pipeline Repair System (CPRS) Testing for Fittings, Flanges, Bends, etc. [Cat: Alt Rpr]

Investigate application of CPRS patches to large diameter (>48”) high pressure vessels, above and below ground [Cat: Alt Rpr]

Effects of bending, axial tension, and cyclic loading on composite performance [Cat: Alt Rpr, Std Proc]

- Moving towards a strain-based design as opposed to a traditional stress-based approach

Composite repair of offshore piping, pipelines, and risers [Cat: Alt Rpr]

Additional Identified Gaps

Software solutions for consistent, user-friendly application of assessment technology.

Interpretation and Guidelines for Application of API 1104; ECD Sep 2009: API-1-2

Undertaking testing to compare and contrast all crack assessment methodologies

Effects of bending, axial tension, and cyclic loading on composite performance

- Moving towards a strain-based design as opposed to a traditional stress-based approach

Additional Identified Gaps

Reliable methods to repair non-PE coating damage.

Hot tap welding guidelines for large diameter NPS>20, large branch-to-run ratio, high pressure gas or liquid pipelines

Reinforced Thermoplastic Pipe (RTP) Utilization

Investigate: materials, connections, fittings, joining methods; shortcomings/failure points; testing, evaluation, standards, approvals for use

Pipeline Rehabilitation Techniques

new materials – both local and large sections
procedures – pipe splitting, pipe bursting
processes – low cost, environmentally friendly, hard to access

Additional Identified Gaps

Proper support and backfill procedures

Use of O-let fittings for hot taps

Need standards for approval, testing and long term NDE. Lead in to further language in B31.8, B31.4, B31.8S and maybe additional clauses in CFR §192.309(b) and §192.713 and § 192.485.

Additional Identified Gaps

Coatings – effective maximum operating temperature for FBE coatings to operate long term at higher temperatures and type application methods to extend temperature ranges

Consider/develop fundamental understanding of mechanical damage

- Tribology of damage process, contact stresses, thermal effects
- Depth of damage zone and its effect
- Define “non-threatening” damage
- Damage tolerance of low-stress pipelines

Additional Identified Gaps

Improve tools to address vintage construction methodologies and materials

- Tools are needed locate & remediate if remnant vintage threats, or to manage their continued service – for both blunt and crack-like defects – axial/circumferential orientation
- Need to bridge gaps between criteria used to make decisions for vintage versus modern line pipe

Standardize methods for determining corrosion rates

Reevaluate Seam Weld Fatigue [

- Appropriate crack growth rate constant
- Appropriate pressure sample rate for pressure signal analysis
- Understand vintage pipe initial quality
- Develop reliability approaches

Additional Identified Gaps

Improve characterization of fitness for service input data for girth welds
- Describe fracture toughness and ductility properties of vintage in-service welds
- Applied stresses associated with loadings

Develop guidelines for investigation and repairs [Cat: Assess]
- Improve pre-excavation evaluation methods for >2% topside dents
- Develop quick ranking process for dent and gouge evaluation