PMHSA R&D Forum
Repair Challenges

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Regulatory Framework

§192.713 Transmission lines: Permanent field repair of imperfections and damages.

(a)Each imperfection or damage that impairs the serviceability of pipe in a steel transmission line operating at or above 40 percent of SMYS must be

(1) Removed by cutting out and replacing a cylindrical piece of pipe; or

(2) Repaired by a method that reliable engineering tests and analyses show can permanently restore the serviceability of the pipe.

(b) Operating pressure must be at a safe level during repair operations.

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Code References

- B31.8 (2007)

  (e) Non-metallic composite wrap repairs are not acceptable for repair of injurious dents or mechanical damage, unless proven through reliable engineering tests and analysis.

- B31.8S (2004) Table 4 Acceptable Threat Prevention and Repair Methods
  - Composite repairs only listed for Corrosion repair

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ILI Analysis Criteria

Immediate Indications – HCA

- Metal loss with Pf/MAOP < 1.25
- Metal loss with a depth > 70% of w.t.
- Any dent that has an indication of metal loss, cracking, or a stress riser
- Metal-loss indications localized to the long seam for LF ERW or EFW welds
- All indications of Category 3 stress corrosion cracks

Urgent Indications – same as Immediate but non-HCA

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ILI Analysis Criteria

One Year Indications – HCA

- A smooth dent located between 8 o'clock and 4 o'clock with a depth greater than 6%
- A dent with a depth greater than 2% associated with a girth weld or longitudinal seam

Scheduled Indications – All

- Follow Fig 4 guidelines (eg. Class 1 Pf/MAOP < 1.39)
- Applies where corrosion rates are acceptable
- Option to perform detailed growth analysis
- After detailed analysis the following may be added
  - Dents > 6%, Dents on welds, metal loss > 40% in casings or on welds, internal corrosion on bottom of pipe, bulges, hard spots, mill defects

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ILI Analysis Criteria

Monitored Conditions - HCA

- A smooth dent located on lower 1/3 of pipe with a depth > 6%
- A smooth dent located on upper 2/3 of pipe with a depth > 6% with a documented Engineering Strain Analysis
- A dent with a depth > 2% of the pipe diameter associated with a girth weld or longitudinal seam with a documented Engineering Strain Analysis.

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Repair and Maintenance

- Many pipelines in operation since early 1940ties.
- Ageing infrastructure requires repairs sometimes in very challenging environments and gas supply constraint areas
  - Pipe damage during excavation is always a potential threat.
  - Cut outs create undesirable gas emissions, gas venting or flaring.
- Steel sleeves and cut outs considered permanent, but emerging technology looking to replace them
- Need to strive for wider use of less restrictive repair methods.

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Repair Challenges

- Need for repair techniques that:
  - allow less constraints for pipeline outages, are less labor intensive, faster return to service time, less reliance on highly skilled labor.
  - Expand use of composite repairs to complex defects, wrinkles and wrinkle bends, branch connections even girth weld defects.
- Some of the research currently addressed by PRCI composite repair program (Chris Alexander will talk about it in more detail) but more needs to be done.
- 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

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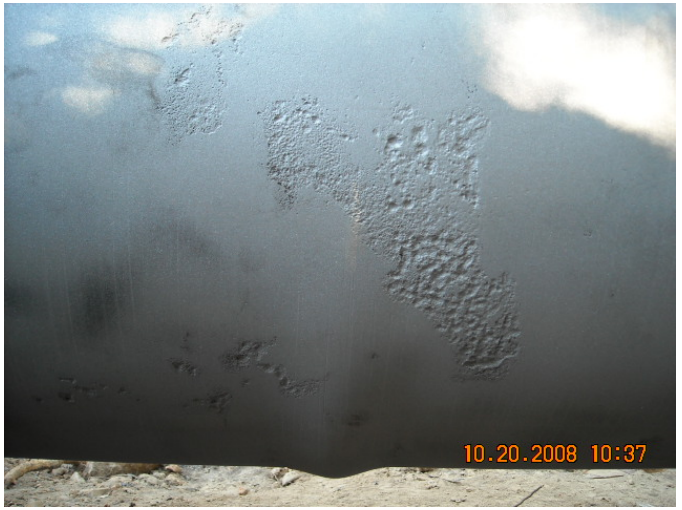
Composite Repairs

Composites

- Easy to install
- No restriction on geometry to repair dents, wrinkles buckles branch connection all possible
- Often less than 2 hrs to install and less restriction on return to service time
- Many testing programs to date allow wider use



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Repair of Leaks and Cracks

- Type B - Full encirclement split sleeves with welded ends, in lieu of replacement, is recommended for pipes containing leaks or cracks or crack like defects that are not removed by grinding
- It is becoming difficult to find welders that are qualified to weld on live pipelines. Repairs typically takes a full day to complete the welds.

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In-Service Welding Challenges

- Concern for type B sleeves has always been the circumferential fillet welds
  - toe cracking, under bead cracking
  - carrier pipe stresses
  - Hydrogen cracking
- Welding techniques and use of UT inspection techniques have enabled us to use these assemblies where design requires but challenges remain.
- Improved welding procedure or process ideally automated to eliminate potential issues is desired. Initial work done at EWI, but never fully developed or tested.

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Needed/Challenges summary

- Expand use of composite repairs to complex defects, wrinkles, wrinkle bends, branch connections, girth weld defects and class upgrades.
  - Need formal approval process and additional language in B31.8, B31.8S, B31.4 and likely CFR 192 and other standards (ISO or ASTM).
  - NDE protocols and accept/reject criteria for old composite repair installations.
- For in service welding and type B sleeves – need improved welding procedures and processes to eliminate potential issues with circumferential filet welds.

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Thank You

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