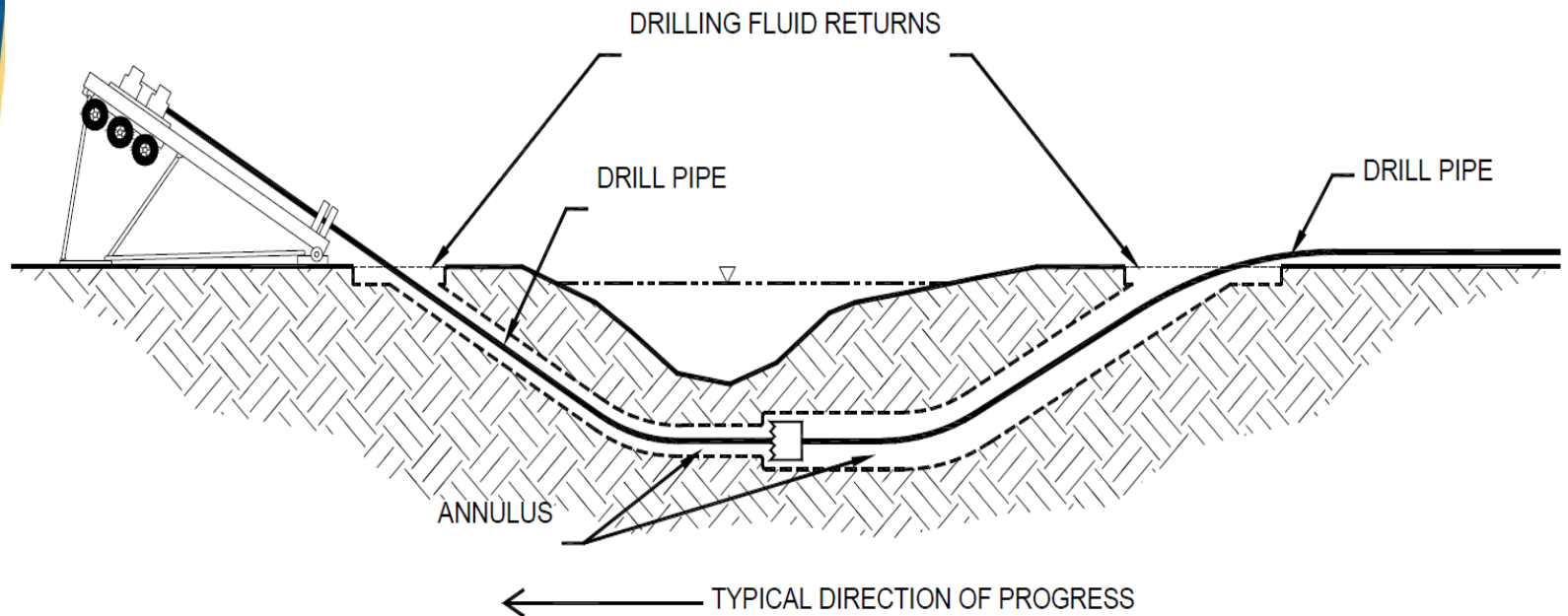


The Hidden Damage Done (HDD?)



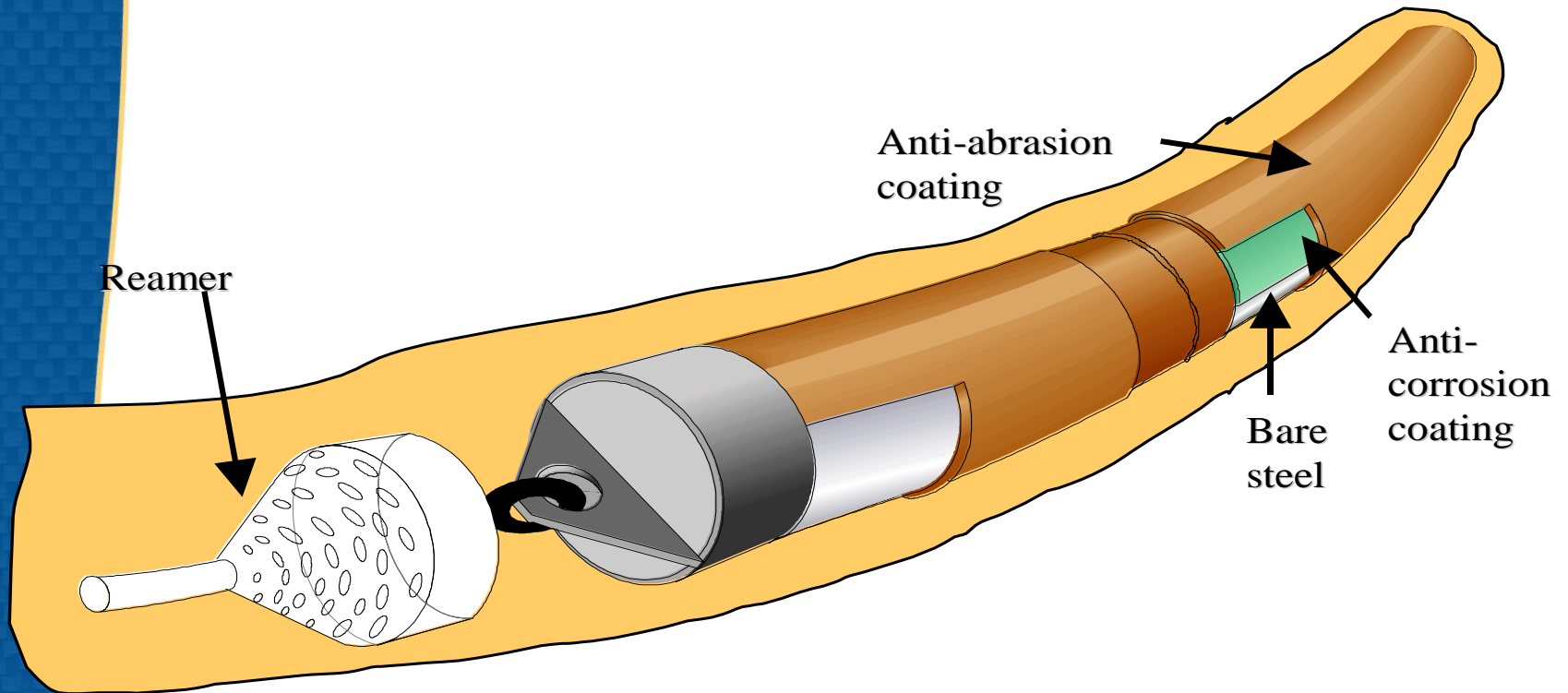
Horizontal Directional Drill



WHY USE HDD

- Inaccessible area for trenching
 - Structures, geography, population
- Used at river crossings, beneath buildings, under roadways, railroad tracks, etc.

HDD INSTALLATIONS

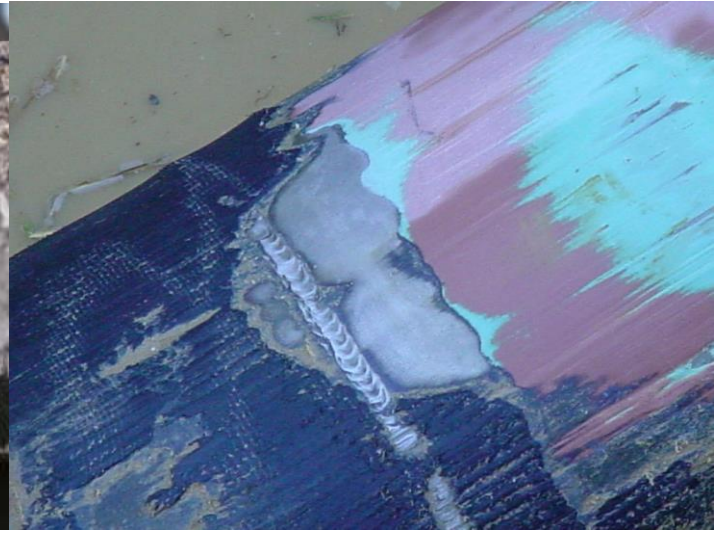


COATING DAMAGE

THE REASON

- ◆ **Gouge**
- ◆ **Abrasion**
- ◆ **Impact**
- ◆ **Bending load**
- ◆ **Installation method**

HDD Coating Damage



WHY DOES IT MATTER

- Corrosion is the #1 cause of pipeline incidents
- Corrosion coatings are the primary defense
- Most coating damage starts at the weld

WHY DOES IT MATTER

Identification of HCAs for hazardous liquid pipelines focus on *populated areas, drinking water sources, and unusually sensitive ecological resources.*

49 CFR 192.455 External corrosion control: Buried or submerged pipelines

(a) Except as provided in paragraphs (b), (c), and (f) of this section, each buried or submerged pipeline installed after July 31, 1971, must be protected against external corrosion, including the following:

- (1) It **must have an external protective coating** meeting the requirements of § 192.461.
- (2) It must **have a cathodic protection system** designed to protect the pipeline in accordance with this subpart, installed and placed in operation within **1 year** after completion of construction.

§ 192.461 External corrosion control: Protective coating.

(a) Each external protective coating, whether conductive or insulating, applied for the purpose of external corrosion control must -

- (1) Be applied on a properly prepared surface;
- (2) Have sufficient adhesion to the metal surface to effectively resist under film migration of moisture;
- (3) Be sufficiently ductile to resist cracking;
- (4) Have sufficient strength to resist damage due to handling and soil stress; and
- (5) Have properties compatible with any supplemental cathodic protection.

(b) Each external protective coating which is an electrically insulating type must also have low moisture absorption and high electrical resistance.

(c) Each external protective coating **must be inspected just prior to lowering** the pipe into the ditch and backfilling, and any damage detrimental to effective corrosion control must be repaired.

(d) Each external protective coating must be protected from damage resulting from adverse ditch conditions or damage from supporting blocks.

(e) **If coated pipe is installed by boring, driving, or other similar method, precautions must be taken to minimize damage to the coating during installation.**

Industry Steps Forward

- TG 352, "Coatings Systems (External) for Pipeline Directional Drill Applications,"
- PHMSA - MEGA RULE -a revision to CFR 192 and 195
 - enhanced corrosion control requirements, including CIPS, post construction surveys for coating damage, and interference current surveys

ASSESSMENT OF HDD COATING CONDITION

- Pulling a sacrificial section joint through prior to pullback
- Use of DCVG or ACVG to gauge the extent and location of damage
- Visual or Holiday inspection on protruding pipe
- Monitor CP current requirements and coating conductance to determine %bare area after installation

PRCI Guidance

| Test Conditions | %Bare (PB) | Visual Inspection | Status |
|---------------------|--------------|-------------------|---------------------------|
| Unstable Potentials | N/A | Pass | Pass |
| | | Borderline | Suitable for monitoring |
| | | Poor | Scheduled Action Required |
| Stable Potentials | PB<0.01 | Pass | Pass |
| | | Borderline | Suitable for monitoring |
| | | Poor | Scheduled Action Required |
| | 0.01<PB<0.05 | Pass | Suitable for monitoring |
| | | Borderline | Suitable for monitoring |
| | | Poor | Scheduled Action Required |
| | 0.05<PB<1 | Pass | Scheduled Action Required |
| | | Borderline | Scheduled Action Required |
| | | Poor | Scheduled Action Required |
| | PB>1 | Pass | Scheduled Action Required |
| | | Borderline | Scheduled Action Required |
| | | Poor | Immediate Action Required |

On the surface it appears to be a good rational for taking action, that is until you read what the actions mean.

- **A. Suitable for Monitoring** -This coating damage is of low importance. A properly maintained CP system generally provides long-term protection to these areas of exposed steel. These locations shall be recorded and short close interval potential surveys (**CIPS**) shall be conducted during the commissioning of the temporary and/or the permanent CP system **to confirm that the line is fully protected.**
- **B. Scheduled Action Required** - The amount of exposed steel in such a crossing indicates that it may drain a significant amount of protection current and affect the protection level of the pipe. Additional testing (i.e., current requirement test and soil resistivity measurements) shall be conducted in order to design and implement remedial **work to restore the protection level.** The design calculations shall be documented in a calculation note and the implementation of the remedial work shall be documented.

PRCI Guidance

| Test Conditions | %Bare (PB) | Visual Inspection | Status |
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| | | Poor | Immediate Action Required |

40 Feet *12 = 480 inches

480" X 0.01 = 4.8" Bare Steel

IS THIS OKAY?!



CONSIDERATIONS FOR EXTERNAL COATINGS

- Standard performance tests for carrier pipe coating are insufficient
- Coating must also be rated for resistance to damage during HDD installation
- System should be compatibility with CP

SUMMARY

- HDD installations are now commonplace and are part of every major pipeline
- HDD installations vary greatly in type, size, and conditions
- Ordinary pipeline coatings do not hold up well to HDD installations
- Selection of coatings should be dependent upon the specific HDD project
- Accurate assessment of coating condition after installation is difficult
- Coating failures are **expected** so CP systems must be adequate to protect pipe

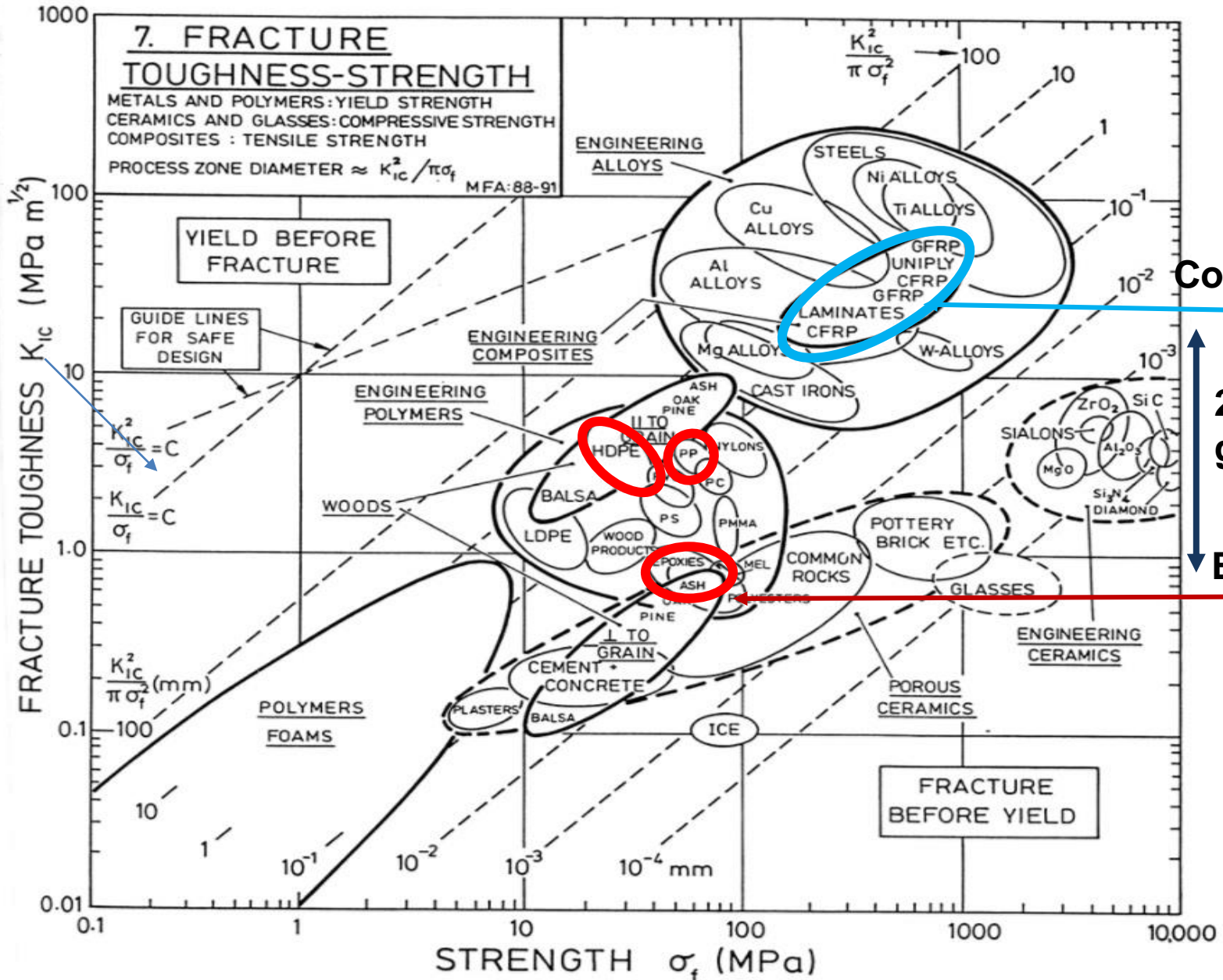
Improvements & Alternatives

- Composite systems provide an alternative to the trade off effects that occur with standalone coating types
- Sacrificial composite systems can also be used over other types of coatings to allow for a broader range of corrosion coatings



7. FRACTURE TOUGHNESS-STRENGTH

METALS AND POLYMERS: YIELD STRENGTH
 CERAMICS AND GLASSES: COMPRESSIVE STRENGTH
 COMPOSITES: TENSILE STRENGTH
 PROCESS ZONE DIAMETER $\approx K_{Ic}^2 / \pi \sigma_f$ MFA:88-91



Composites

20-60x greater

Epoxies

Multiple Ways to Employ Composite Systems



Rapid Application & Improved Performance



CONCLUSION

- ◆ When aggressive soil conditions are expected – wrap your pipe.
- ◆ It's like insurance; increased layers equals increased protection

SCAR ◆ GUARD™

THANKS!

If you have any questions about this presentation please direct them to your presenter today

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