



From Underground to the Forefront of Innovation and Sustainability

Repair of In-Service HDPE Water Distribution Pipe

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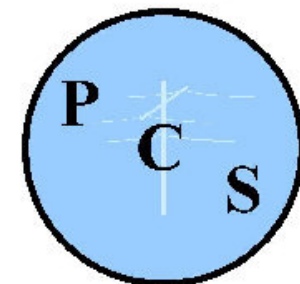
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Outside Plant Consulting Services, Inc.



Survey - Team Members

Mohammad Najafi (Task A – United States)

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Tom Sangster (Task B – Europe)

Downley Consultants (Geneva, Switzerland)

Todd Grafenauer (Task C – Manufacturers)

Murphy Pipeline Contractors, Inc.

Lawrence Slavin (Task D – Results & Conclusions)

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Task A (USA Survey)

Large Number (95) Utilities Contacted*

- Relative frequency of repairs (HDPE vs. other pipe types)
- Description of damage or leakage experience
- Circumstances of repairs
- Type of repair couplings and fittings normally stocked by utility
- Repair methods actually employed
- Repair time
- Repair cost

* Primarily water (but also some gas) utilities.

Task A (USA Survey)

Large Number Utilities Contacted (cont'd)

- Initial vs. permanent repairs and types (mechanical vs. fusion)
- For fusion repair, methods used to create clean dry environment
- Long-term evaluation/reliability
- Training of maintenance crews
- Additional required support from manufacturers.
- “Best” type of repair (utilities’ experiences)

Task B (Europe Survey)

Relatively Few (19) Utilities Contacted

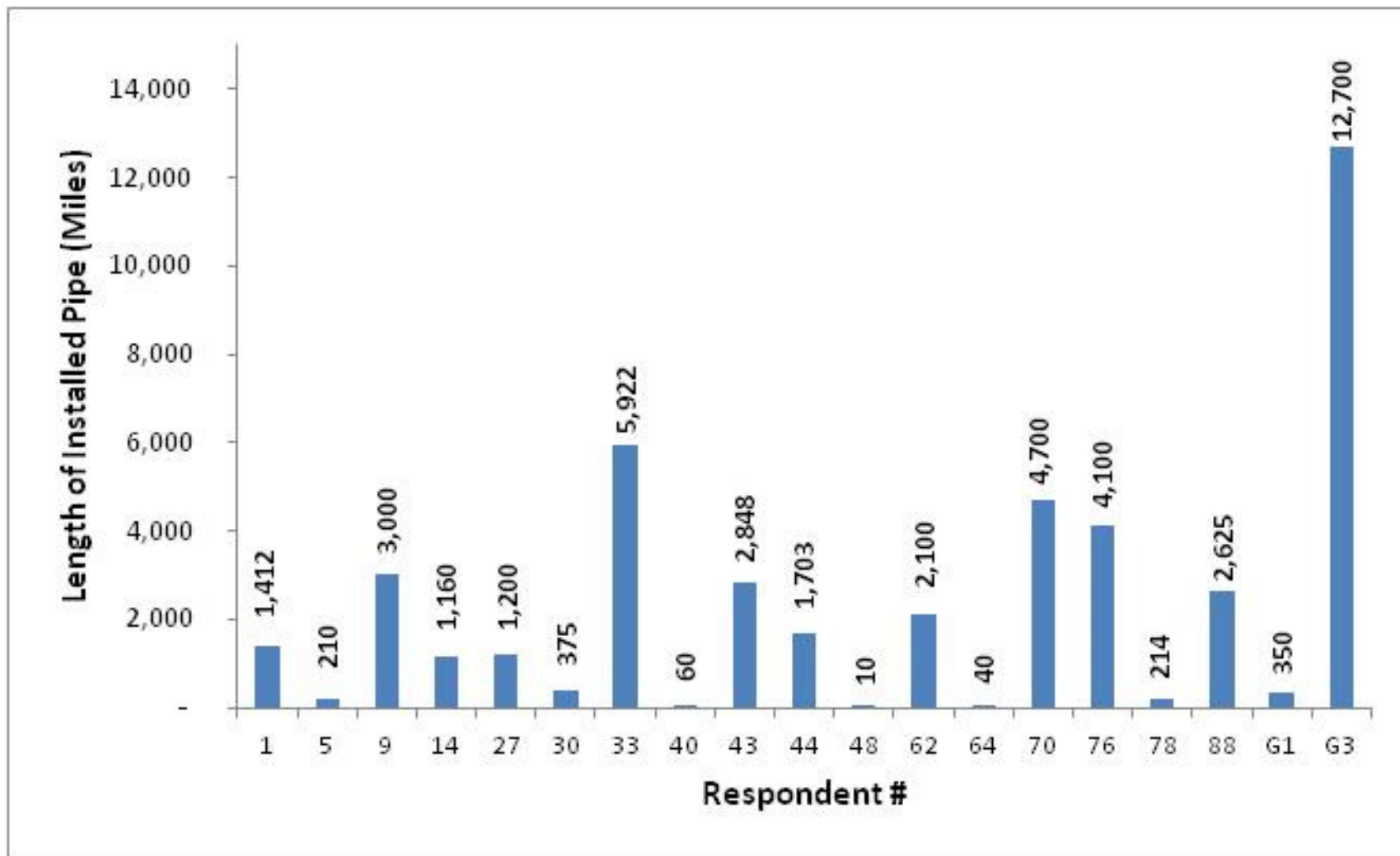
- Similar objectives as US Survey
- Questionnaires completed by 9 water utilities:
 - UK 6
 - Germany 2 (questionnaire translated to German)
 - Belgium 1
- Responses received from 9
- All are water utilities and big users of PE pipe
- **Interviews** held with 5 in UK, Germany and Belgium

Task C (Manufacturers Survey)

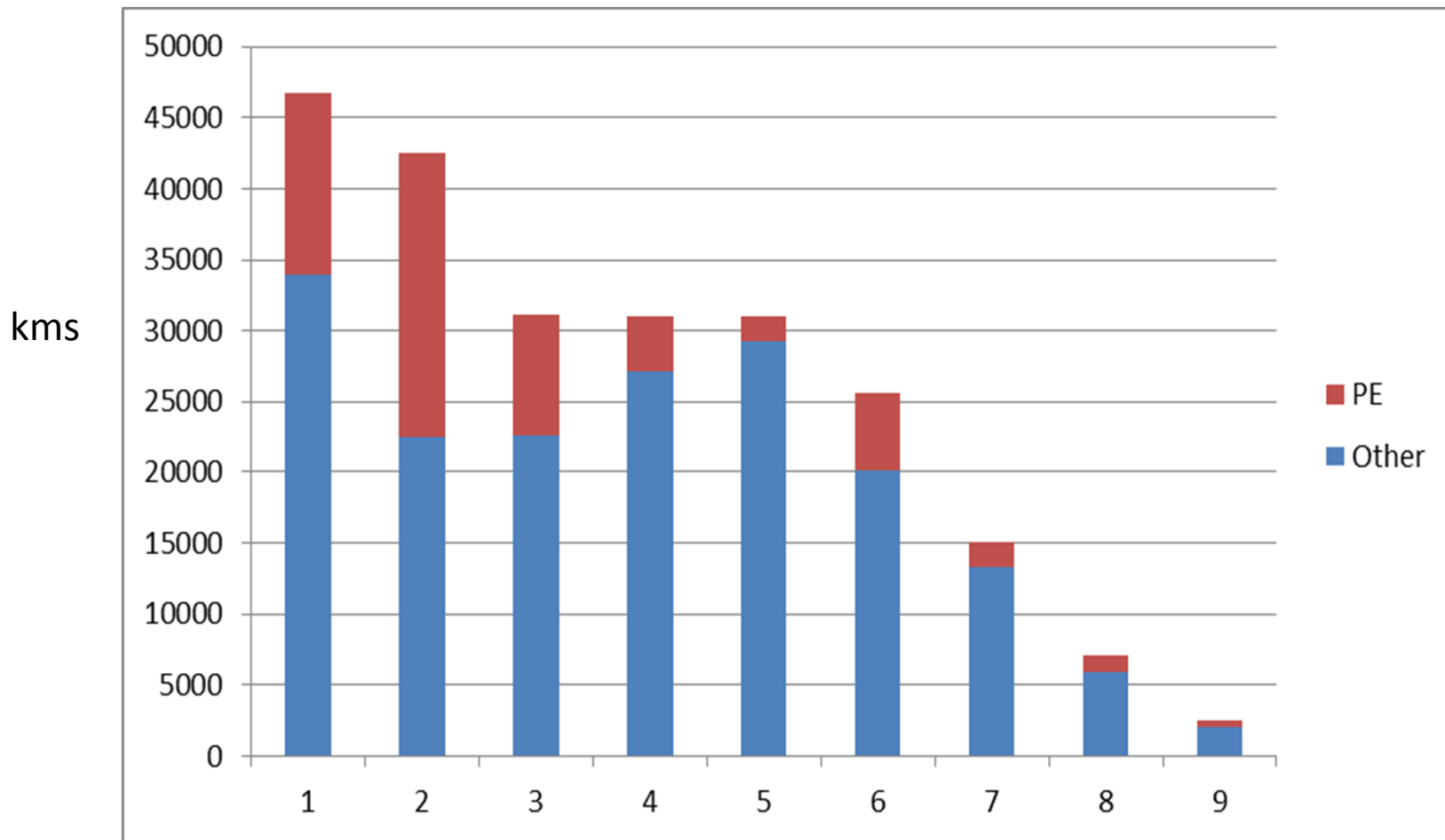
Large Number (36) Mfrs/Distrs Contacted

- Manufacturers' products for field repair of HDPE pipe
- Length of time available
- Sales volume (if provided)
- Customer support and training
- Reported errors commonly made by users
- Feedback regarding field performance of products (as available; see Task A)
- Recommendations or suggestions improving reliability of repairs
- Manufacturers' method of verifying product reliability

USA Respondents



Europe Respondents



Fusion vs. Mechanical

Fusion (heat or electrofusion)

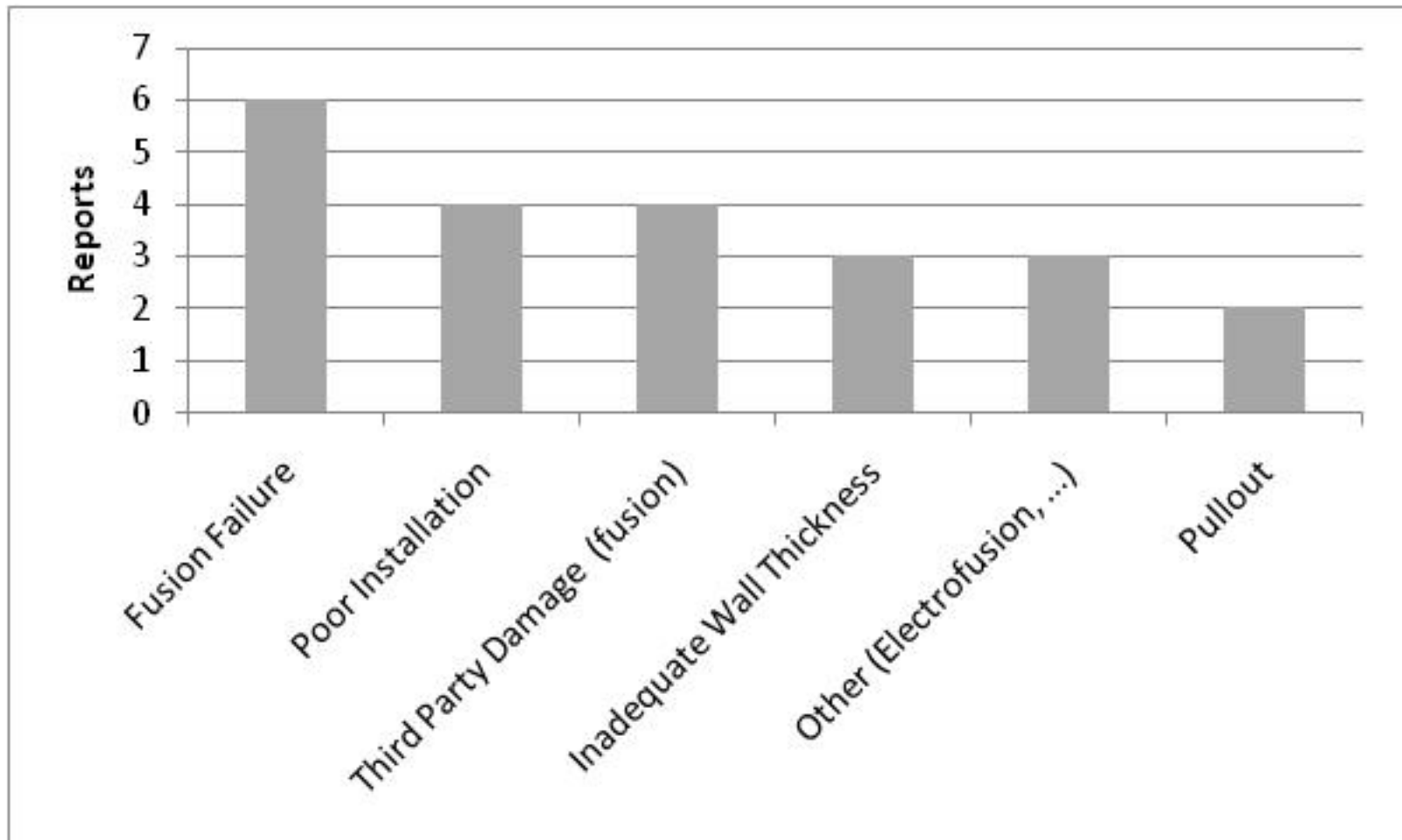
- Ideal for **new** installations
 - Essentially seamless
 - Leak proof
 - Retains full strength (e.g., for trenchless pulling)
- Not necessarily optimum for in-service field repairs
 - Requires **clean, dry** conditions
 - Requires **skill, judgment** for such applications

Fusion vs. Mechanical

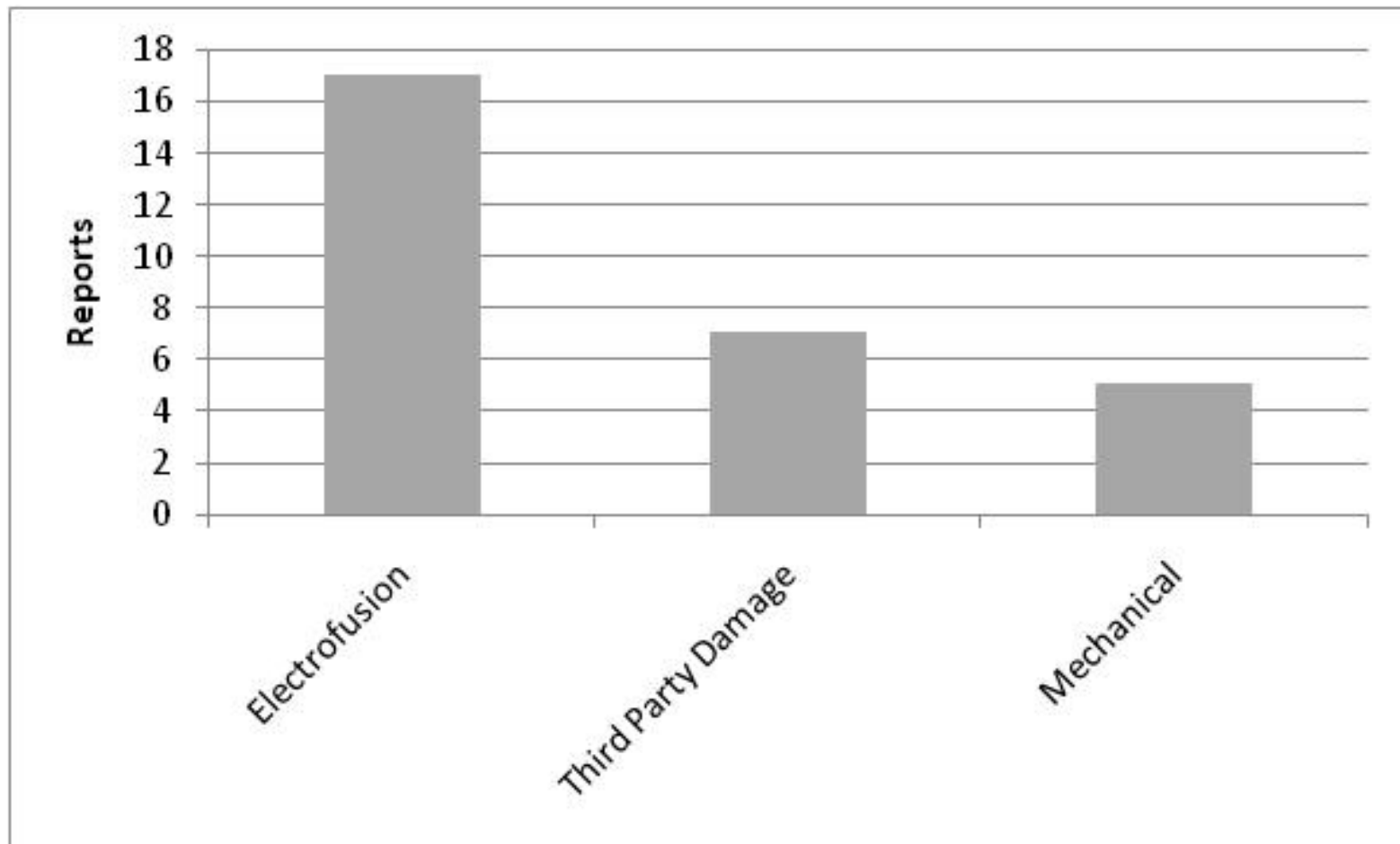
Mechanical

- May be used for **new** installations, if convenient
 - Fittings may be installed **in pit**
 - **Minimal training** and **equipment**
 - Improper installation typically evident upon pressurization
- Most appropriate for in-service field repairs
 - **Forgiving** to non-ideal field conditions

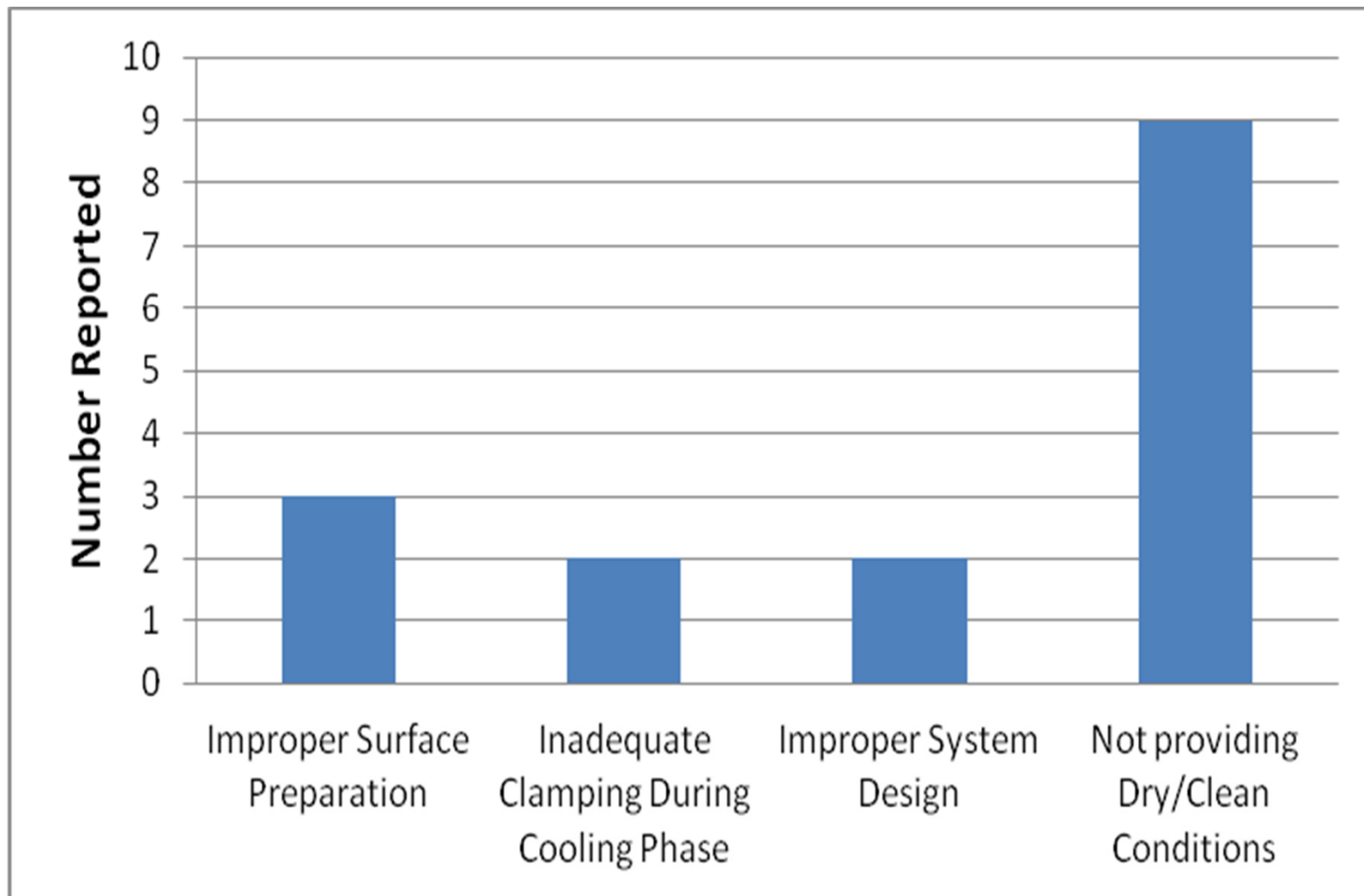
Failure Causes (USA)



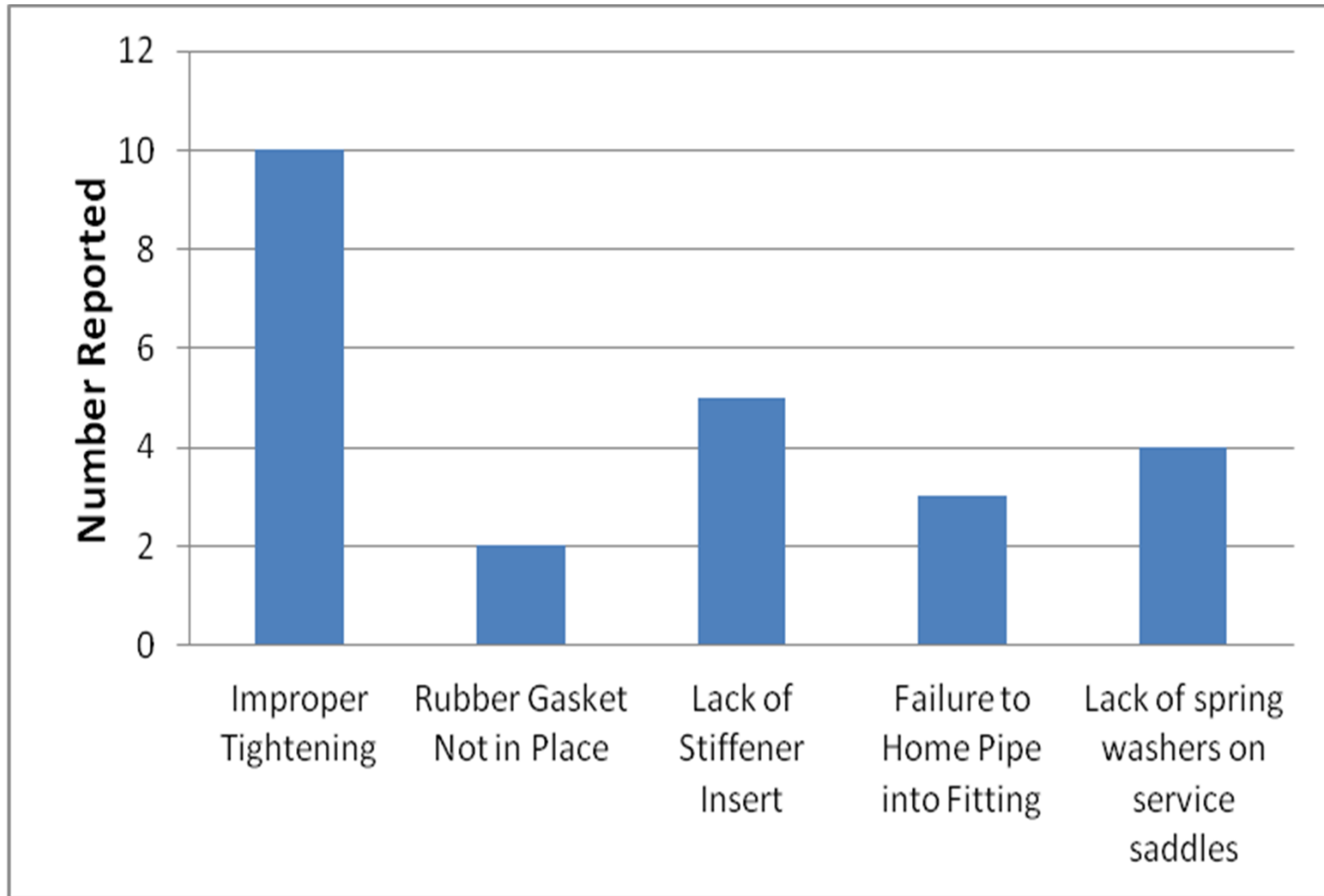
Failure Causes (Europe)



Fusion – Errors/Failures



Mechanical – Errors/Failures



Main Conclusions

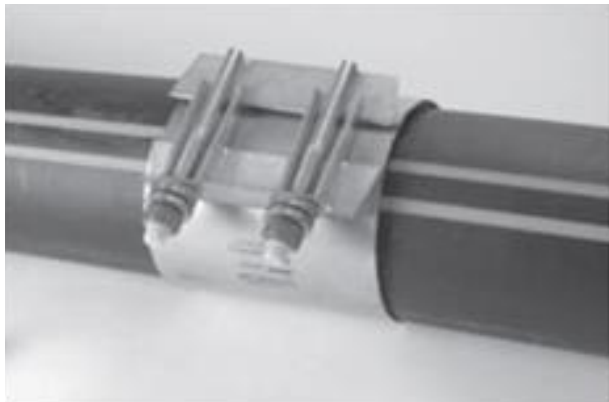
- **Fusion** procedures **difficult to perform** for typical field repairs of leaking water pipes
 - Requires clean, dry environment
 - Skill, judgment

BUT

- **Mechanical** connections/repairs can represent **efficient, practical permanent** repairs

Recommended Mechanical Repairs

Localized Damage (full-circle band clamps)



(Courtesy Teekay)



Recommended Mechanical Repairs*

Extensive Damage (replace section)

- **Circumferentially bolted** mechanical coupling
- **Radially bolted** type mechanical restraint with MJ gasket
- **Compression fittings** (various types), using internal stiffeners, with full axial restraint capability, as available (may depend on pipe size)

* Typically require inserts.

Recommended Mechanical Repairs

Circumferentially bolted



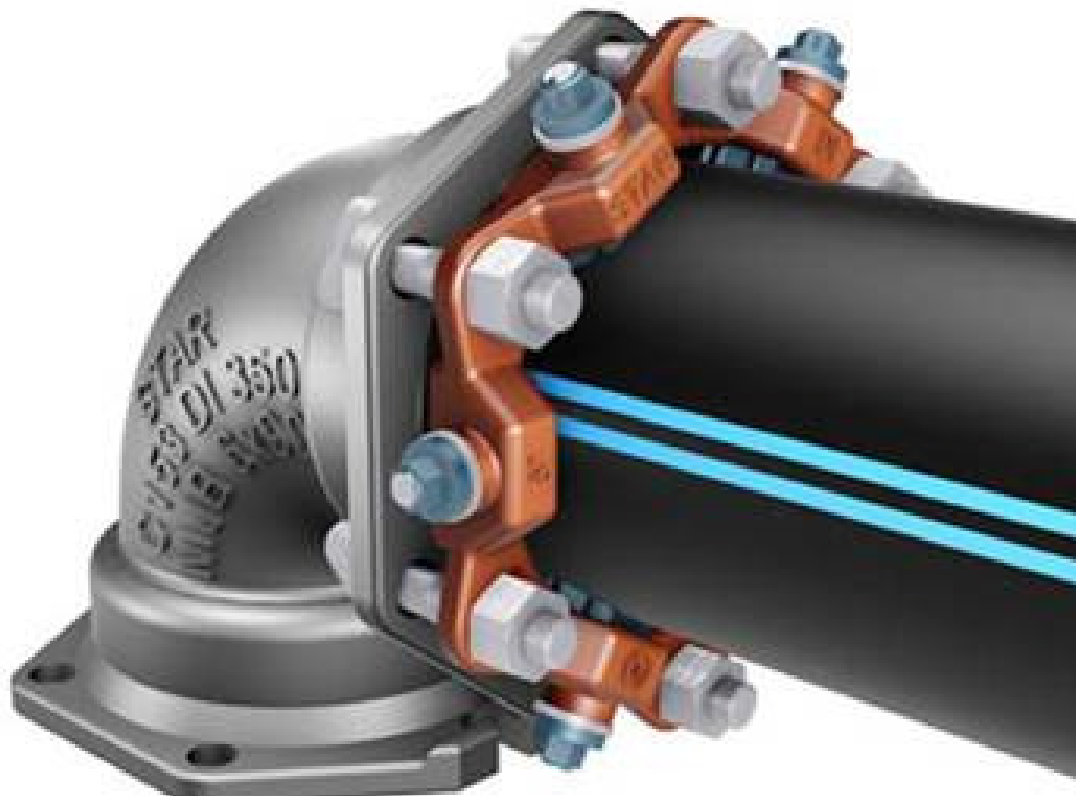
(Courtesy Victaulic®)



(Courtesy Robar/ARPOL®)

Recommended Mechanical Repairs

Radially bolted (fitting, ...)



(Courtesy Star® Pipe Products)

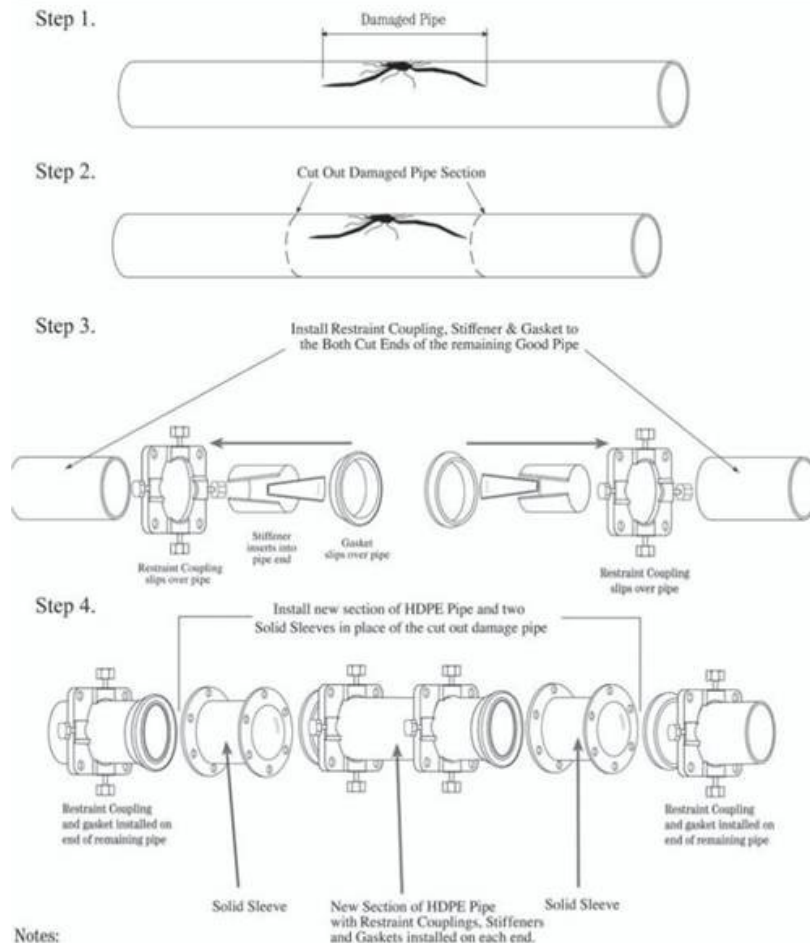
Recommended Mechanical Repairs

Radially bolted (dissimilar pipe materials)



(Courtesy EBAA Iron, Inc.)

Mechanical Repair Procedure



Repair Assembly Using Spool Piece and Sleeves

Notes:

Notes: 1. This method of repair is acceptable when area is wet or fusion equipment not available.

2. All steps must be followed.

Typical Application (Fusion or Mechanical)

PREFERRED METHOD

INSTALLATION PROCEDURES FOR ELECTROFUSION COUPLING

1. READ OPERATING INSTRUCTIONS PROVIDED BY THE FUSION MACHINE MANUFACTURER. ENSURE THE ELECTROFUSION FITTING IS THE CORRECT SIZE (DIAMETER & TPI), PRESSURE CLASS, AND COMPATIBLE WITH THE FUSION MACHINE.
2. PREPARE PIPE:
 - a. CHECK PIPE FOR OUT-OF-ROUND CONDITION. RESTORE THE ROUNDNESS IF NECESSARY.
 - b. CUT PIPE ENDS SQUARE. ENSURE PIPE ENDS ARE CLEAN AND FREE FROM ANY CONTAMINANTS.
 - c. MARK OFF EACH PIPE END AT THE STAB DEPTH LOCATION (1/3 OF THE COUPLING) WITH NON-PETROLEUM BASED MARKER.
 - d. SCRAPE THE OUTSIDE PIPE SURFACE WITH MANUFACTURER'S RECOMMENDED SCRAPING TOOL TO EXPOSE THE VIRGIN PIPE MATERIAL. REMOVE ANY DEBRIS AND CLEAN PIPE.
3. INSERT COUPLING INTO BOTH PIPE ENDS AT THE STAB DEPTH MARKS LOCATION. DO NOT JAM PIPES INTO THE COUPLING.
4. SUPPORT AND RESTRAIN EACH PIPE WITH MANUFACTURER'S RECOMMENDED RESTRAINT DEVICES.
5. CONNECT FUSION LEAD ENDS BETWEEN THE COUPLING AND THE FUSION UNIT. SEAM BAR-EDGE AND START THE FUSION PROCESS. REMOVE FUSION LEADS WHEN FUSION CYCLE IS COMPLETE.
6. ALLOW COUPLING TO COOL IN ACCORDANCE WITH COUPLING MANUFACTURER'S RECOMMENDED COOLING TIME BEFORE REMOVING THE RESTRAINT DEVICES OR PLACING ANY STRESS ON THE JOINT.

STEP 1

STEP 2

STEP 3

HDPE PIPE REPAIR USING ELECTROFUSION COUPLING

INSTALLATION PROCEDURES FOR MECHANICAL COUPLING

SEE NOTE 3

1. CUT PIPE ENDS SQUARE USING QUALITATIVE CUTTING TOOL/BLADE. ENSURE PIPE ENDS ARE CLEAN AND FREE FROM DAMAGE OR SCRATCHES WITHIN 1" FROM ENDS.
2. MARK OFF EACH PIPE END AT TSP (FOR 12" - 12" DIAMETER PIPE) AND AT THE INSERTION DEPTH LOCATION (REFER TO MANUFACTURER'S TABLE).
3. PLACE GASKET OVER BOTH PIPE ENDS. PUSH ENDS TOGETHER UNTIL THEY BUTT. ALIGN PIPE MARKS WITH OUTER EDGE OF GASKETS. LUBRICATE THE BACK OF GASKET WITH VEGETABLE OIL.
4. PLACE HOUSING OVER GASKET AND ENSURE THE HOUSING TONGUE AND NOTCHES ARE PROPERLY MATED.
5. INSERT BOLTS AND APPLY ZINC CAPS FINGER TIGHT. TIGHTEN THE CAPS UNIFORMLY AND ON ALTERNATING SIDES UNTIL HOUSING BOLT PADS MEET TIGHTLY METE-TO-METAL.
6. FULLY ENCAPSULATE THE ASSEMBLY WITH WRAP TAPE IN TWO LAYERS. OVERLAP THE TAPE IN A 45° TAPED MANNER. PRESS AND SMOOTH OUT THE LAP SEAM TO ENSURE THEY ARE SEALED. EXTEND THE TAPE 4" BEYOND EACH END OF THE COUPLING.

STEP 1

STEP 2

STEP 3

HDPE PIPE REPAIR USING VICTAULIC COUPLING

EMERGENCY HYDRANT REPAIR DETAIL

NOTE: TPO REDUCING TEE WITH HOPE FLANGE ADAPTER WITH BACK-UP RING PRE-FUSED PIECE.

GENERAL NOTES:

1. USE MECHANICAL COUPLING REPAIR DETAIL AS SHOWN ON THIS DRAWING ONLY IF FUSION JOINT CANNOT BE ACHIEVED.
2. REFER TO STANDARD DRAWING 9946-08 FOR GENERAL NOTES FOR HOPE PIPE AND CONNECTION OF HOPE PIPE TO OTHER PIPE MATERIALS.
3. MECHANICAL COUPLING SHALL BE VICTAULIC ORS OR EQUAL AS APPROVED BY ENGINEER.

<p>PROJECT: EAST BAY MUNICIPAL UTILITY DISTRICT</p> <p>DRAWING NO.: 9946-1-08</p> <p>DATE: 7 JAN 10</p> <p>DESIGNED BY: [Signature]</p> <p>CHECKED BY: [Signature]</p> <p>APPROVED BY: [Signature]</p>	<p>EAST BAY MUNICIPAL UTILITY DISTRICT</p> <p>OAKLAND, CALIFORNIA</p> <p>STANDARD DRAWING</p> <p>HOPE PIPE REPAIR DETAILS</p> <p>12" AND UNDER</p> <p>9946-1-08</p>
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Conclusions

- 25% water distribution in Europe is of HDPE -- order of magnitude greater than that in the USA
- Fusion difficult and sometimes impractical for field repair of leaking water lines
- **Mechanical solutions, properly installed, represent permanent repairs for water distribution applications**
- Most mechanical repair fittings for HDPE pipe will also repair DIP and PVC pipe; converse not true
- Most water applications use **DIPS** sizes vs. some HDPE fittings with only **IPS** sizes currently available

Conclusions (cont'd)

- When pipe section replacement **not** necessary (local damage): recommend **full circle band clamps**
- When pipe section **replacement necessary** (more extensive damage):
 - **Radially bolted**
 - **Circumferentially bolted**
 - **Compression** fittings (may depend on pipe size)
- Fusion methods require proper (extensive) training, including judgment when not to apply

THANK YOU !

(Please provide feedback on results of applications)



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