

Corrosion Control Advancements Reduce Water System Leaks



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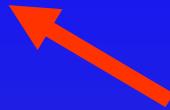
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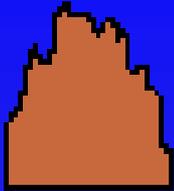
Corrosion



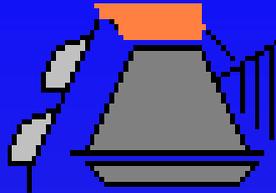
Temporary Fix ?



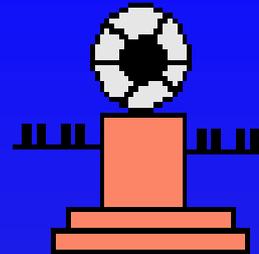
Corrosion - A Natural Process



IRON OXIDE



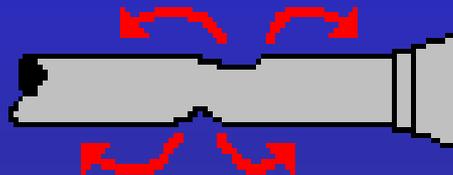
REFINING



MILLING



IRON, STEEL, PCCP

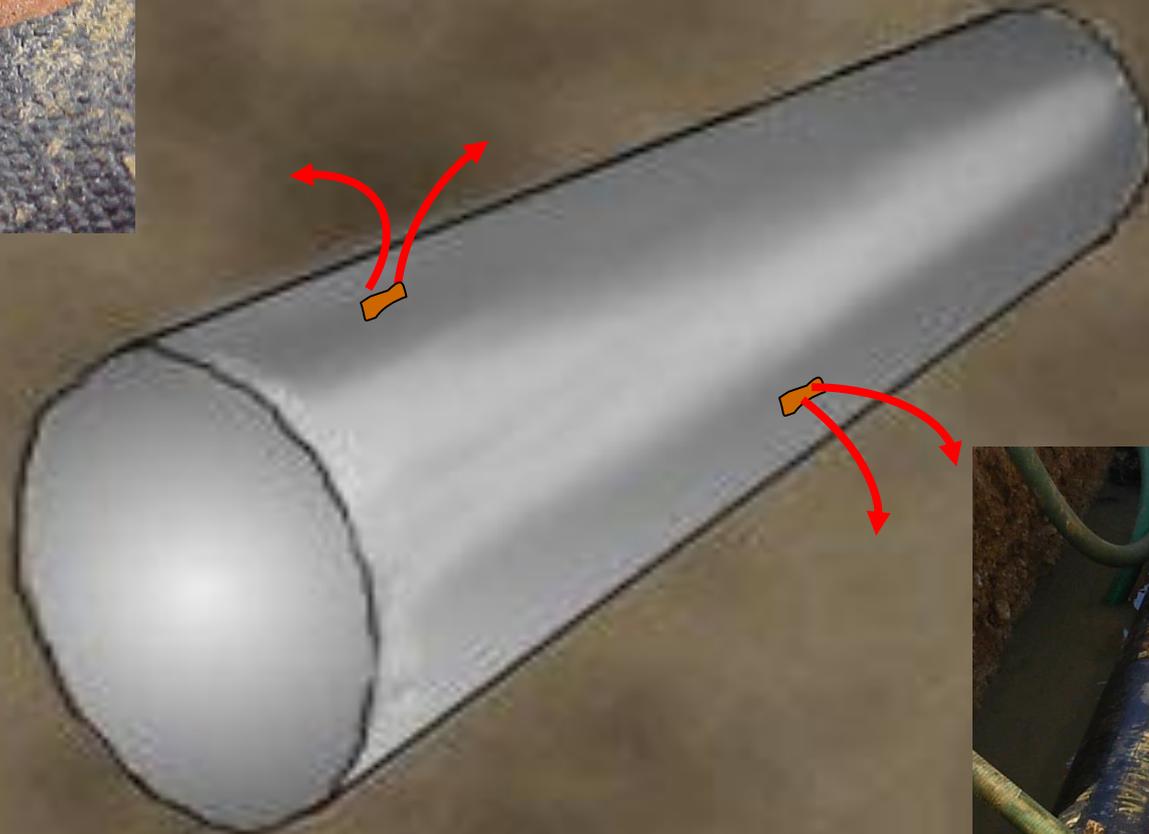


CORROSION



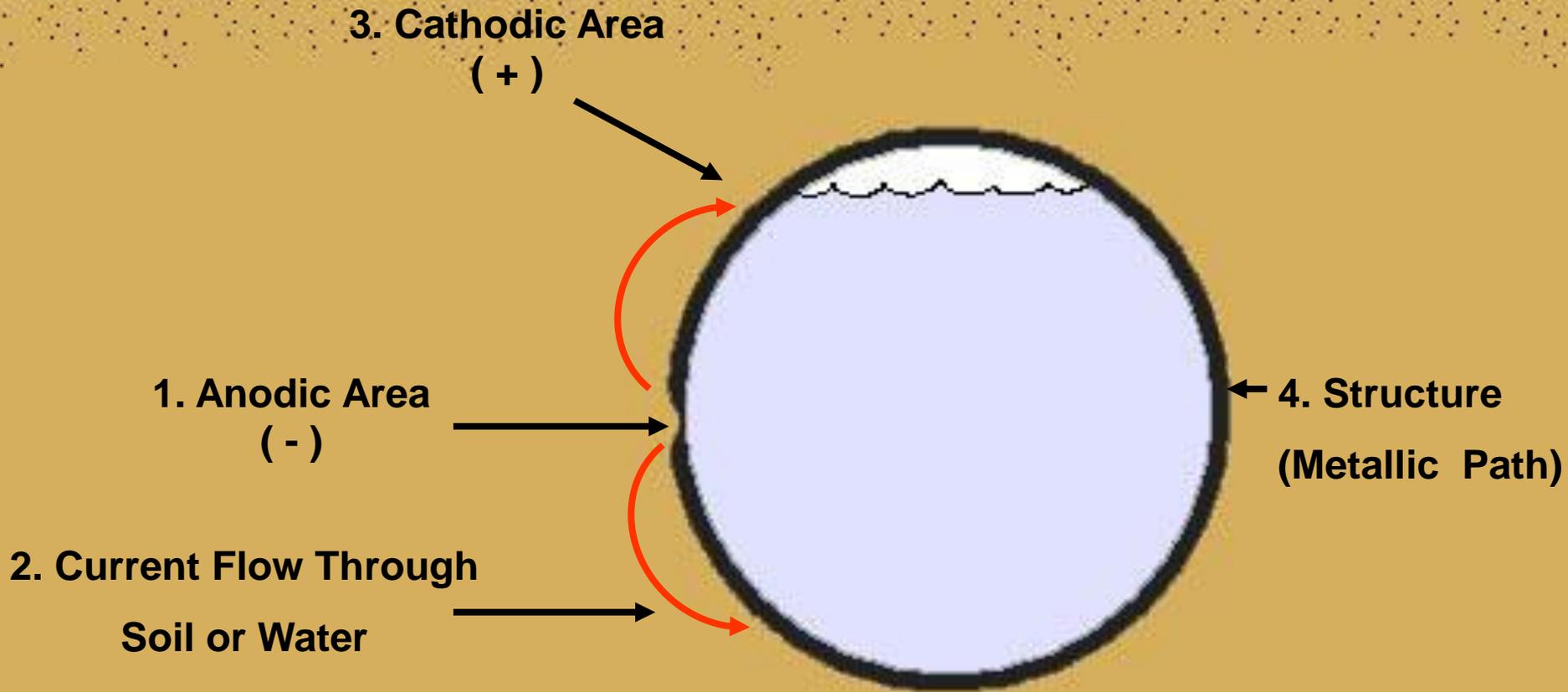
IRON OXIDE

Corrosion of Metallic Structure



Corrosion Cell on Buried Piping

4 Prerequisites





Adverse Conditions for Metallic Pipe

- *High Chlorides*
- *Low Soil/Water Resistivity*
- *High Sulfates*
- *Acidic Soils*
- *Bimetallic Couplings*
- *Stray Current Interference*



History of Iron Pipe

Cast Iron

- Introduced to North America during the 1800's and installed till the 1970's.
- Early on, statically cast process produced a thick walled, heavy pipe.
- No longer produced in North America.

Ductile Iron

- Introduced in 1955 as an improvement to cast iron.
- Centrifugal casting process produces a thinner walled, lighter pipe which is stronger and more ductile than cast iron.



Cast (Grey) Iron Failures

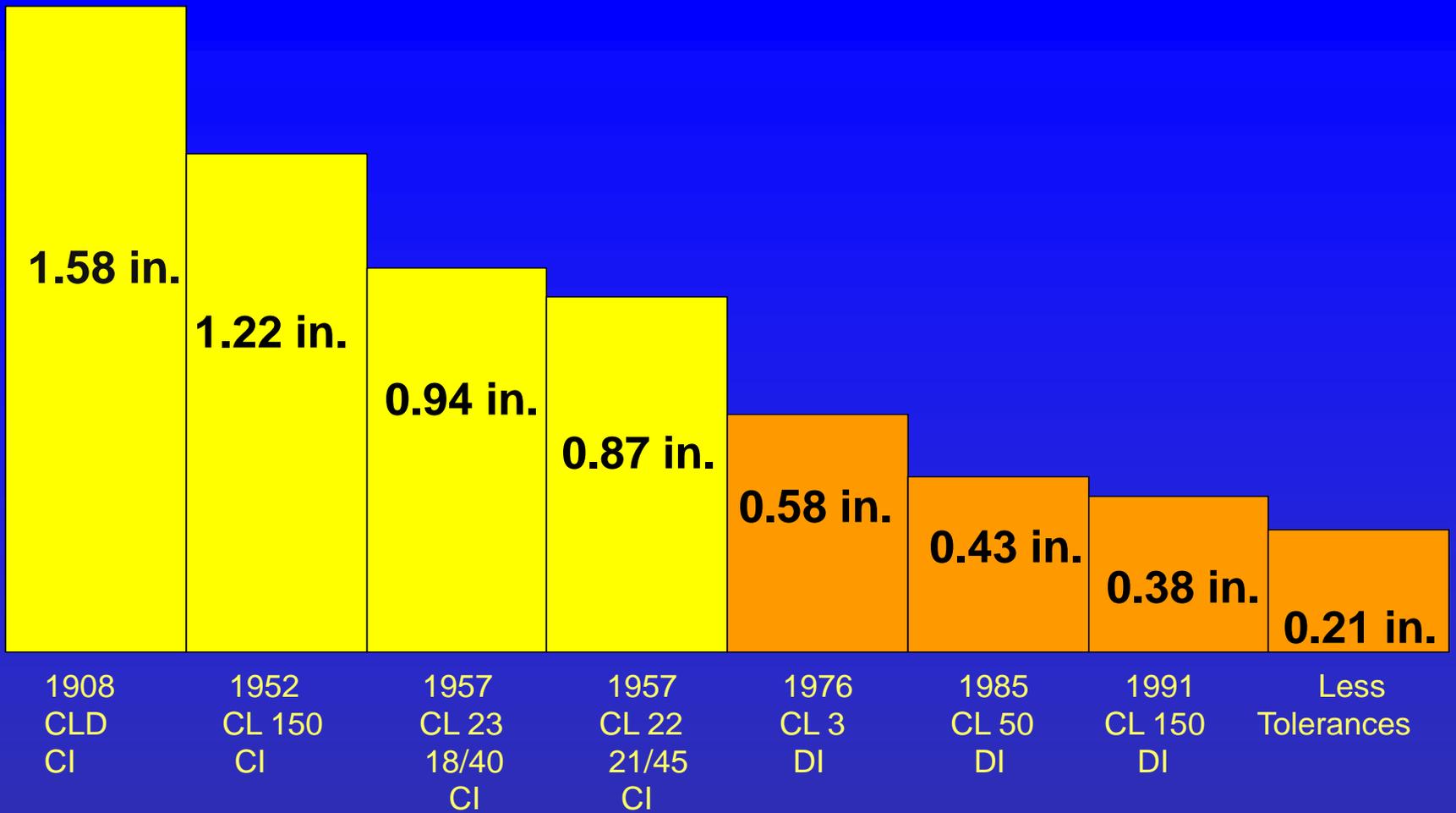


Graphitization leaves pipe brittle and weakened.

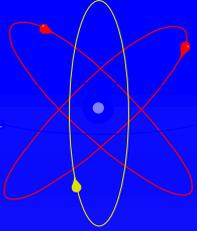
Ductile Iron



Pitting (concentrated) corrosion attack on ductile iron pipe.



Actual size of AWWA Specification Thickness Reductions for 36-inch Diameter Cast and Ductile Iron Pipe - 1908 to Present (150 PSI Operating pressure)

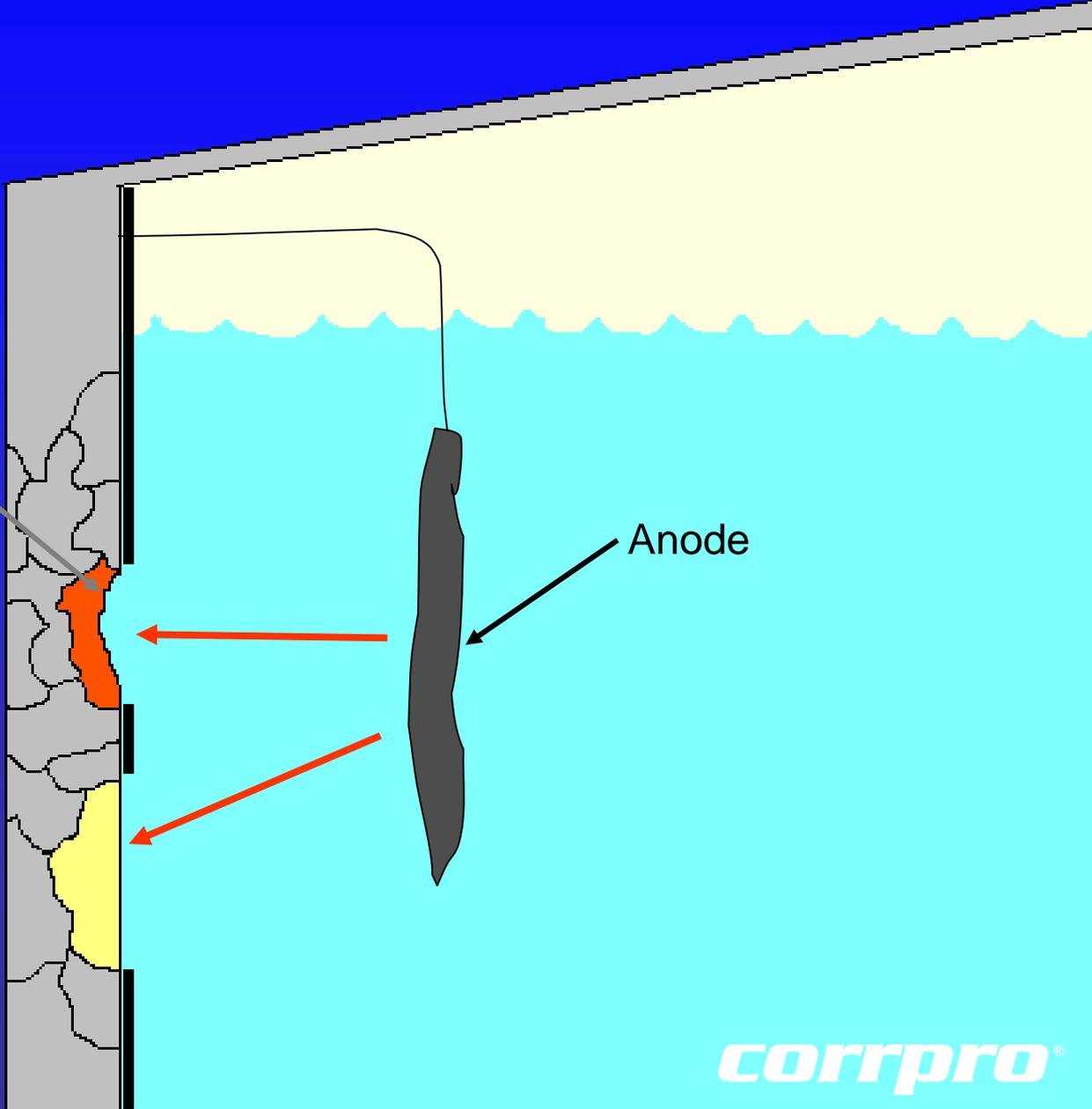
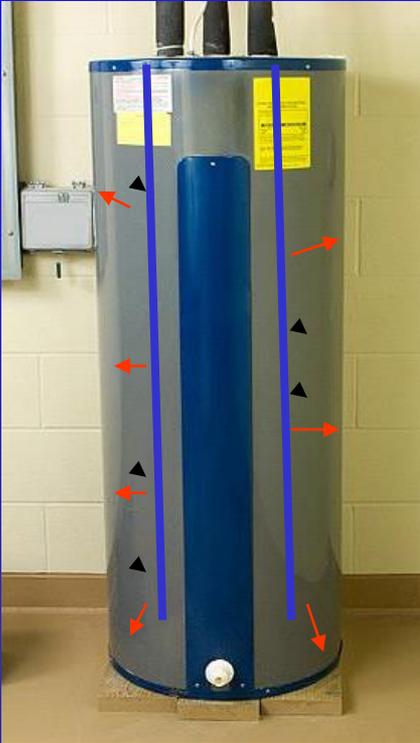


PRACTICAL GALVANIC SERIES

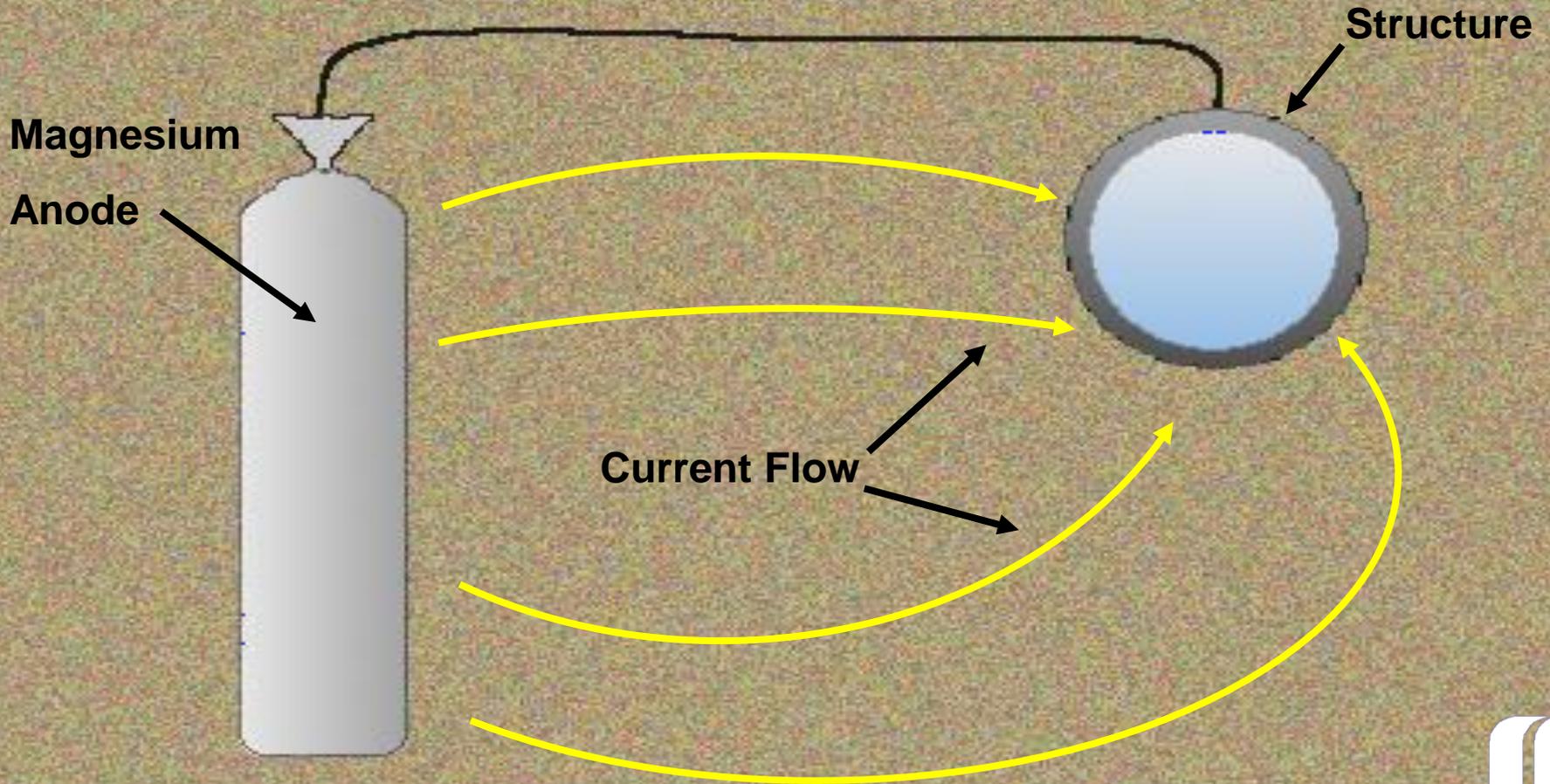
Material	Potential*
Pure Magnesium	-1.75
Zinc	-1.10
Aluminum Alloy	-1.00
Cadmium	-0.80
Mild Steel (New)	-0.70
Mild Steel (Old)	-0.50
Cast/Ductile Iron	-0.50
Stainless Steel	-0.50 to + 0.10
Copper, Brass, Bronze	-0.20
Gold	+0.20
Carbon, Graphite, Coke	+0.30

* Potentials With Respect to Saturated Cu-CuSO₄ Electrode

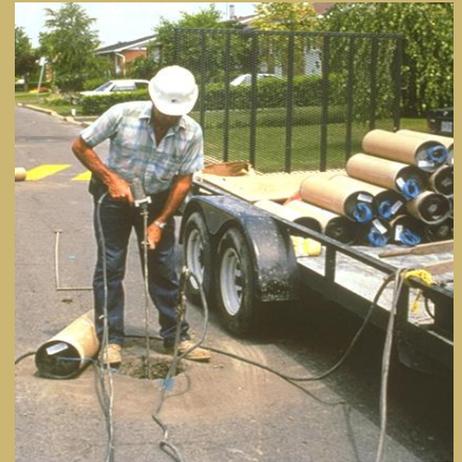
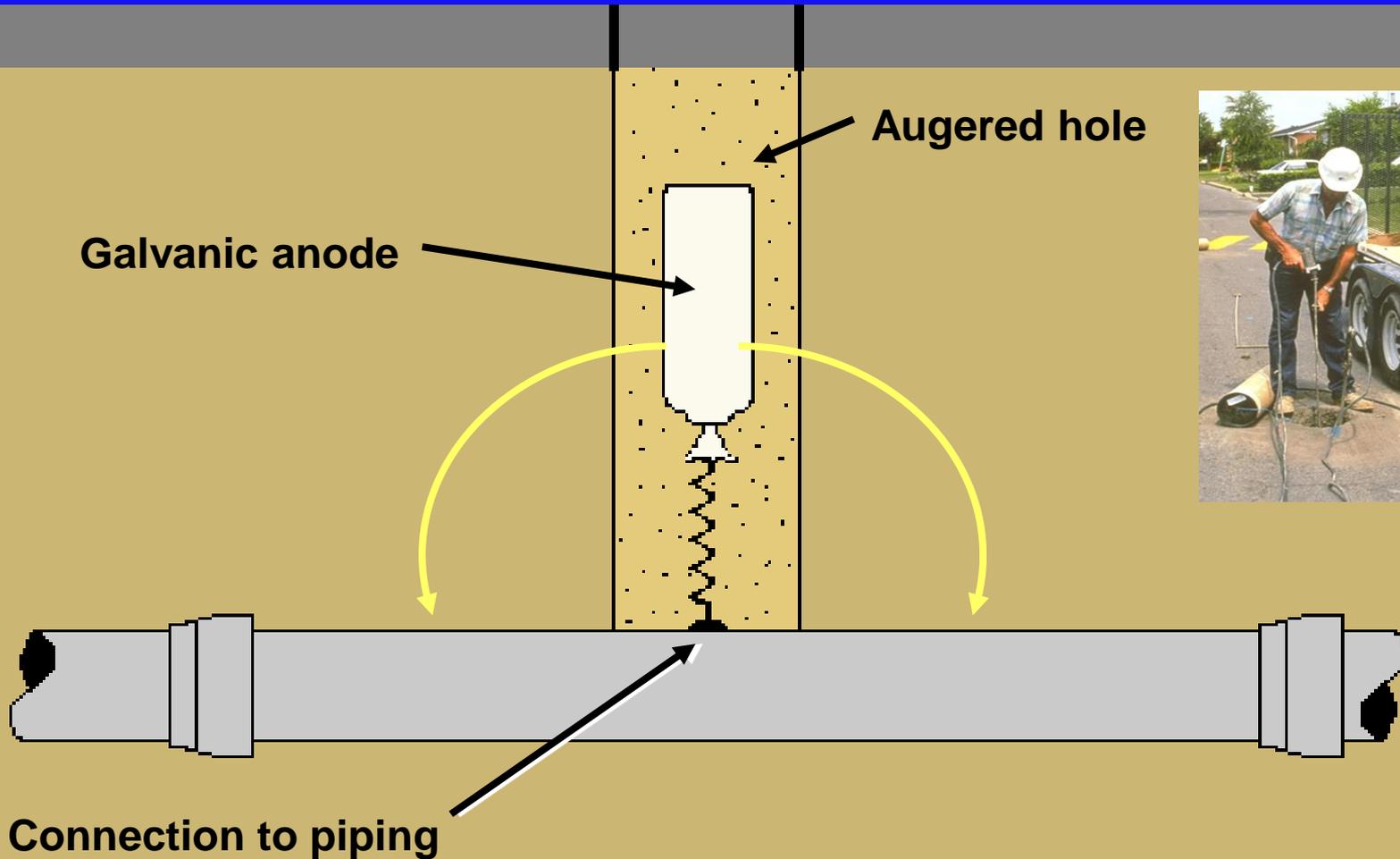
Cathode
(Protected)



Galvanic Anode



Anode Installation

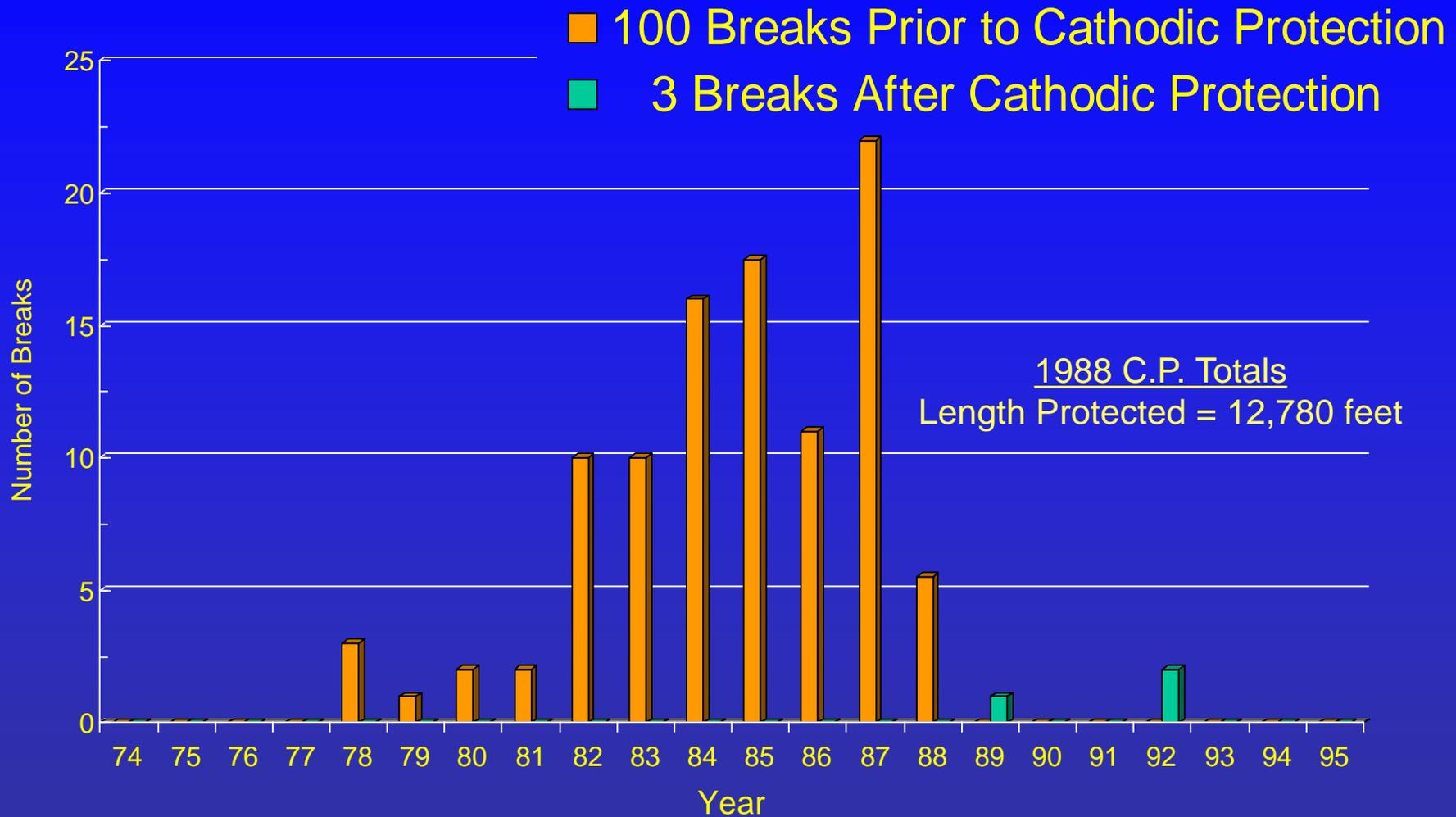


Thermit Weld to Pipe





Access to Pipe



Break Records for Water Mains Cathodically Protected in 1988

Temporary Fix ?



Repair of Break Should Include Anode Installation



Incomplete



Complete

Water Leak Repair Kit



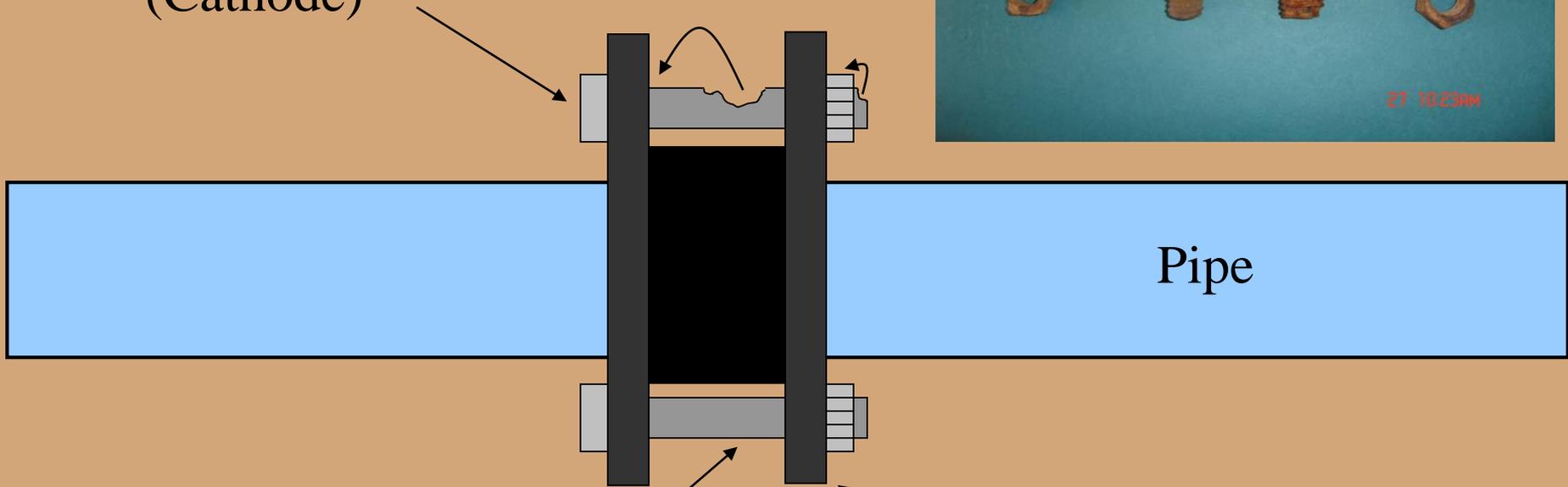
Includes:

Installation instructions.

One day onsite technical assistance.

Cathodic protection components/connection materials suitable for 10 repairs.

Lower Stress Area
(Cathode)

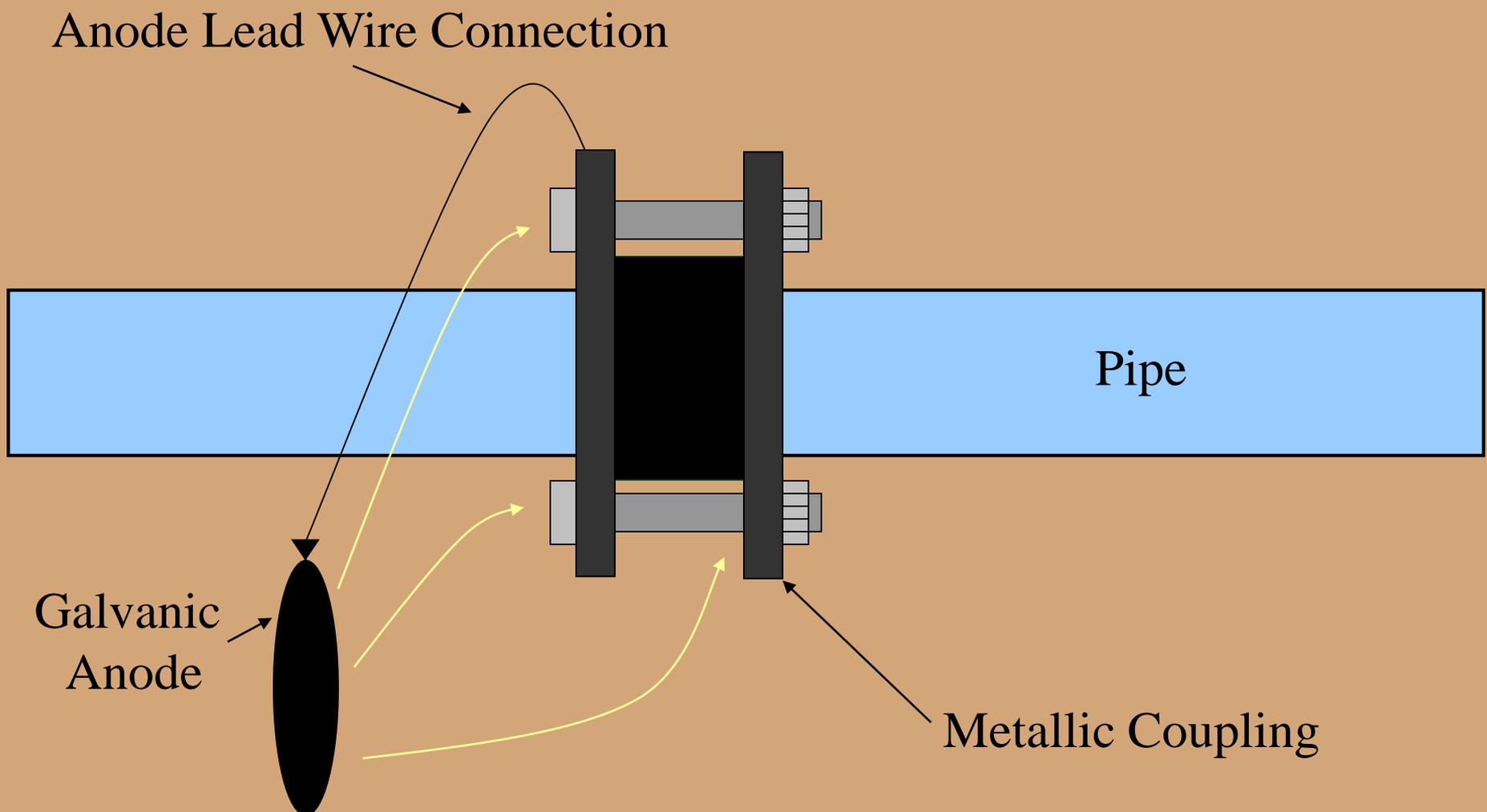


Threaded Bolt
Higher Stress Area
(Anode)

Metallic Coupling

Stress Corrosion





Anode Lead Wire Connection

Pipe

Galvanic Anode

Metallic Coupling

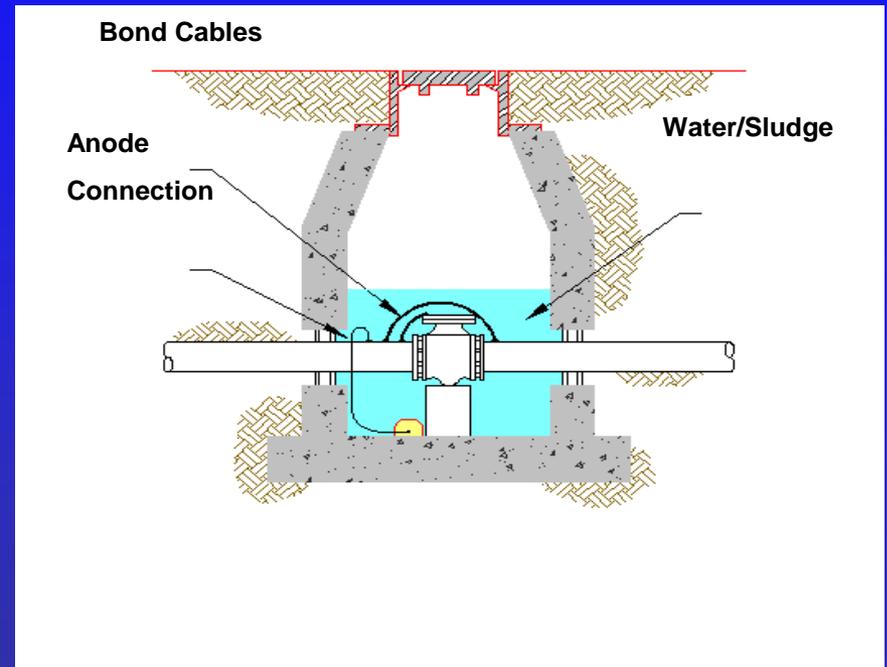
Cathodic Protection of Metallic Fitting

Anode Installed on Metallic Fitting





Meter Vault Corrosion



Meter Vault with Anode

Gate Valve Corrosion



Stainless Steel Corrosion



Polyethylene Encasement



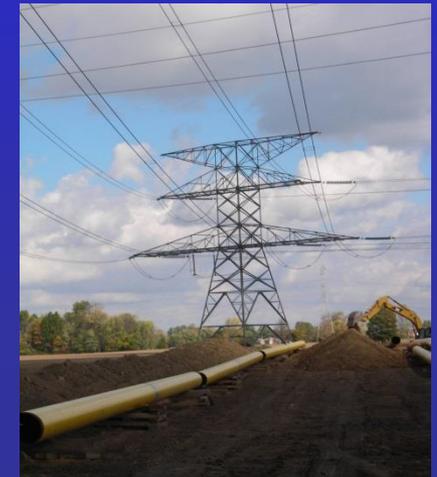
- Follow manufacture's and AWWA recommendations to insure proper installation of polyethylene encasement.
- In extremely corrosive areas, additional methods (bonding of joints, cathodic protection, may be required).

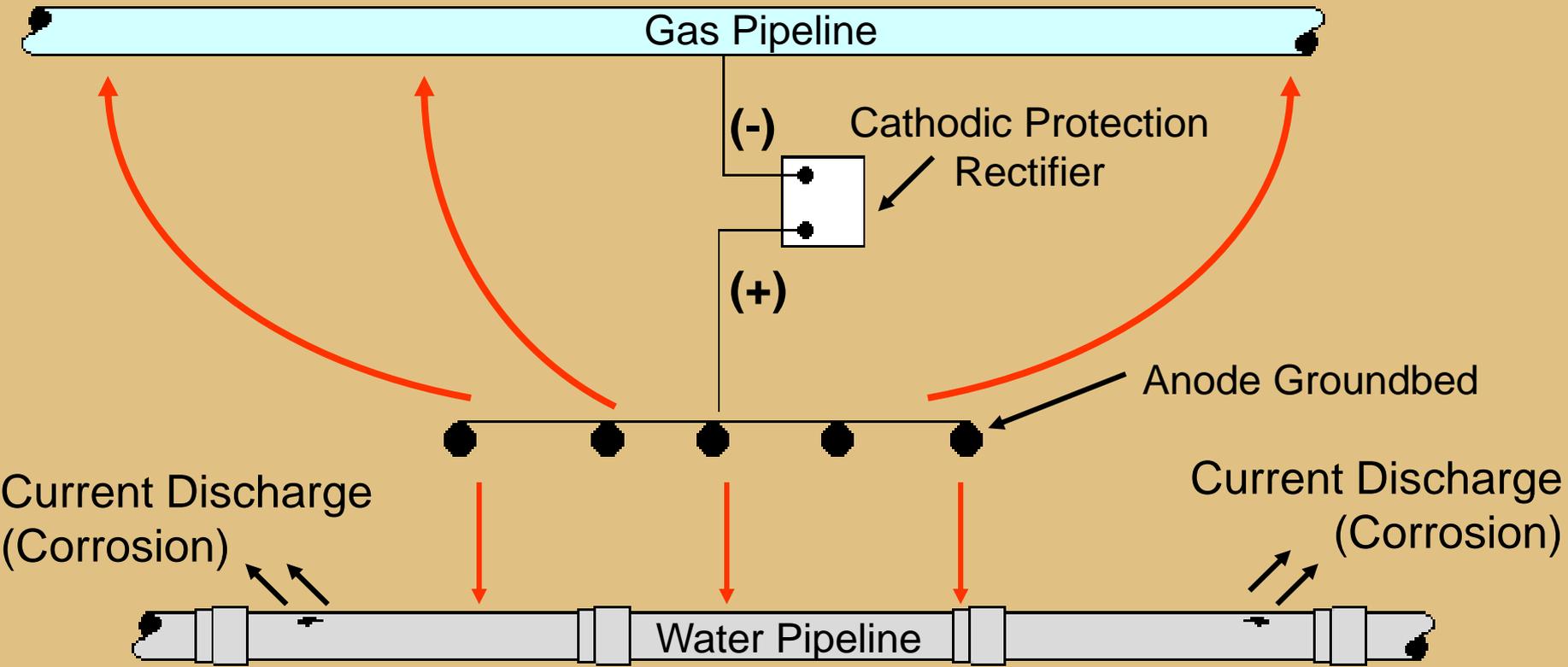
Polyethylene Encasement of Ductile Iron Pipe



- Follow DIPRA installation procedures
- Clean pipe before installing polywrap
- Repair tears or damage to encasement
- Engage an inspector to oversee installation

Stray Current





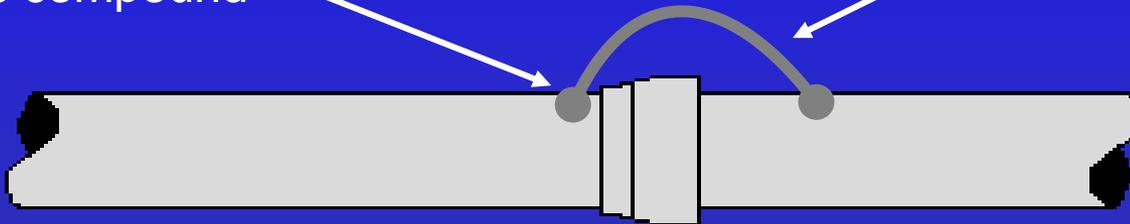
Stray Current Due to Impressed Current Cathodic Protection System



Bonding Across a Bell and Spigot or Slip-joint

Thermite brazed connection coated with bitumous compound

Copper wire with direct burial insulation



Pumping Stations



For New or Refurbished Tanks



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Internal Corrosion of Force Mains....



**Solids
Buildup**

Investigative Structure (Existing)

Corrosion Assessment

- Review of General Characteristics of Water System
 - Age
 - Material Type
 - Wall Thickness
 - Construction Practices
- Review Break / Leak History
- Field Survey
 - Soil Conditions (Resistivity, Moisture Content, Chemical Analysis)
 - Electrical Test
- Data Analysis & Risk Management
- Priority Index (Identification of Opportunities to Reduce Replacement / Repair Costs)



QUESTIONS ?

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