

# Corrosion and Corrosion Prevention in Municipal Infrastructure

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**Atlantic Waterworks Ltd.**

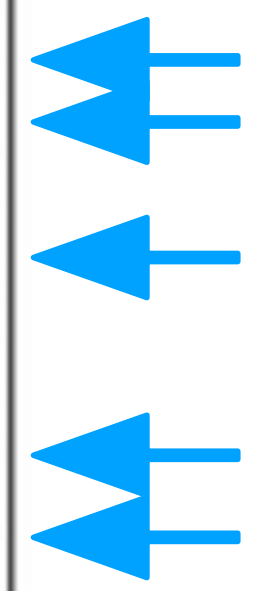




**SUGGESTED USE:**

Adults: Take two (1) tablet daily with food.  
 Not formulated for use in children. Do not exceed suggested use.

| Supplement Facts                              |      | Amount Per Serving     | % DV |
|---|------|------------------------|------|
| Serving Size 1 Tablet                         |      |                        |      |
| Amount Per Serving                            | % DV |                        |      |
| Vitamin A 1,050 mcg<br>(29% as Beta-Carotene) | 117% | Pantothenic Acid 15 mg | 300% |
| Vitamin C 90 mg                               | 100% | Calcium 210 mg         | 16%  |
| Vitamin D <sub>3</sub> 25 mcg<br>(1,000 IU)   | 125% | Iron 8 mg              | 44%  |
| Vitamin E 20.3 mg                             | 135% | Phosphorus 20 mg       | 2%   |
| Vitamin K 60 mcg                              | 50%  | Iodine 150 mcg         | 100% |
| Thiamin 1.2 mg                                | 100% | Magnesium 100 mg       | 24%  |
| Riboflavin 1.3 mg                             | 100% | Zinc 11 mg             | 100% |
| Niacin 16 mg                                  | 100% | Selenium 100 mcg       | 182% |
| Vitamin B <sub>6</sub> 2 mg                   | 118% | Copper 0.9 mg          | 100% |
| Folate 333 mcg DFE<br>(200 mcg Folic Acid)    | 83%  | Manganese 2.3 mg       | 100% |
| Vitamin B <sub>12</sub> 6 mcg                 | 250% | Chromium 35 mcg        | 100% |
| Biotin 40 mcg                                 | 133% | Molybdenum 50 mcg      | 111% |
|   |      | Chloride 72 mg         | 3%   |
|   |      | Potassium 80 mg        | 2%   |
|   |      | Lycopene 600 mcg       | *    |



**INGREDIENTS:** Calcium Carbonate, Magnesium oxide, Potassium Chloride, Microcrystalline Cellulose, Ascorbic Acid (Vit. C), Dibasic Calcium Phosphate, DL-alpha Tocopheryl Acetate (Vit. E), Maltodextrin, Modified Corn Starch, Corn Starch.  
**Contains <2% of:** Beta-Carotene, BHT (to preserve freshness), Biotin, Calcium Pantothenate, Cholecalciferol (Vit. D<sub>3</sub>), Chromium Picolinate, Copper Sulfate, Crospovidone, Cyanocobalamin (Vit. B12), Ferrous Fumarate, Folic Acid, Gelatin, Lecithin (soy), Lycopene, Magnesium Stearate, Manganese Sulfate, Niacinamide, Phytonadione (Vit. K), Polyethylene Glycol, Polyvinyl Alcohol, Potassium Iodid, Pyridoxine Hydrochloride (Vit. B<sub>6</sub>), Red 40 Lake, Riboflavin (Vit. B2), Silicon Dioxide, Sodium Ascorbate (to preserve freshness), Sodium Molybdate, Sodium Selenate, Talc, Thiamine Mononitrate (Vit. B1), Titanium Dioxide, Tocopherols (to preserve freshness), Vitamin A Acetate, Yellow 6 Lake, Zinc Oxide. **Contains:** Soy.



Cor-ro-sion, (noun):

Corrosion is the deterioration and loss of a material and its critical properties due to chemical, electrochemical and other reactions of the exposed material surface with the surrounding environment.



# CORROSION VISUALIZED



# A LOOK BACK:

- 1848 - California Gold Rush Begins
- 1856 - Pipe Installed in Halifax
- 1861 - Abraham Lincoln Becomes President of US
- 1861 - US Civil War Begins



# TYPES OF CORROSION

## Microbial Corrosion

This type of corrosion is also called Bio-Corrosion and is caused by microorganisms. Oxidation is another term.

## Galvanic Corrosion

Also called Bimetallic corrosion where one metal corrodes preferentially when it is in electrical contact with another, in the presence of an electrolyte.

**AN ELECTRICAL CONNECTION MUST BE PRESENT FOR CORROSION TO OCCUR!**



# GALVANIC CORROSION

The most common and costly form of corrosion to utilities

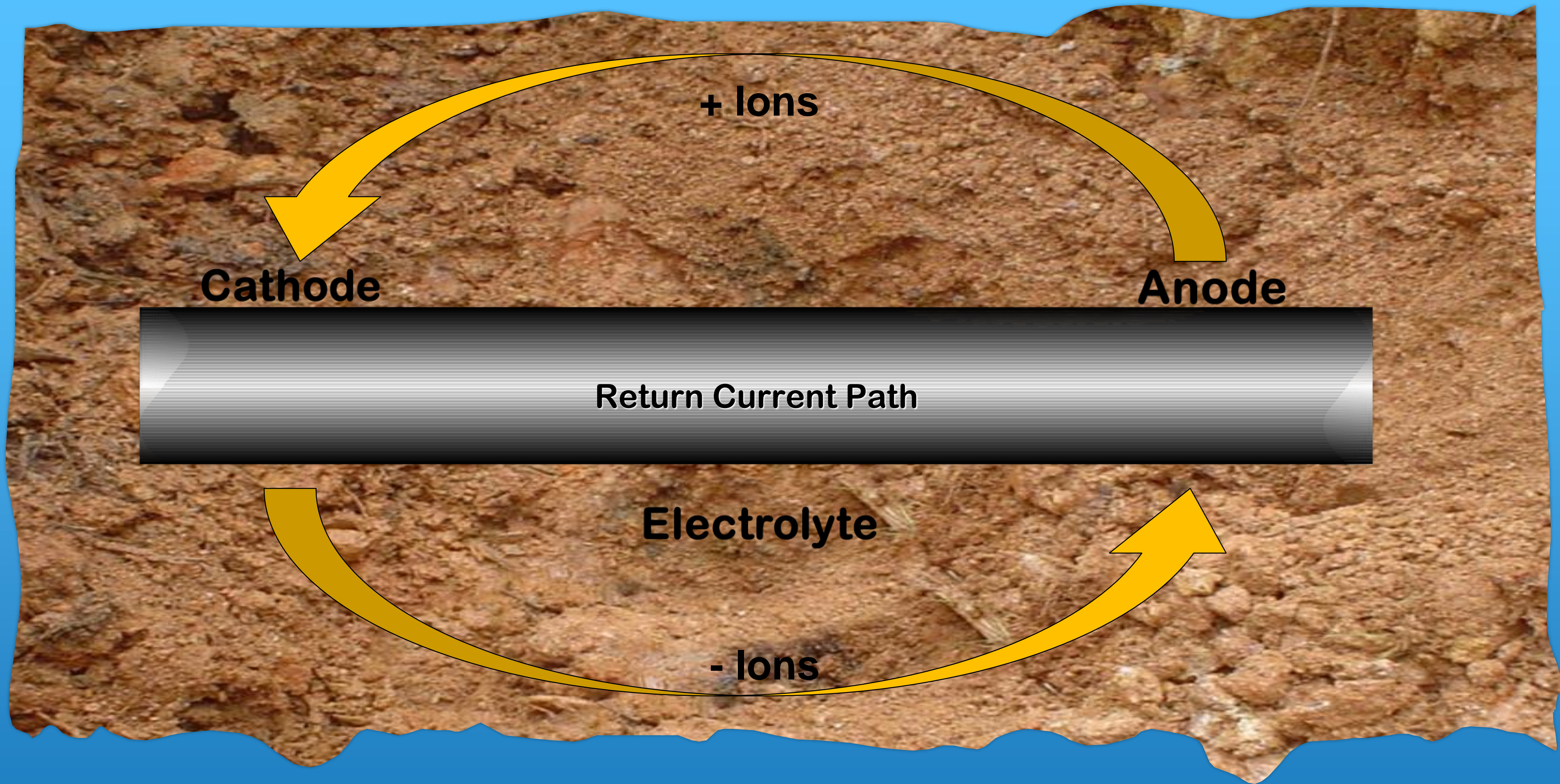
- **CORROSION**

- ANODE
- CATHODE
- ELECTROLYTE
- RETURN CURRENT PATH

- **FIRE**

- FUEL
- OXYGEN
- IGNITION SOURCE





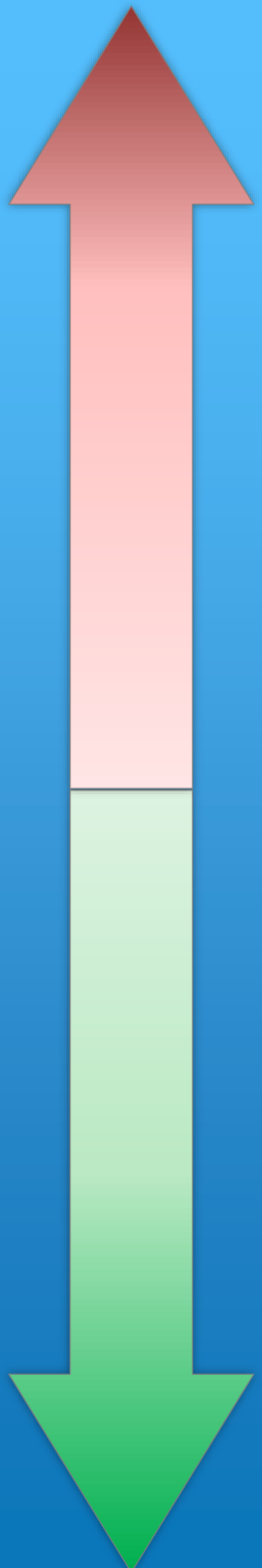




# GALVANIC RANKING

**LESS NOBLE**  
more susceptible  
to corrosive attack  
lower number on  
galvanic scale

**MORE NOBLE**  
less susceptible  
to corrosive attack  
higher number on  
galvanic scale



- magnesium
- zinc
- aluminum
- mild steel
- cast iron
- brasses
- copper
- stainless steel
- silver
- gold
- platinum



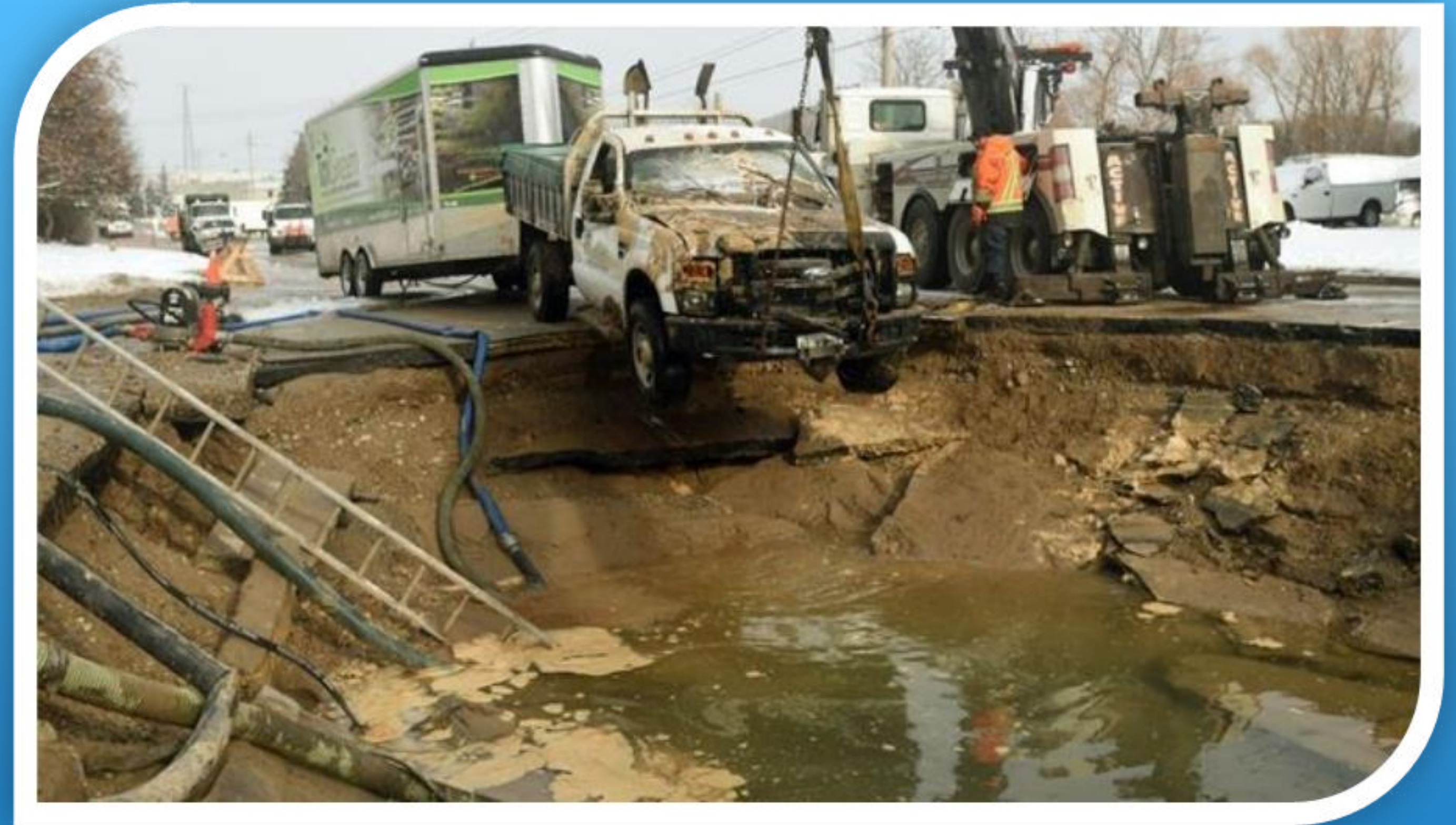
# AGENCIES OF STUDY

- NACE - *National Association of Corrosion Engineers*
- ANSI - *American National Standards Institute*
- ASTM - *American Society for Testing Materials*
- SSPC - *Steel Structures Painting Council*
- API - *American Petroleum Institute*
- ASME - *American Society of Mechanical Engineers*
- DIPRA - *Ductile Iron Pipe Research Association*

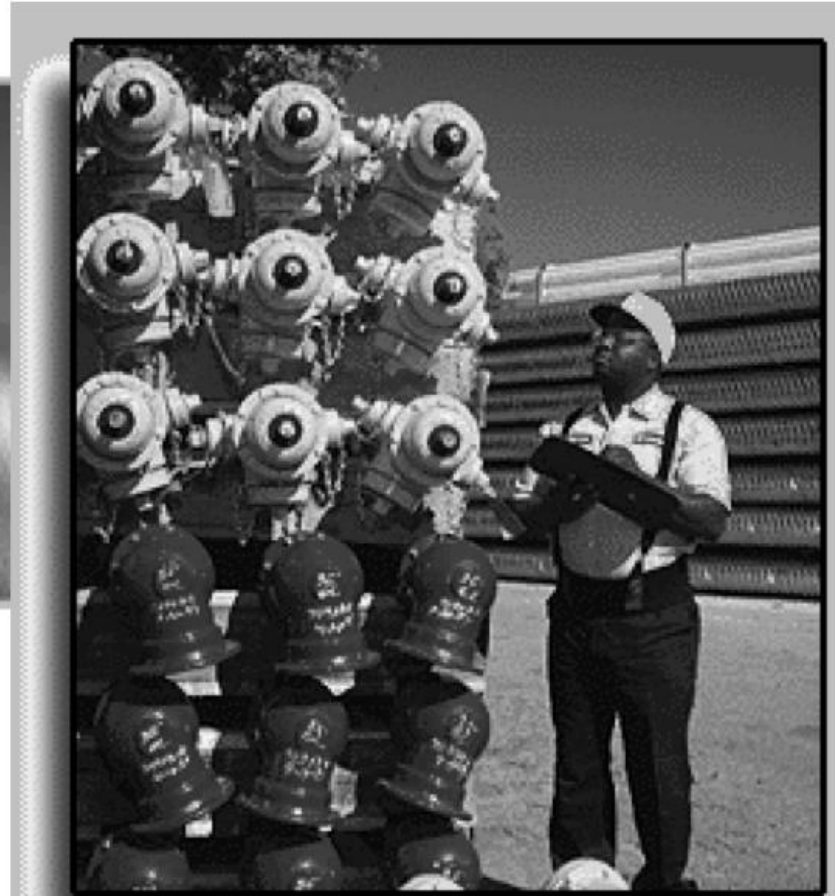


# COST OF CORROSION

- Hardware Plus:
- Leak Detection
- System Down Time
- Cost of exposure
- Cost of return of grade
- Damaged property
- Loss of life / serious injury
- Legal Liability



# IRON IN UTILITIES



## IRON

- Fire hydrants
- Indicator posts
- Gate valves
- Watermain fittings
- Restrainers
- Valve boxes
- Service boxes
- Valve chamber covers



# METHODS OF PROTECTION

- **Petrolatum Tape Systems (such as Denso)**
- **Cathodic Protection/Impressed Current CP**
  - Using a sacrificial anode to protect the pipe or appurtenance.
- **Zinc Coating**
  - The zinc acts as a sacrificial metal.
- **Polyethylene Encasement**
- **Bonded Coatings**
  - A jacket that will adhere to the surface of the pipe or fitting.



# PETROLATUM TAPE SYSTEMS

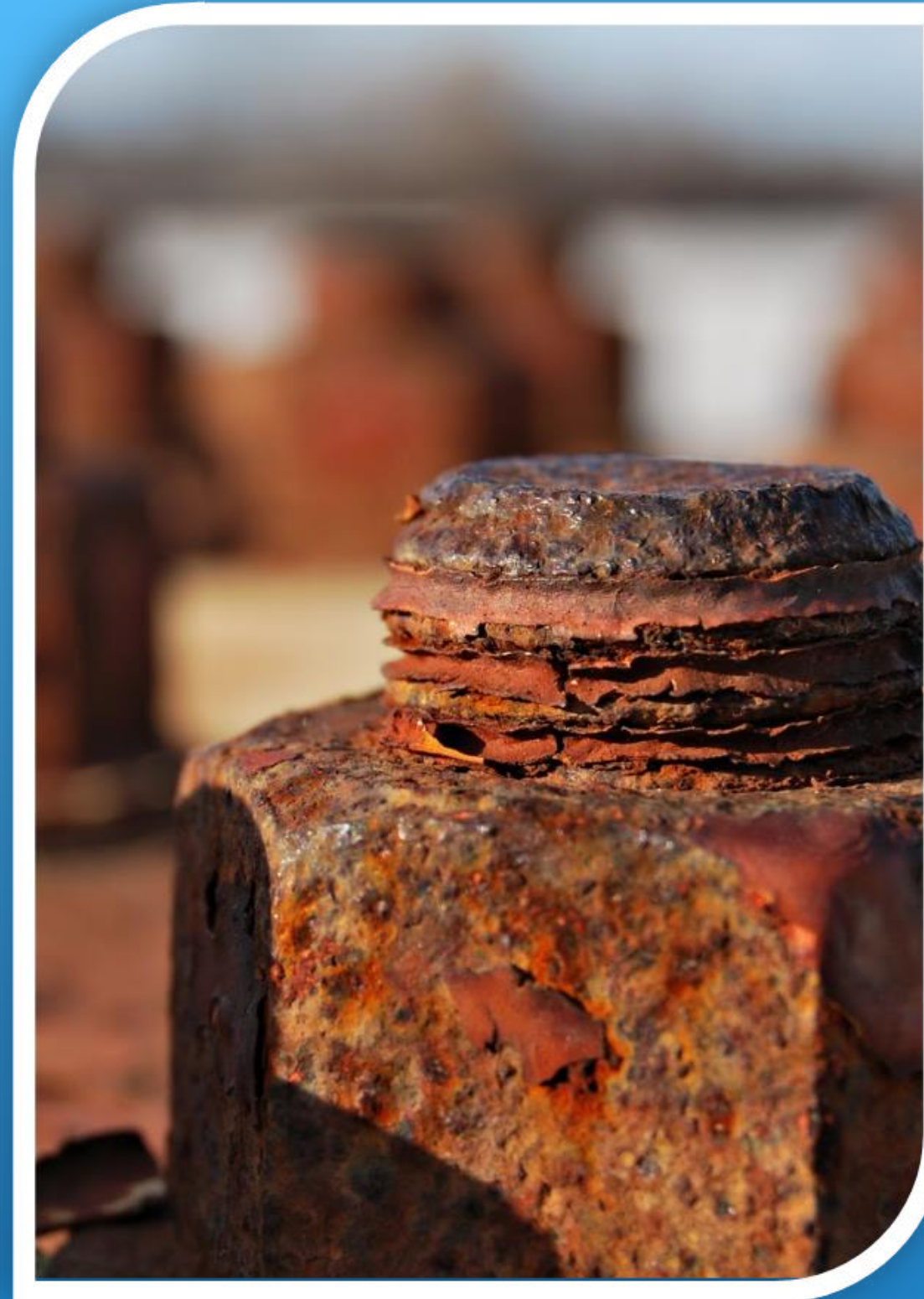
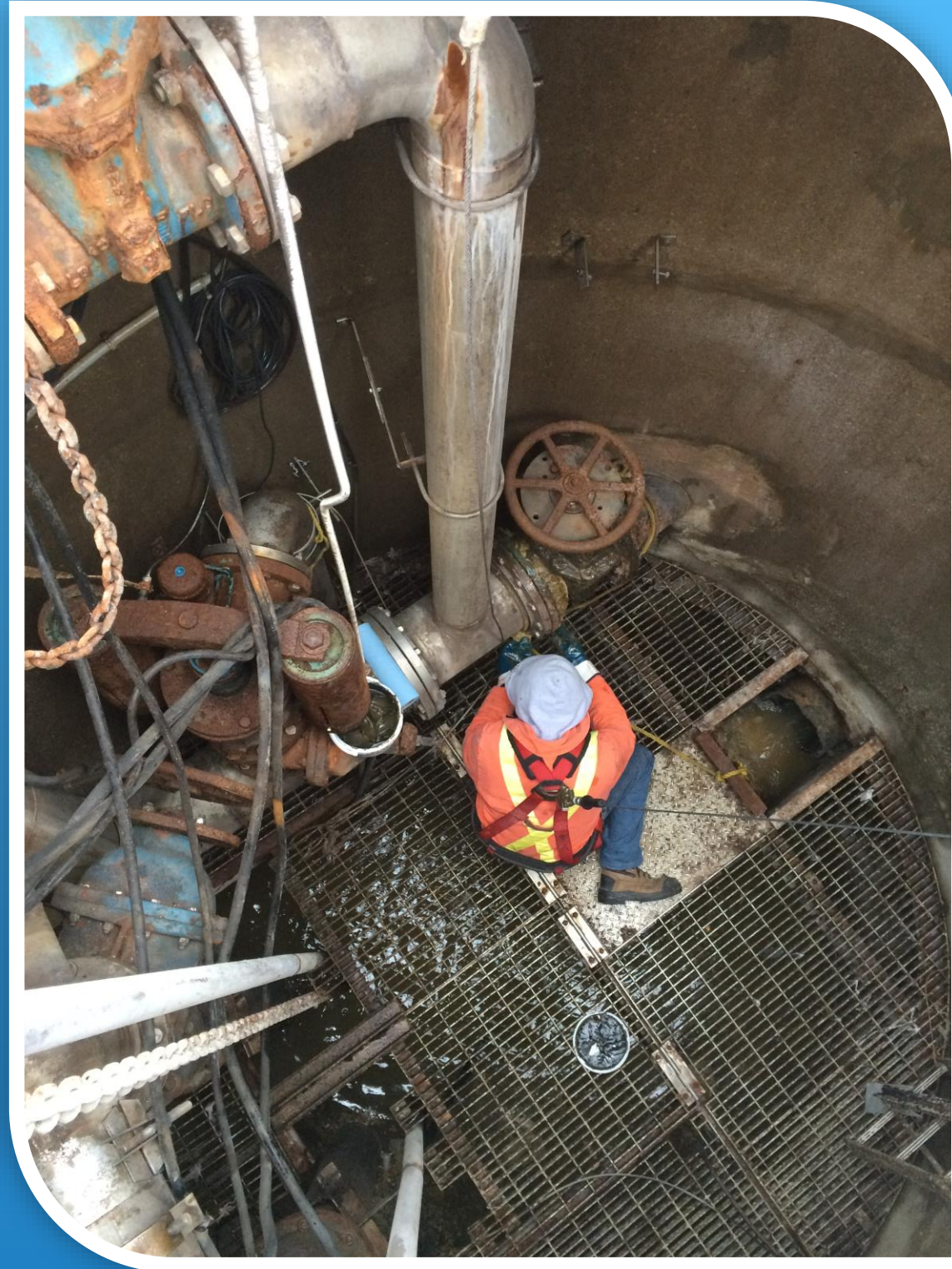


# PETROLATUM TAPE SYSTEMS





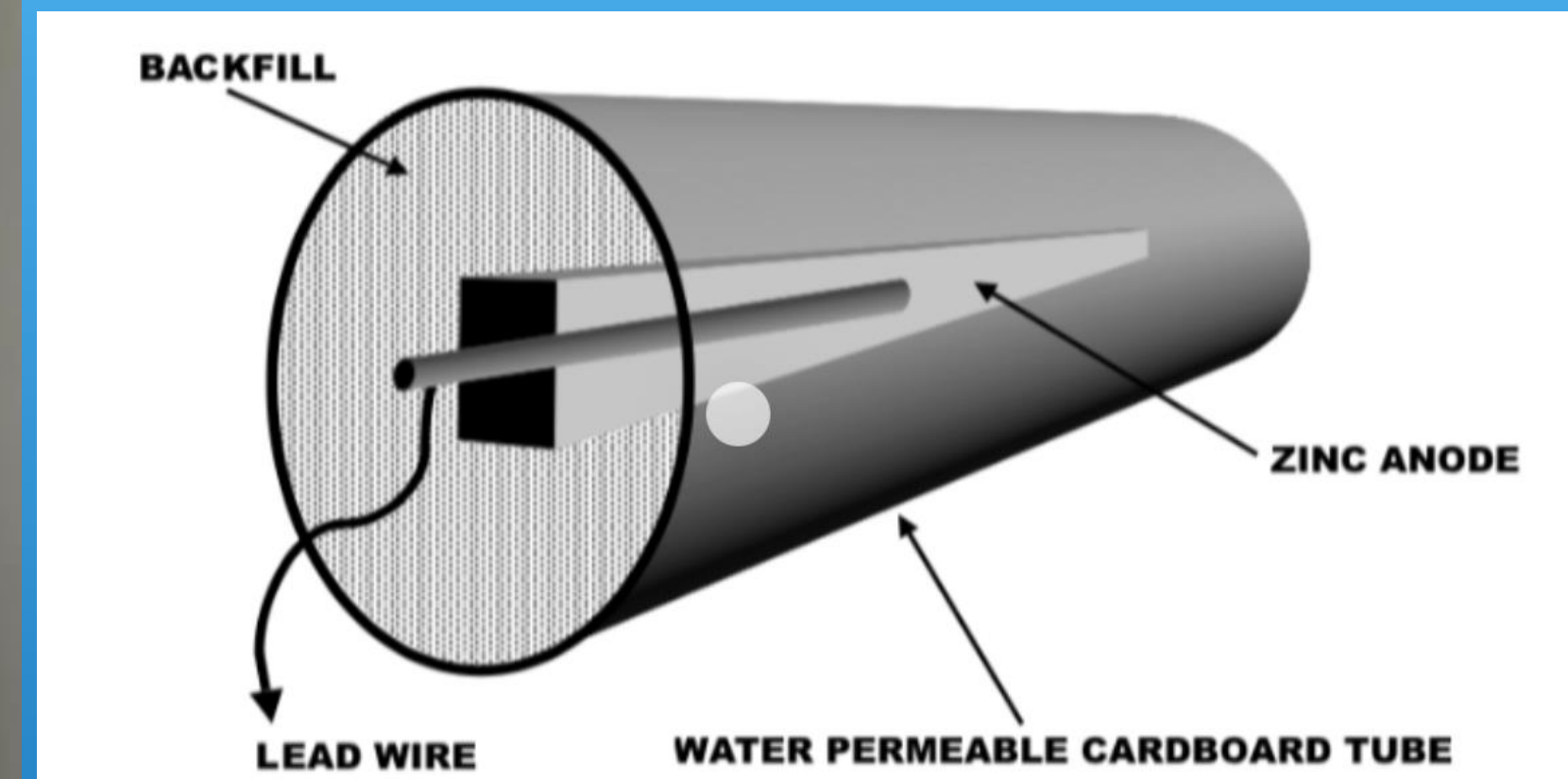
# MICROBIAL CORROSION



# PETROLATUM TAPE SYSTEMS



# CATHODIC PROTECTION - ANODES (ZINC)





# CORROSION CONTROL CONSIDERATIONS

- **Written and Published Municipal Specifications**

- Does our utility have a written specification?
- How recent is the most up to date specification?
- How much detail is written into the specification? Standards, instructions etc.
- Do we have adequate site supervision and inspection?
- Do our installers, both utility and private contractors understand our specification?\*

- **Importance of Infrastructure Itself**

- What size and how long is the water line? What is its design life?
- What does it feed?
- Is there an alternate supply? (Duplicity)
- Is there a history of corrosion in this area?
- Depth of Bury? How difficult and costly is it to access this infrastructure?

- **Redundancy**



# REDUNDANCY



# ALTERNATIVES VS. EQUIVALENTS

- **ALTERNATIVE** products in a specification does not necessarily mean they are **EQUIVALENT** in performance, price, manufacture, application or longevity to name a few.
- **Be very detailed in every written specification. Encourage all manufacturers to attain the highest level of certification deemed reasonable.**



# ALTERNATIVES VS. EQUIVALENTS

## 441.05.16. Corrosion Protection

“... Petrolatum tape systems shall be comprised of three components; paste, mastic and tape and meet the requirements of AWWA C217, CSA compliant, meet ISO 9001 and ISO 14001 and CFIA approved. Mastic must contain polystyrene beads and paste and tape must be of the same manufacturer as mastic to ensure compatibility. The three components provided shall be from the same manufacturer to ensure compatibility and optimal performance AND MUST meet CSA, ISO and CFIA requirements.”





# ALTERNATIVES VS. EQUIVALENTS



The screenshot shows the Canadian Food Inspection Agency (CFIA) website. At the top, there is a header with the Canadian flag and the text "Government of Canada" and "Gouvernement du Canada". Below this is the CFIA logo and a navigation menu with options: "About the CFIA", "Food", "Animals", "Plants", and "Guidance Document Repository". The main content area is titled "Reference Listing of Accepted Construction Materials, Packaging Materials and Products" and includes a "Last Update: 2016/01/25" and a "New Search" link. A table lists three products from Denso of North America Inc., including their categories, product names, and acceptance dates.

Government of Canada / Gouvernement du Canada

Canadian Food Inspection Agency

About the CFIA | Food | Animals | Plants | Guidance Document Repository

Home > Food > Reference Listing

## Reference Listing of Accepted Construction Materials, Packaging Materials and Products

Last Update: 2016/01/25

[New Search](#)

**Company** Denso of North America Inc.  
Toronto, Ontario, Canada, M1X 1M3

| Category (Sub-Category)   | Product Name                   | Acceptance Date |
|---|--------------------------------|-----------------|
| Coatings for Construction (Coating for structural members)        | Denso Protal ST Epoxy Mastic   | 2002/09/04      |
| Construction Material General (Insulation construction materials) | Denso Pipe Wrapping            | 2004/12/02      |
| Construction Material General (Pipe coverings)                    | Denso® Petrolatum Tape Systems | 2012/02/16      |



# QUESTIONS ?

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- 1 (902) 809-2685

**THANK YOU!**

