# AC Mitigation & Cathodic Protection: How Decouplers Make a Difference

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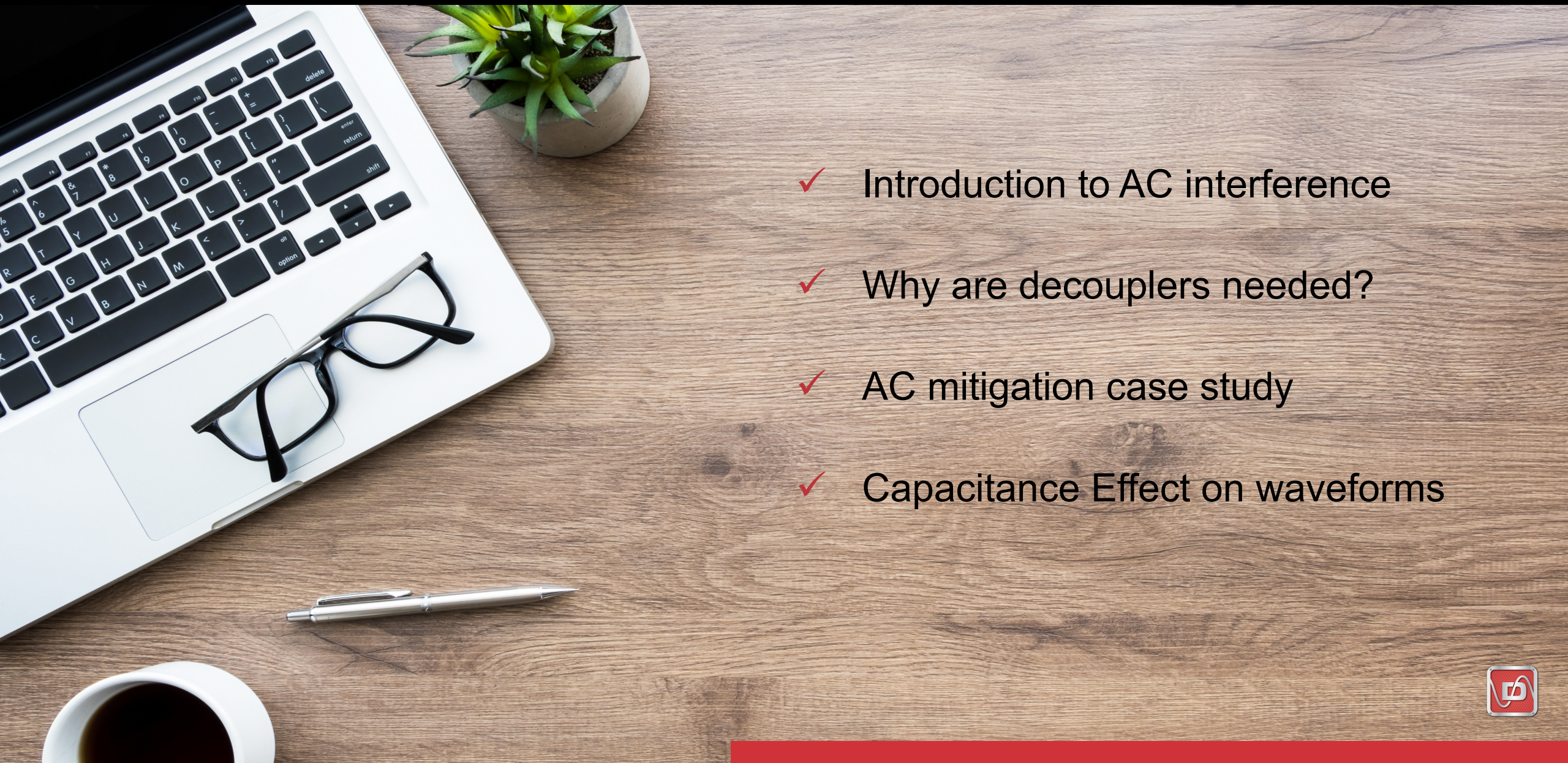
DAIRYLAND
ELECTRICAL INDUSTRIES
ALWAYS RUGGED. ALWAYS RELIABLE.

# OUTLINE



- ✓ Introduction to AC interference
- ✓ Why are decouplers needed?
- ✓ AC mitigation case study
- ✓ Capacitance Effect on waveforms

# DAIRYLAND


**1990 — ISP**
Dairyland created the first solid-state device for high-power utility decoupling.


**1994 — PCR**
Dairyland introduced the first solid-state decoupling device for the corrosion industry.

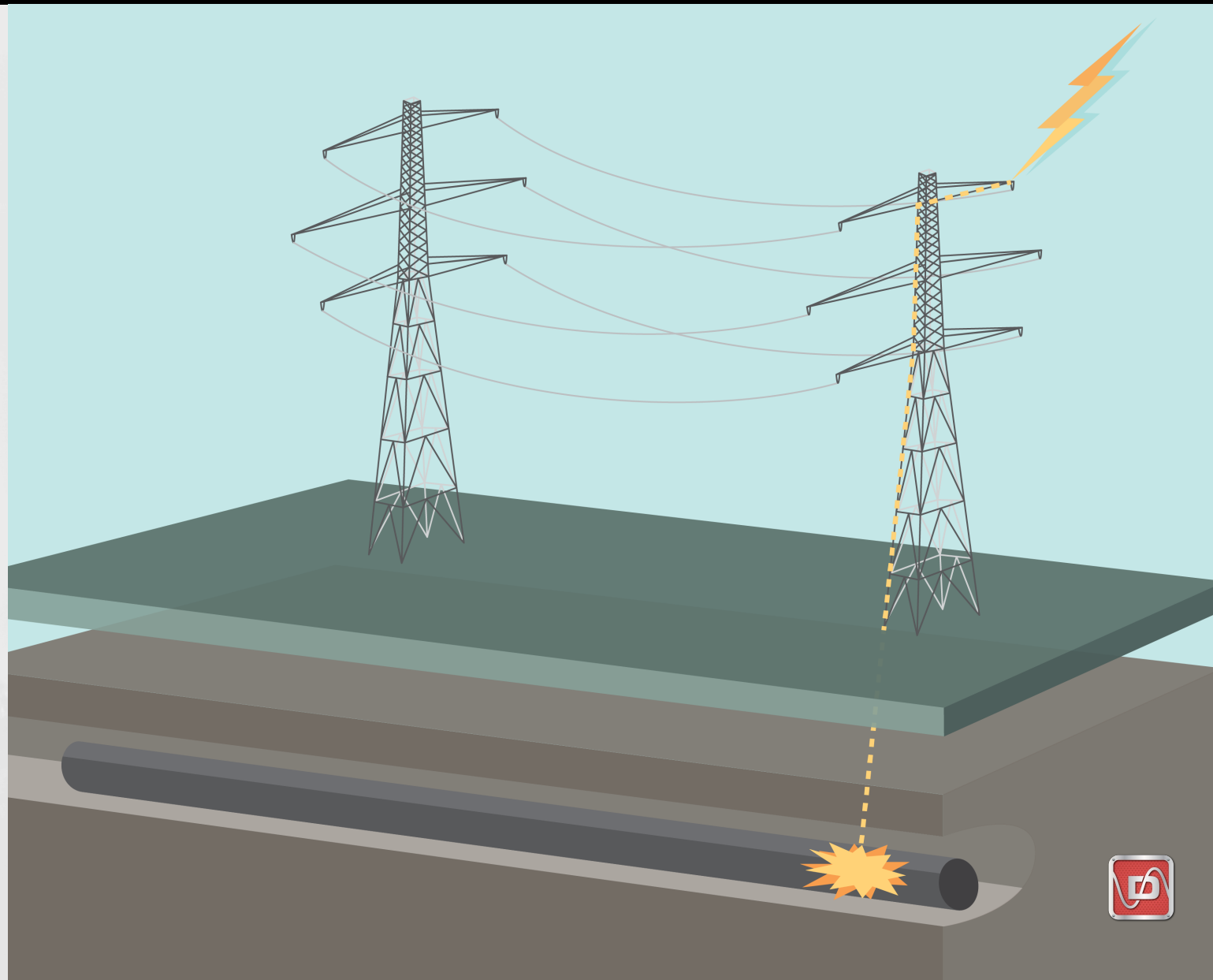
# DAIRYLAND

**Today**
Dairyland is the world's leading manufacturer of solid-state decouplers, with products installed in over 90 countries around the world.

# SOURCES OF AC INTERFERENCE

## Conductive Coupling

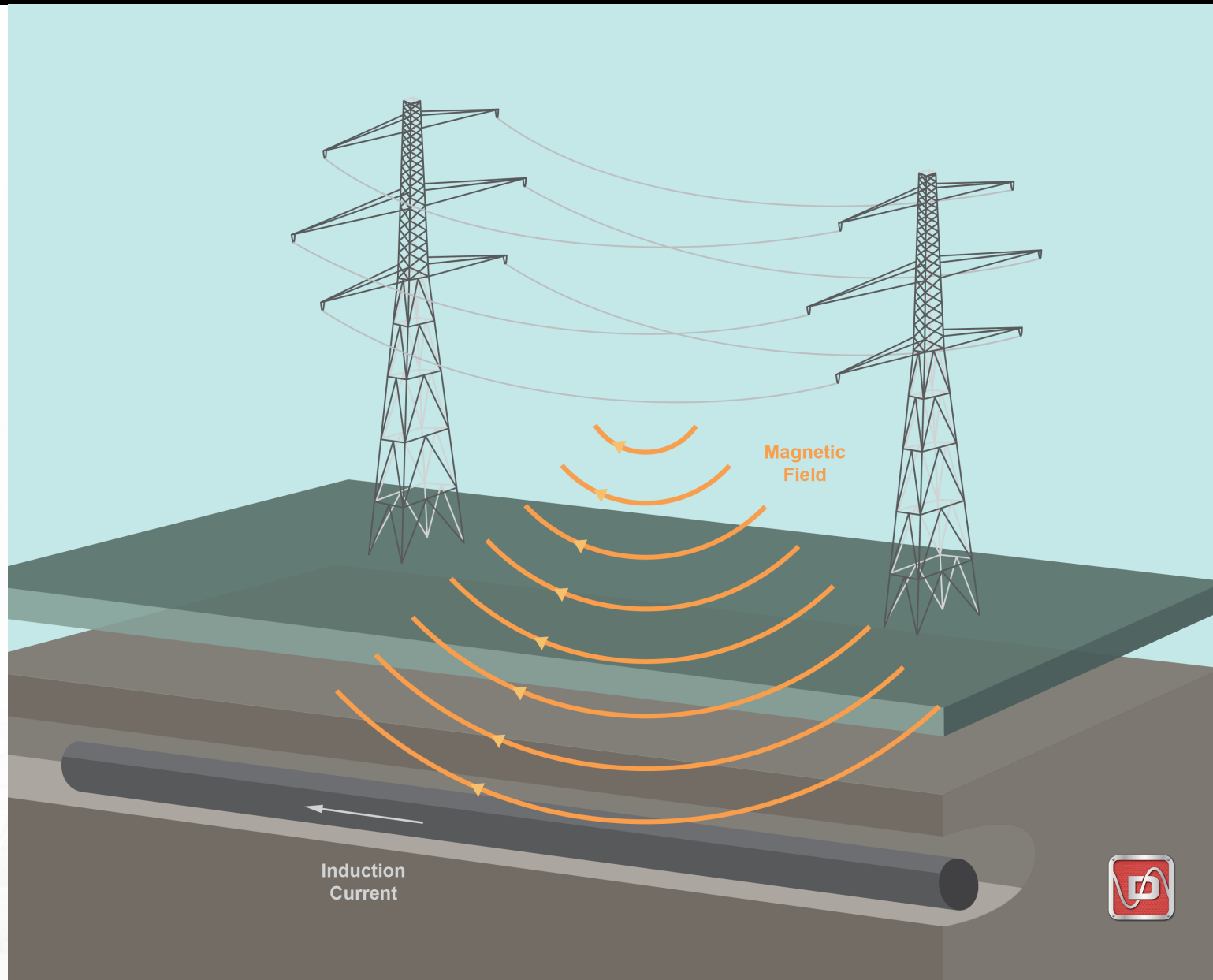
- Lightning or AC fault
- AC current flows onto pipe
- Arcing on the pipe



# SOURCES OF AC INTERFERENCE

## Inductive Coupling

- Power line has magnetic field
- Magnetic field interacts with pipeline
- Newer coatings are more susceptible

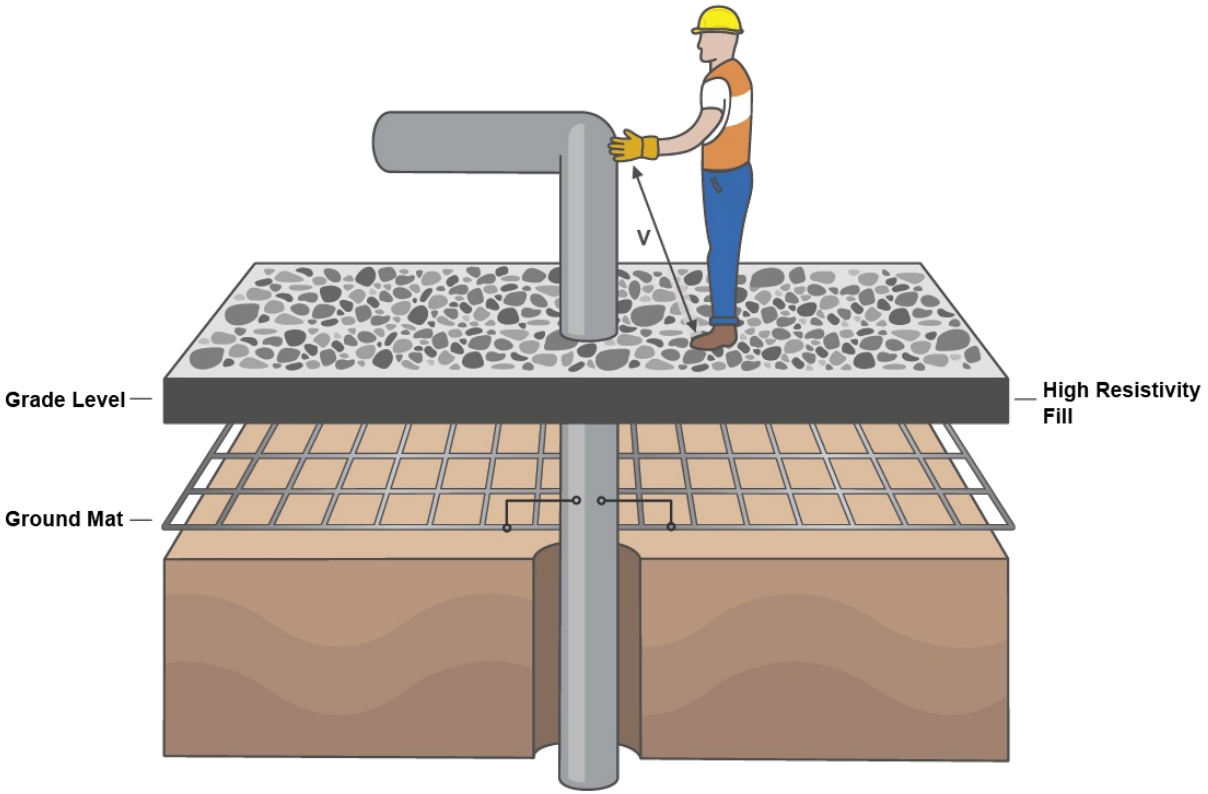


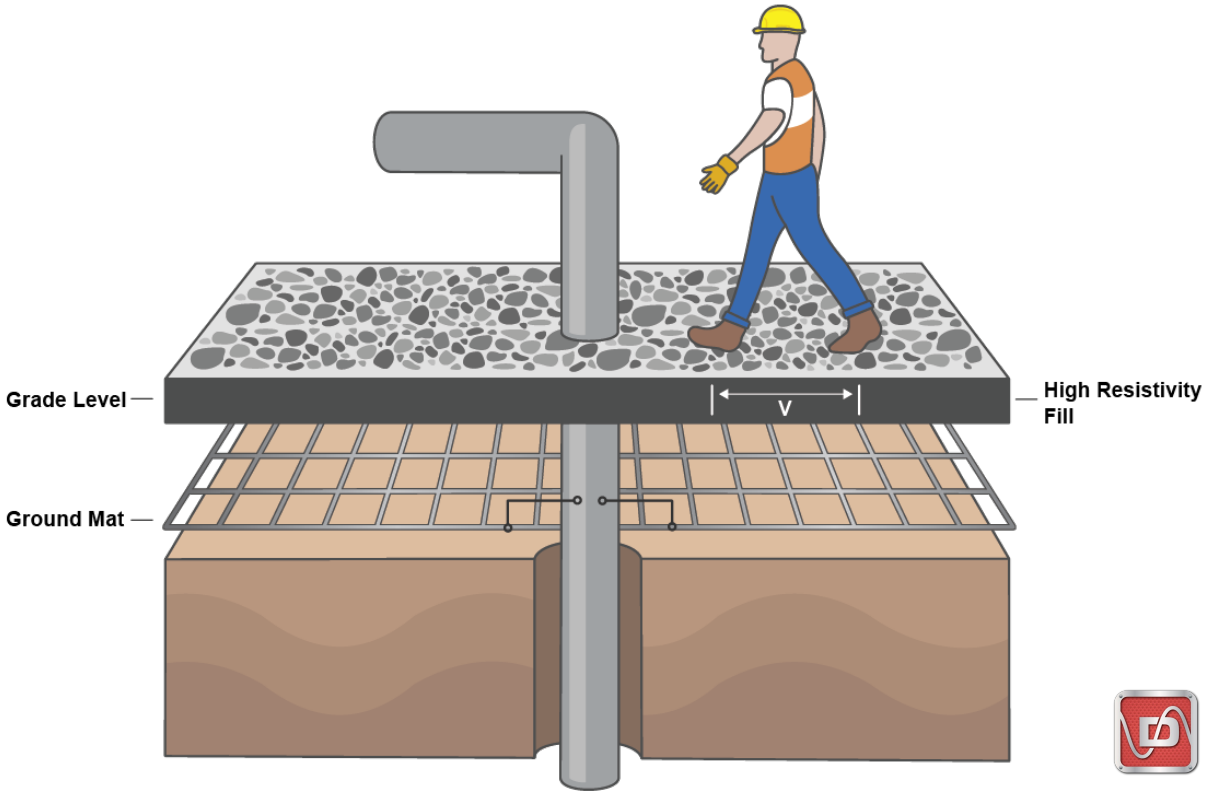
# AC INTERFERENCE - ISSUES

## Personnel Safety Hazard – Touch and Step Voltages

**CRITERIA:** NACE SP0177-2019 & EN 50443

Maximum allowed range: 15 Volts-AC to 60V



# AC INTERFERENCE - ISSUES

## AC Corrosion

- Caused by discharge of AC current at coating defects
- More damaging at smaller defects
- AC current can cause DC depolarization

# AC INTERFERENCE - ISSUES

## AC Corrosion

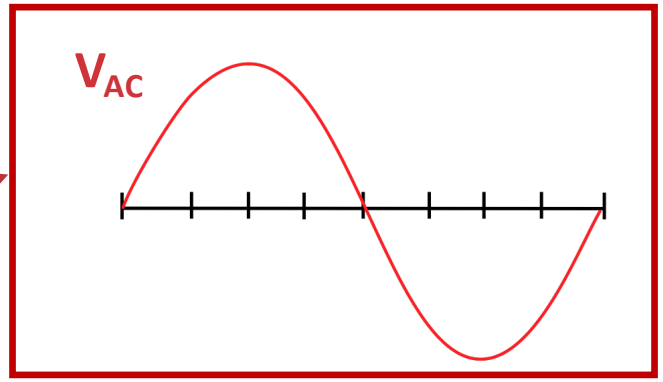
**CRITERIA:** AC corrosion current density ($I_{AC}$)

Options for determining $I_{AC}$

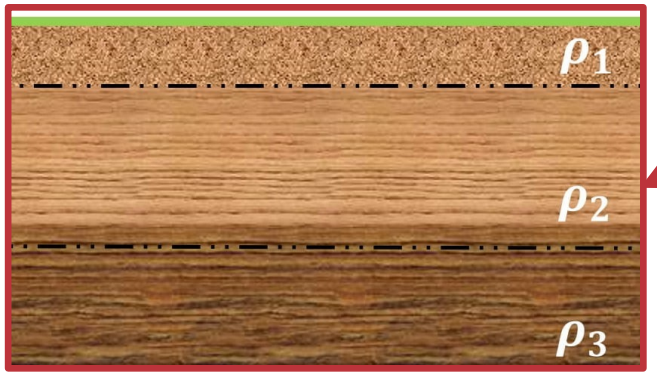
- Calculations:

$$I_{AC} = \frac{8V_{AC}}{\rho \pi d}$$

Pipeline AC Potential




Soil Resistivity




Defect Size

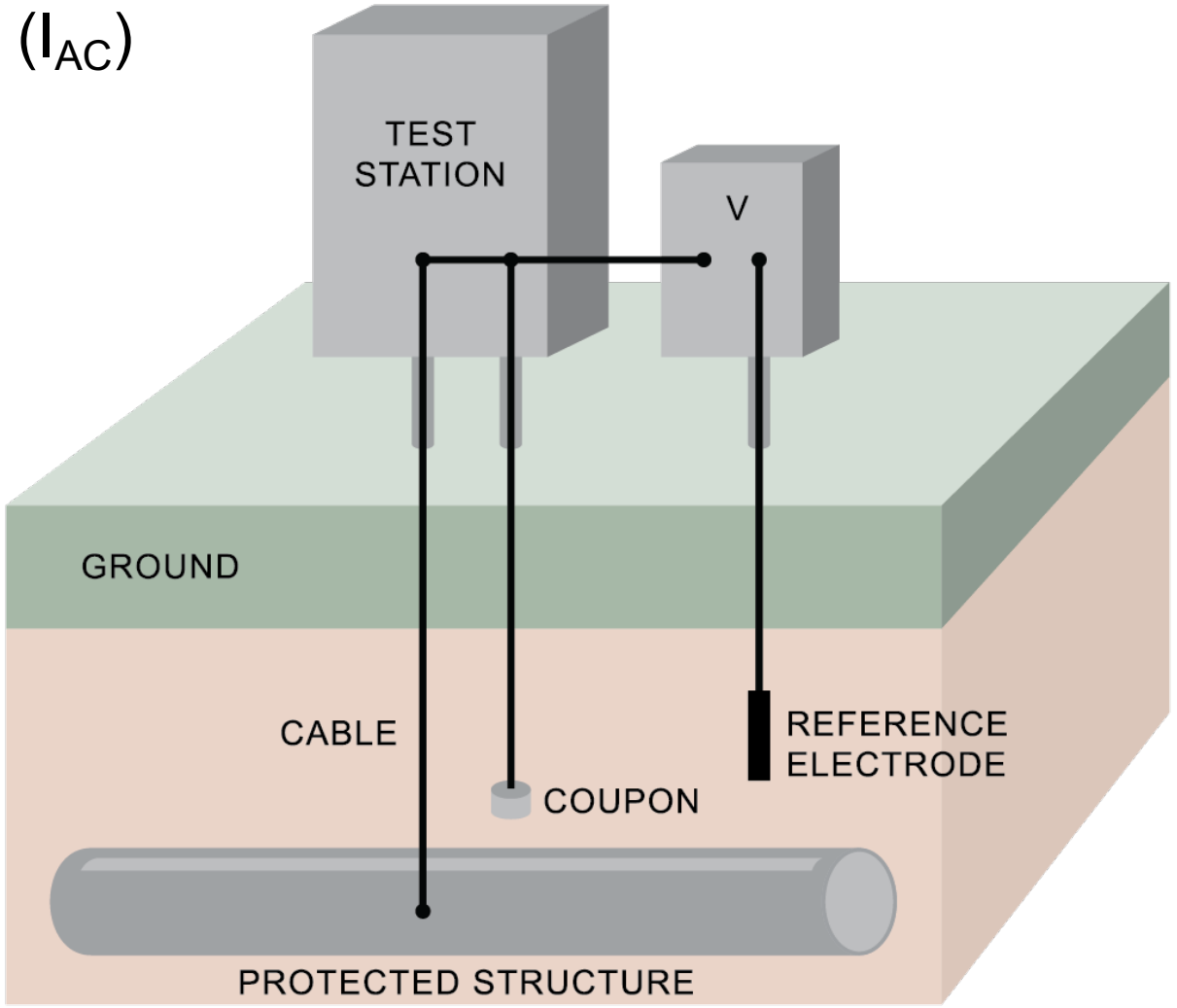
# AC INTERFERENCE - ISSUES

## AC Corrosion

**CRITERIA:** AC corrosion current density ($I_{AC}$)

Options for determining $I_{AC}$

- Calculations
- Directly Measure $I_{AC}$ with Coupon



# AC INTERFERENCE - ISSUES

## AC Corrosion

**CRITERIA:** AC corrosion current density ($I_{AC}$)

- $I_{AC}$ current density limits:

| | DC Current Density > 1 A/m² | DC Current Density < 1 A/m² | AC/DC Current Density Ratio |
|---|---|---|---|
| NACE Limits (SP21424) | AC Current Density < 30 A/m² | AC Current Density < 100 A/m² | |
| European Limits (EN 15280:2013) | AC Current Density < 30 A/m² | No Limit Stated | <5 (Lowest Possible) |
| CFR 192.473 | AC Current Density < 100 A/m² | AC Current Density < 100 A/m² | |

# FACTORS OF INDUCED AC

## Geospatial

- Lateral Separation
- Colocation Length
- Crossing Angle

## HVAC System

- HVAC Current
- HVAC Voltage
- Fault Current

## Environment

- Soil Resistivity
- Seasonal Changes

## Pipeline

- Coating Resistance
- Diameter

Source: CEPA – A/C Interference Guideline Final Report, June 2014

# WHY ARE DECOUPLERS NEEDED?

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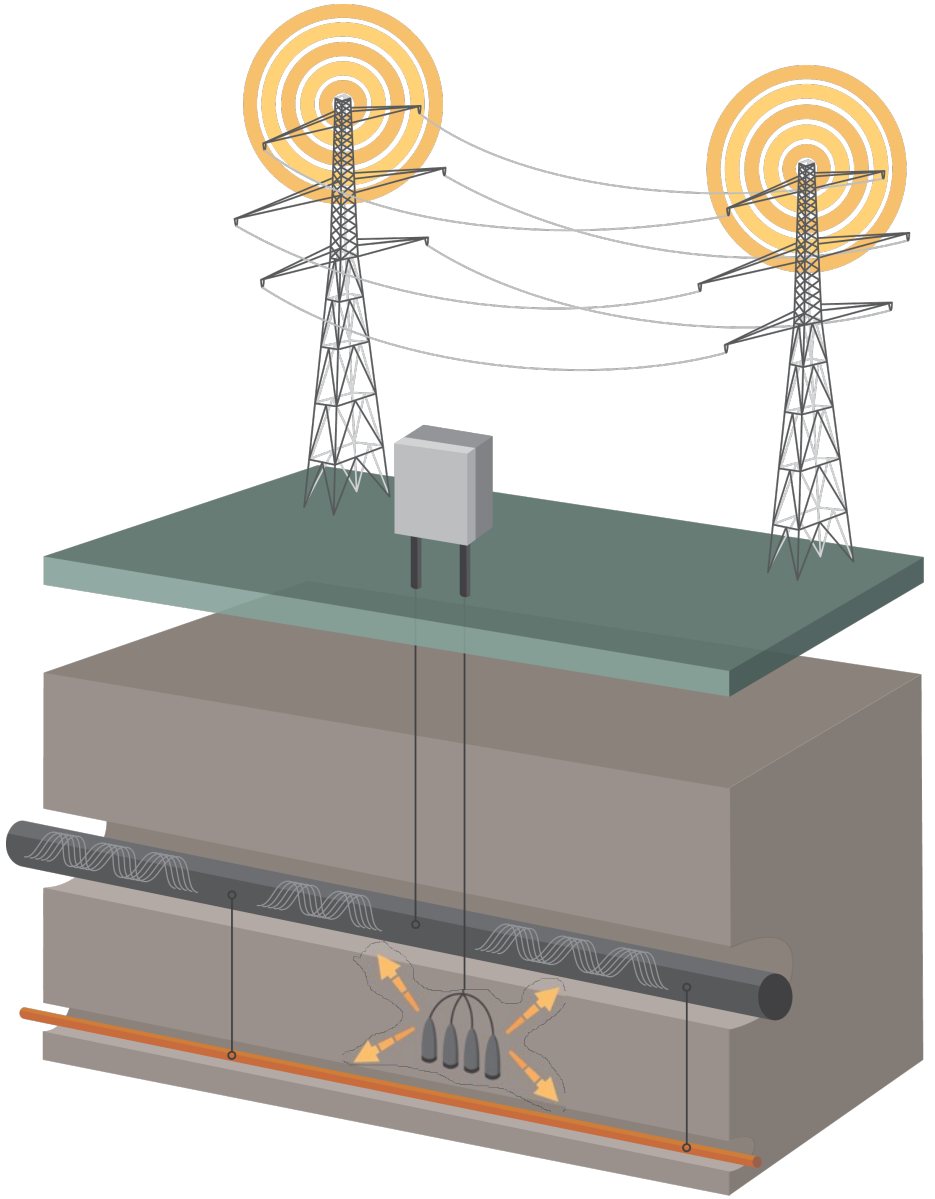
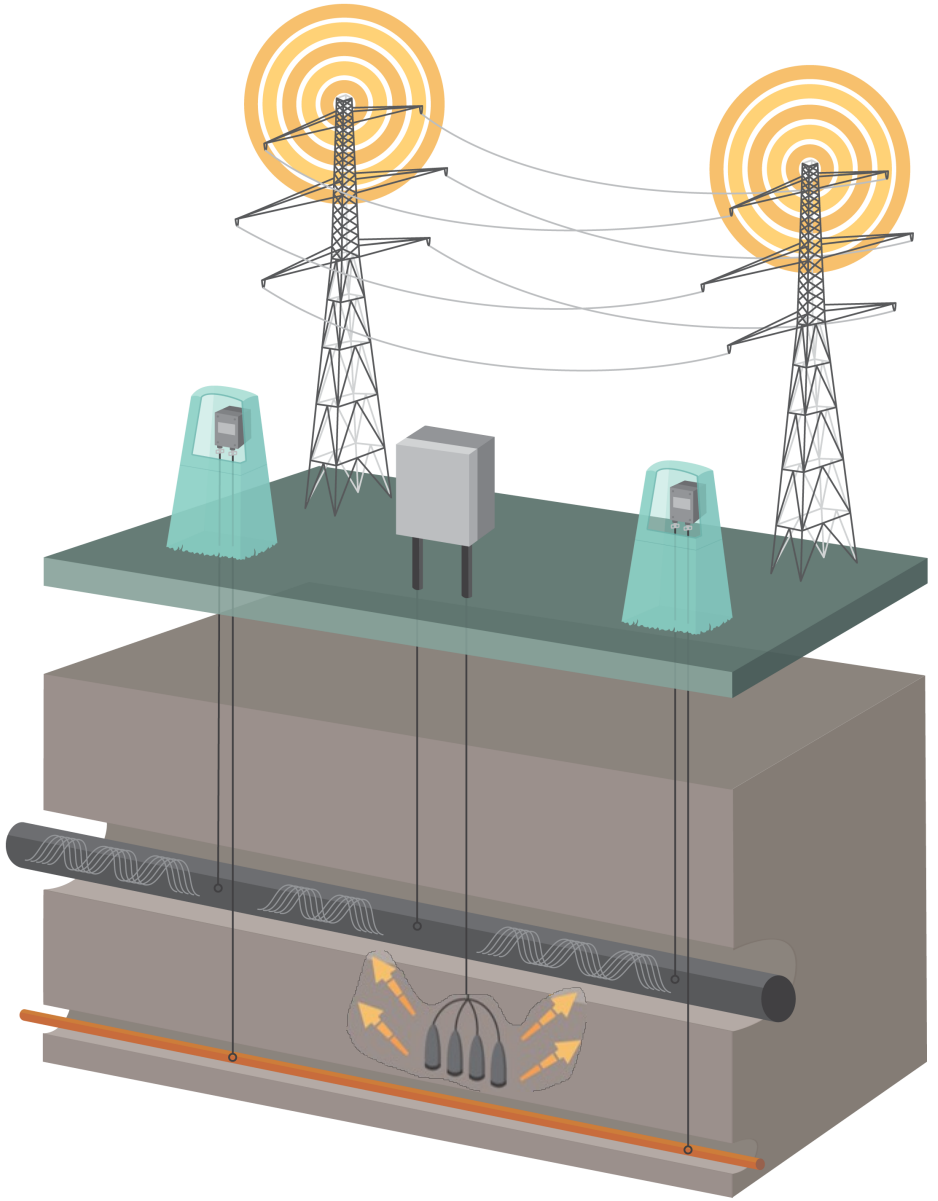
AC mitigation
WITHOUT decoupling



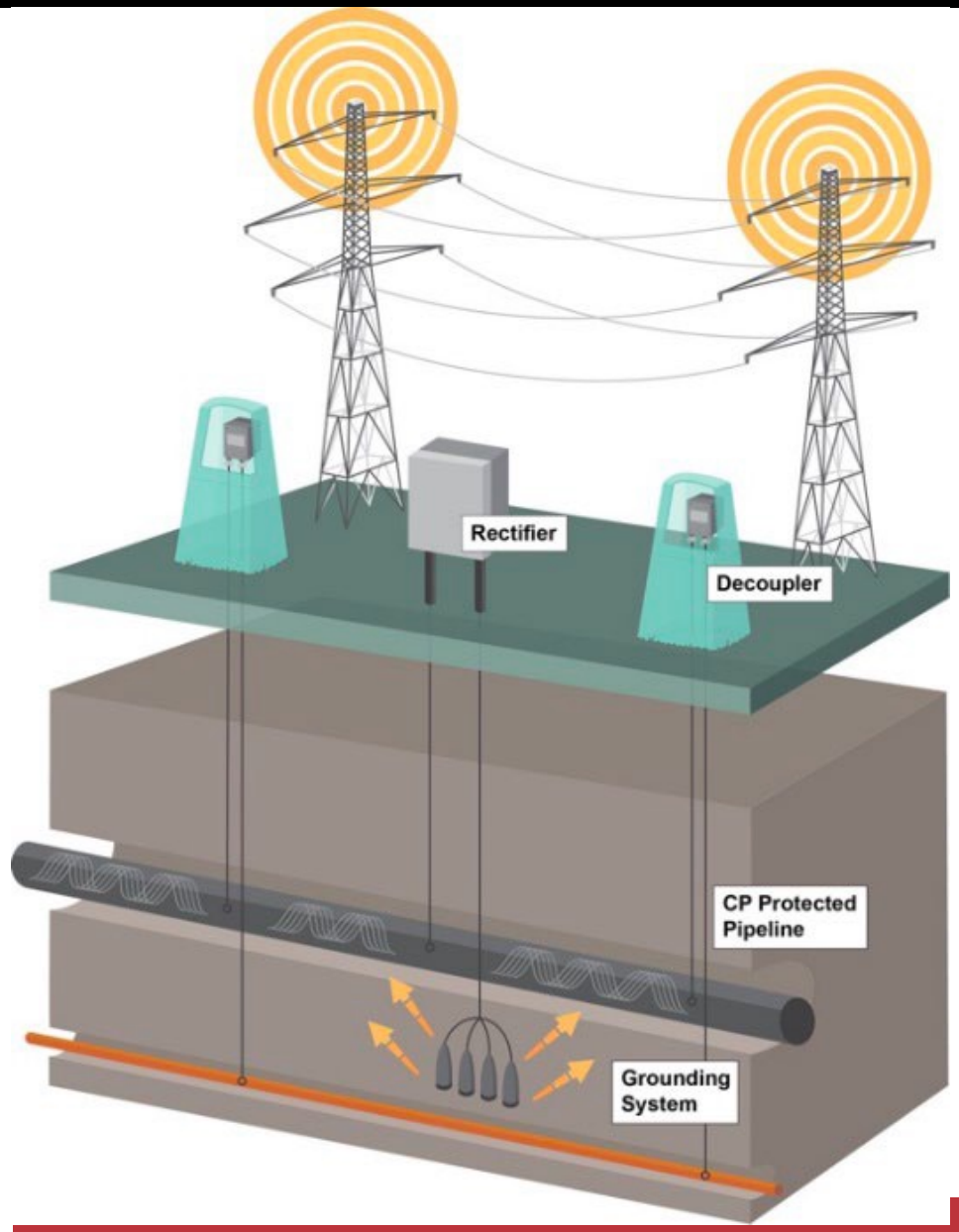
# WHY ARE DECOUPLERS NEEDED?

AC mitigation
WITH decoupling



# WHY ARE DECOUPLERS NEEDED?

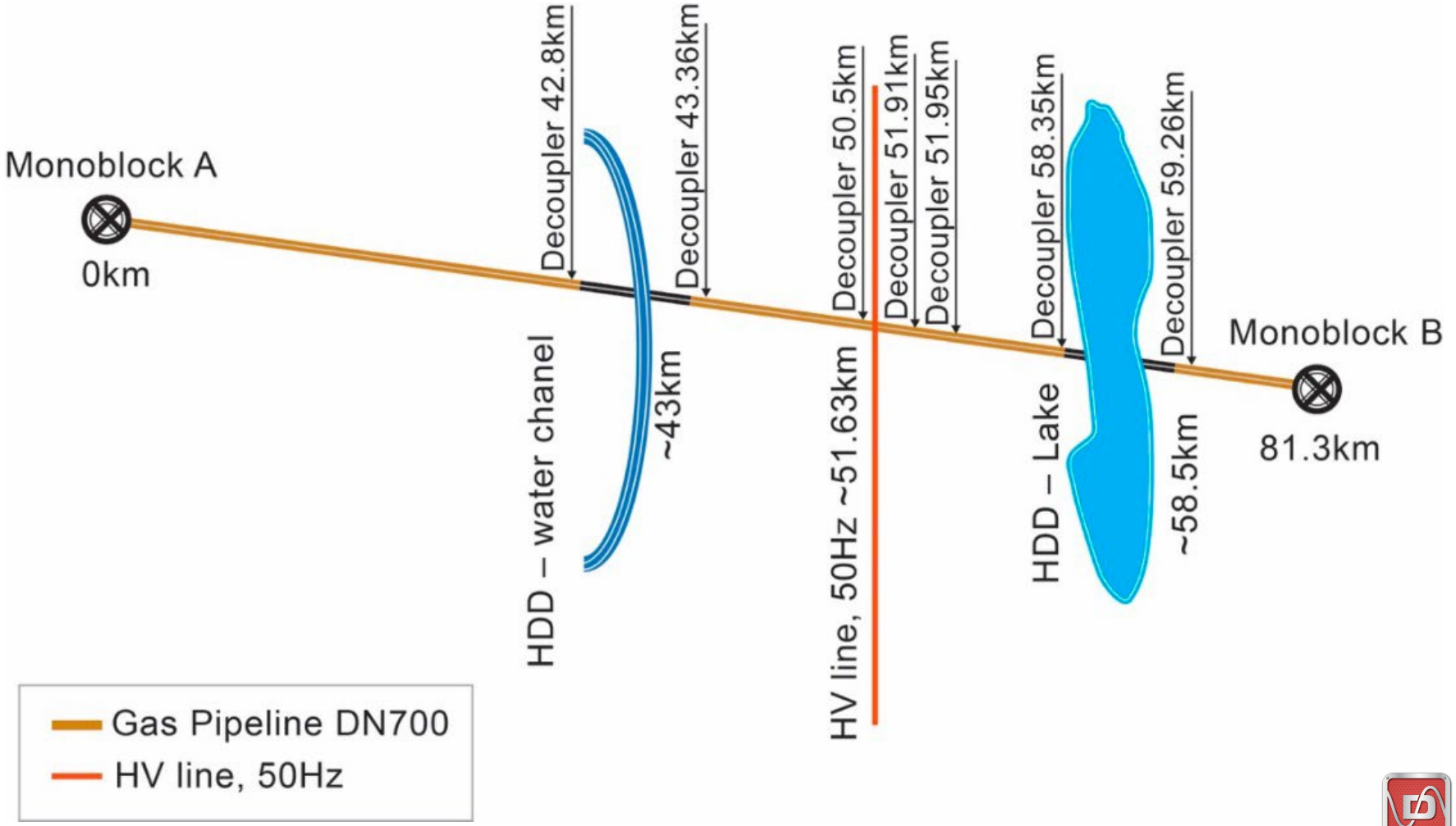
AC mitigation
WITH decoupling



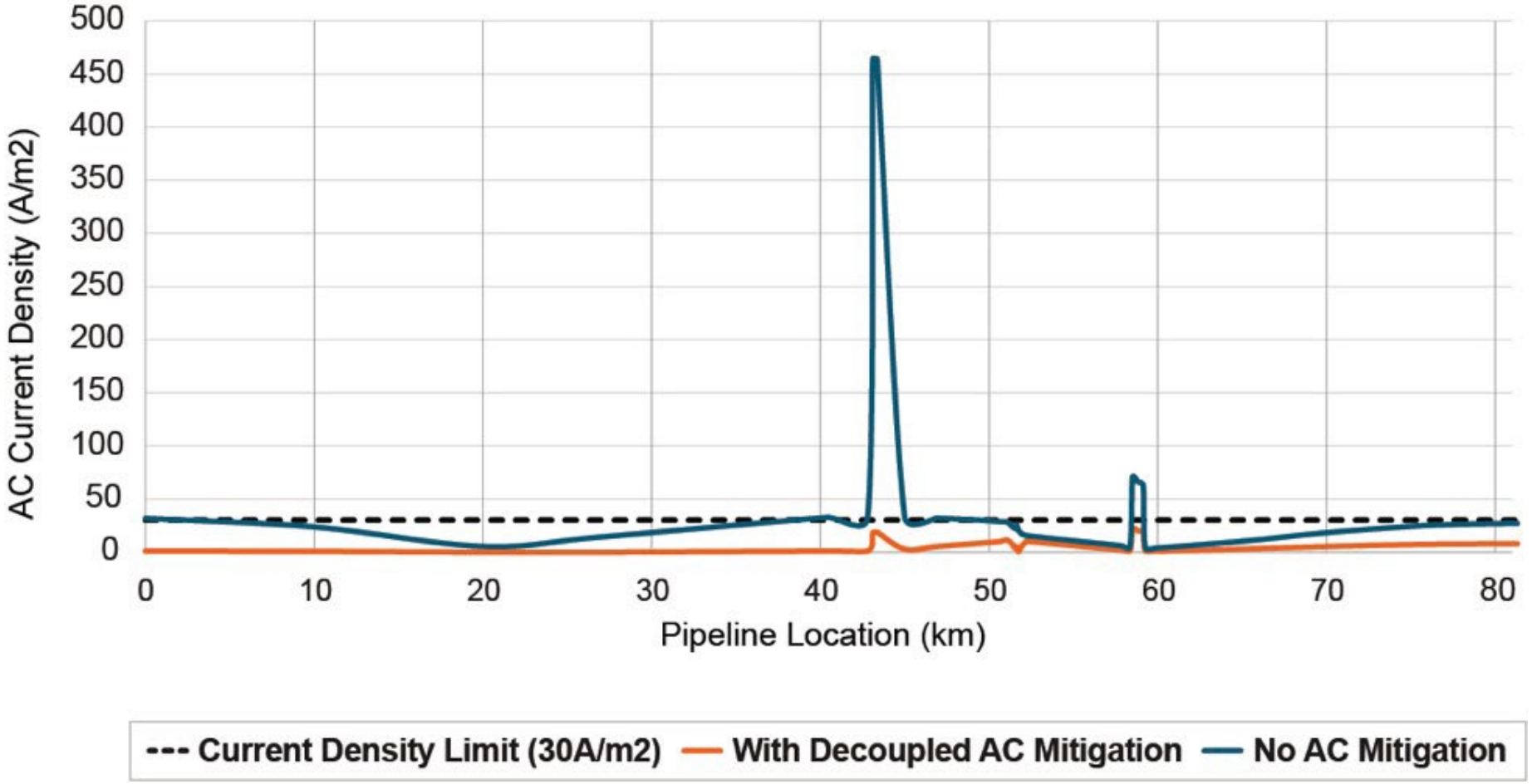
# AC INTERFERENCE CASE STUDY

Example:

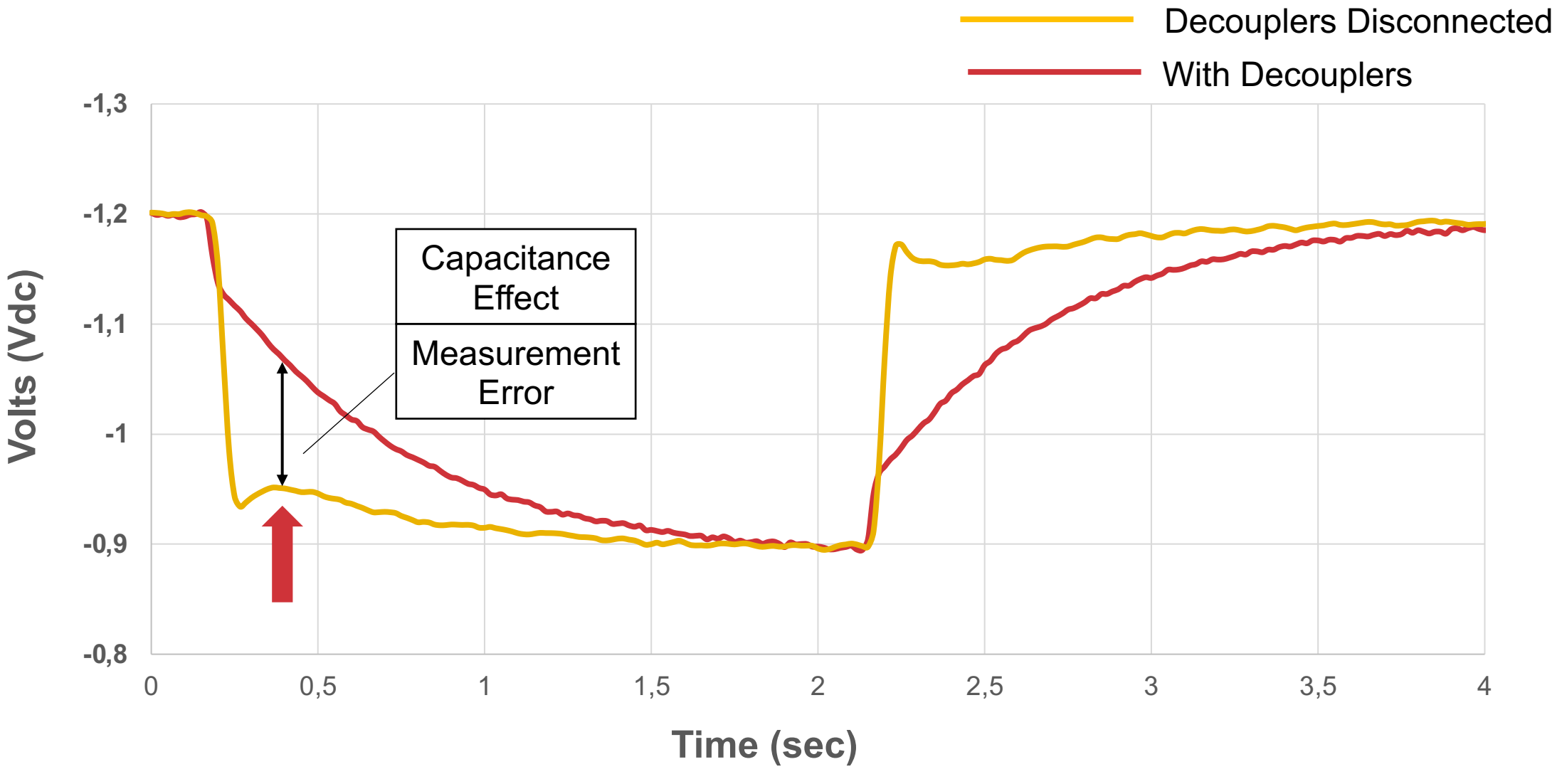
- 3LPE Coating
- Eastern Europe
- 7 Earthing Bonds
- 5 Vac max
- Soil Resistivity 2Ω-m



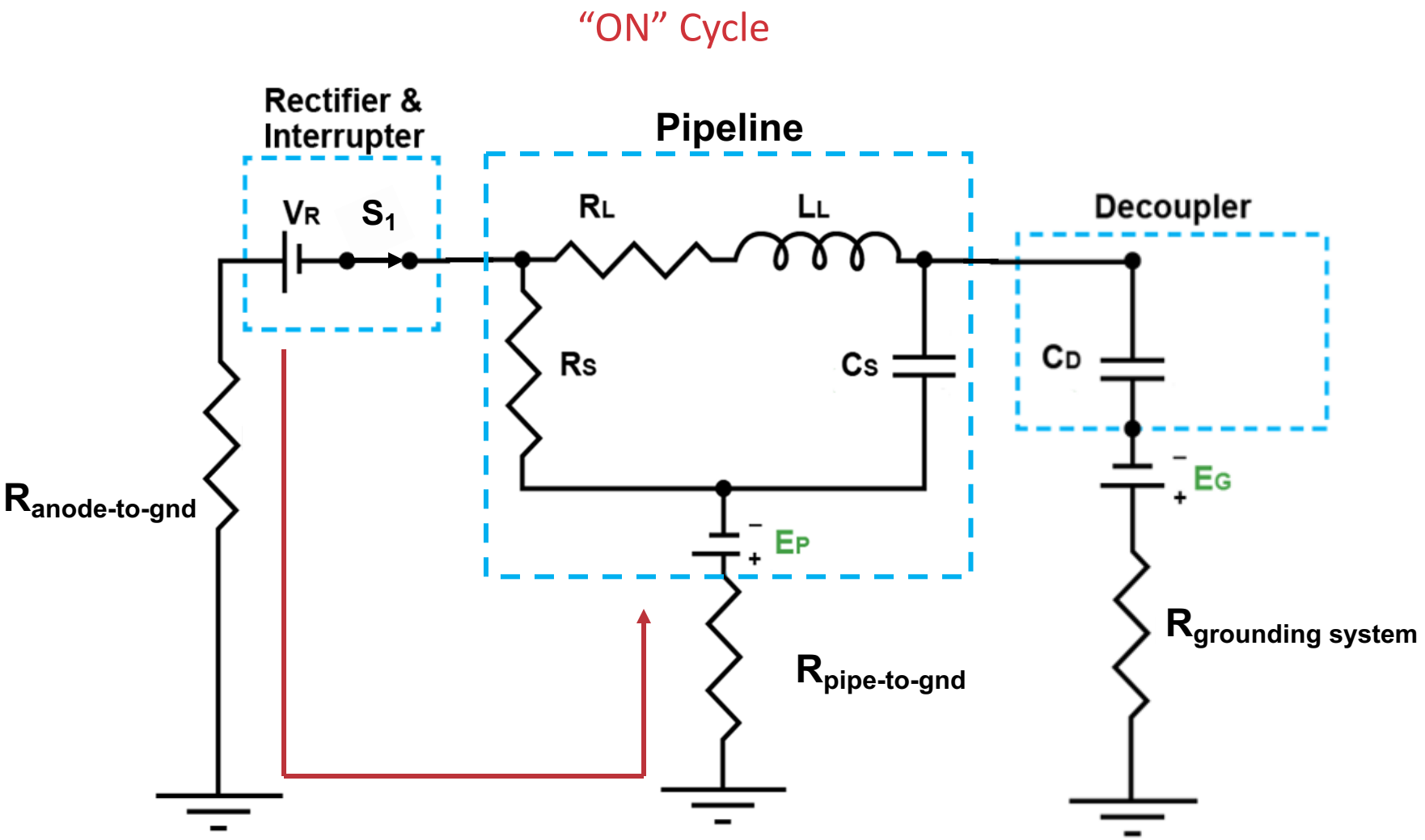
# AC INTERFERENCE CASE STUDY



# CAPACITANCE EFFECT



# WHY DOES THIS OCCUR?



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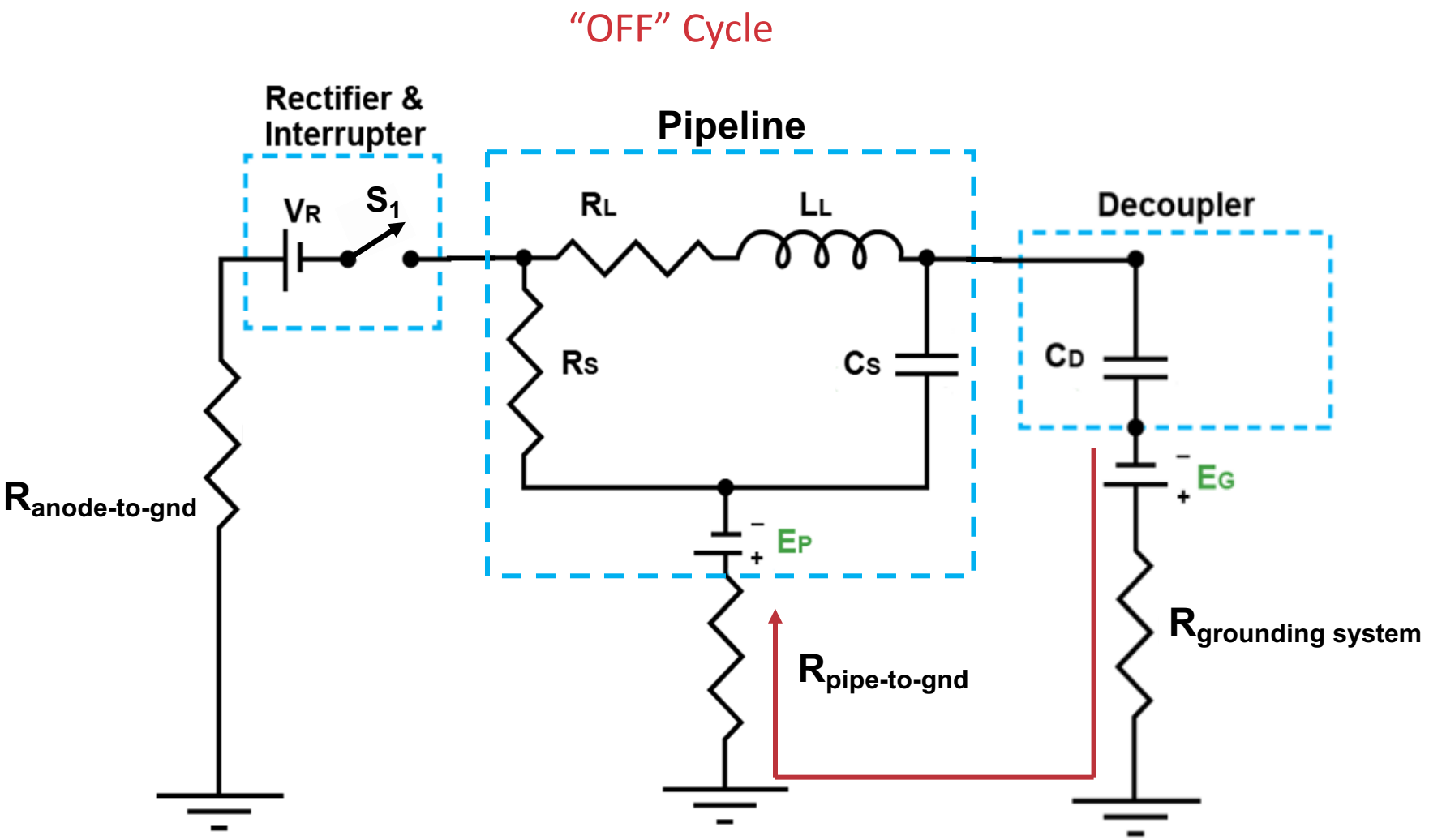
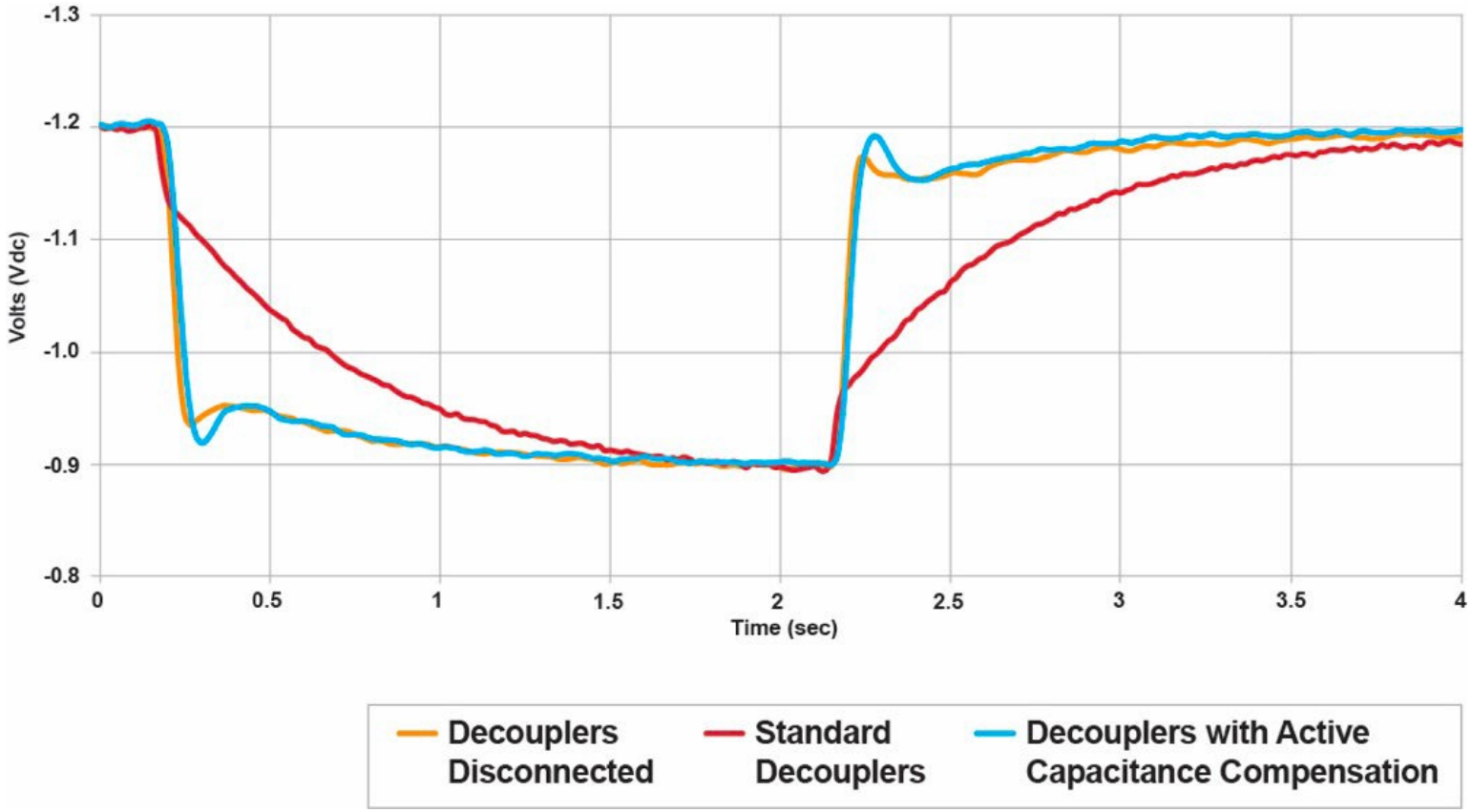


# ACTIVE CAPACITANCE COMPENSATION

Addresses capacitance effect during interrupted surveys




# SOLID-STATE DECOUPLERS

# AC MITIGATION SUMMARY

## AC Mitigation Can be Complex

- Many complex factors create need for modelling

## Decouplers Improve CP Performance

- DC is isolated to intended structure

## Dairyland Offers Many Options

- SSD, PCR, PCRX

## Review Waveforms

- Understand capacitive effects

# QUESTIONS?
# CONTACT DAIRYLAND

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dairyland.com

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