



**AC MITIGATION:
HOW TO MAXIMIZE
YOUR POTENTIALS**



How does Dairyland Pick and Style their cows!!!





AGENDA

- INTRODUCTION TO AC INTERFERENCE
- WHY ARE DECOUPLERS NEEDED?
- AC MITIGATION DECOUPLER APPLICATION GUIDANCE

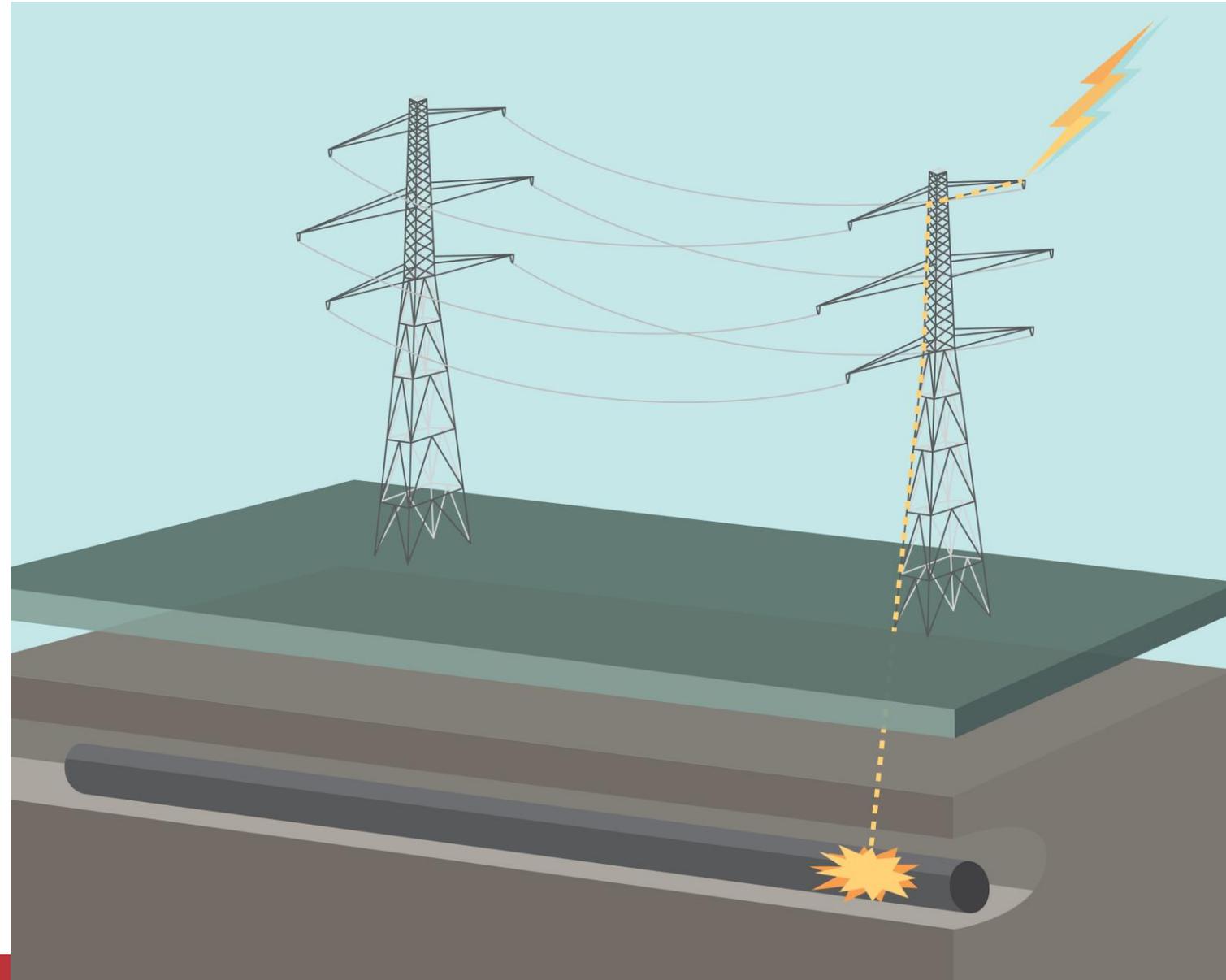




SOURCES OF AC INTERFERENCE

CONDUCTIVE COUPLING

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

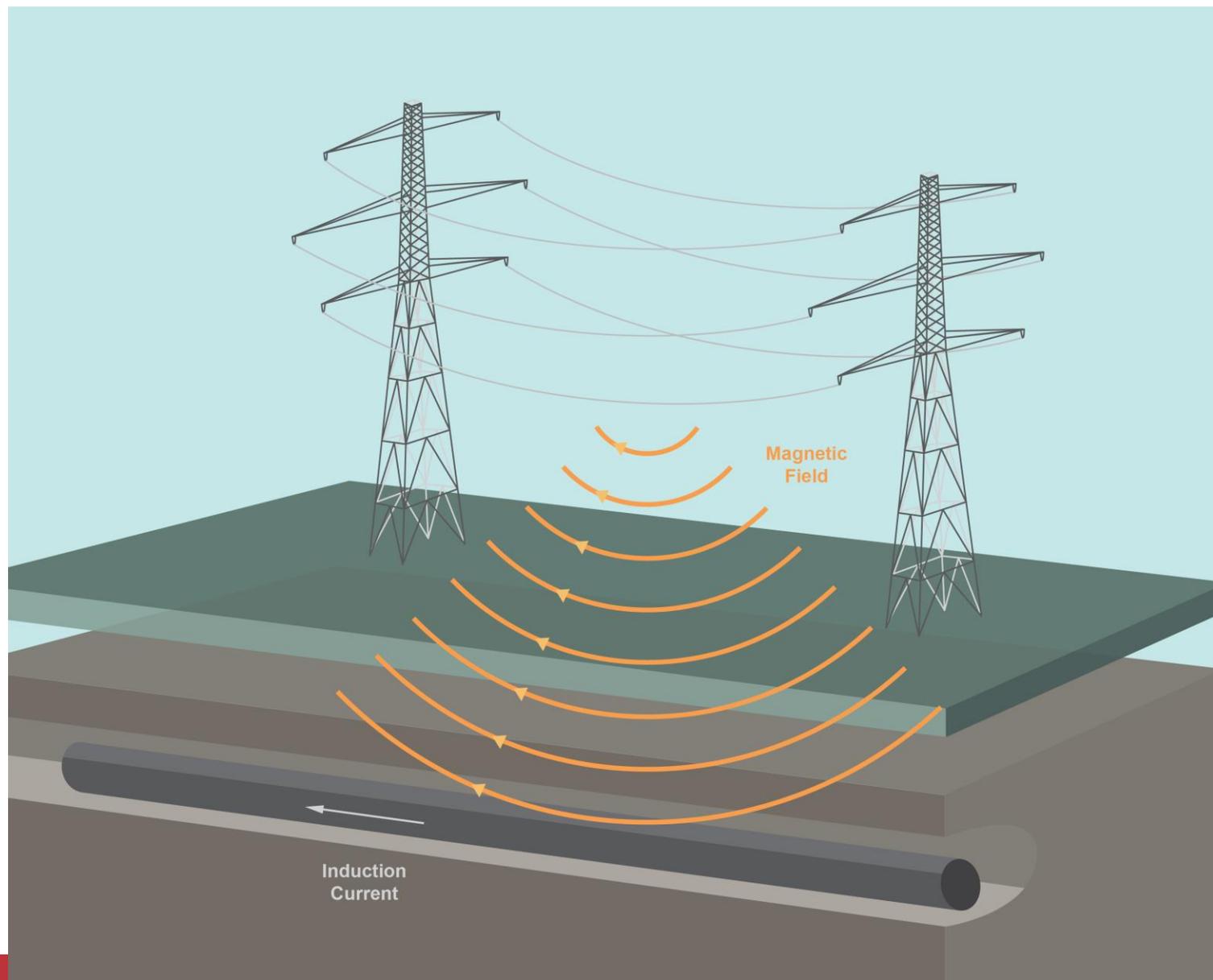




SOURCES OF AC INTERFERENCE

INDUCTIVE COUPLING

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



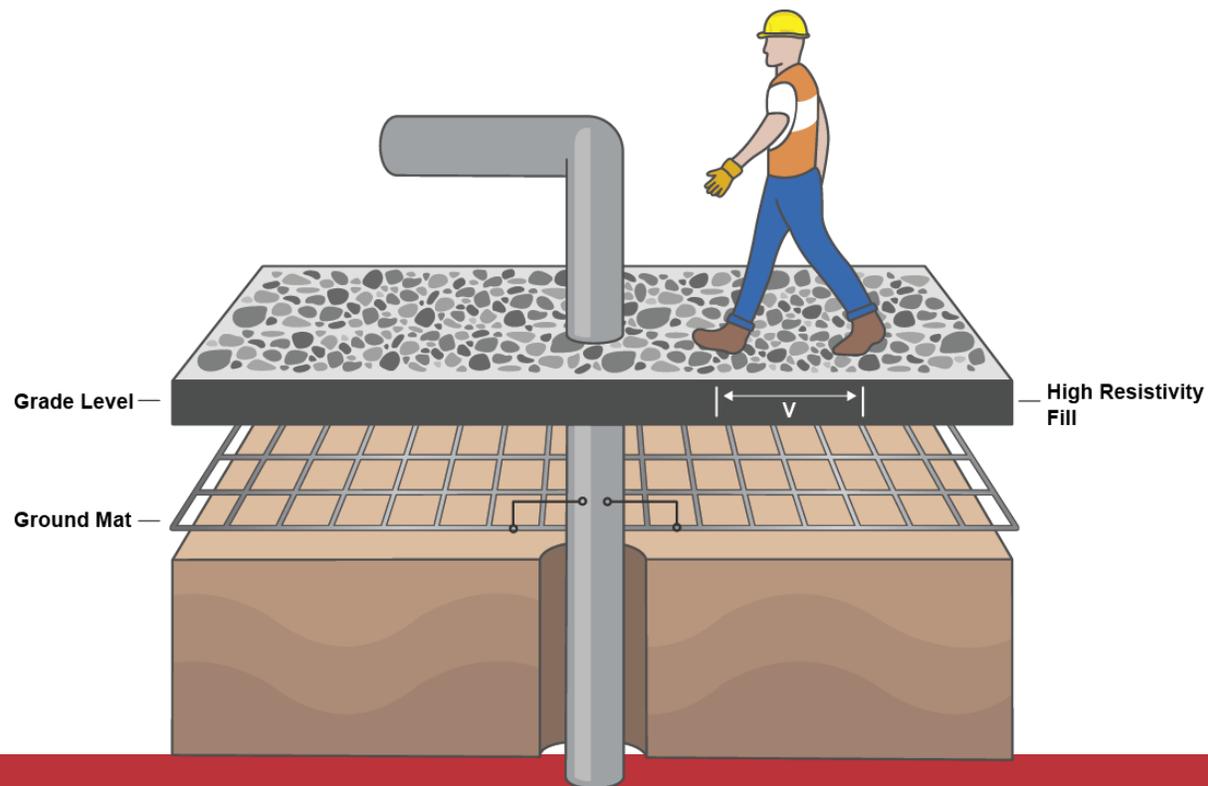
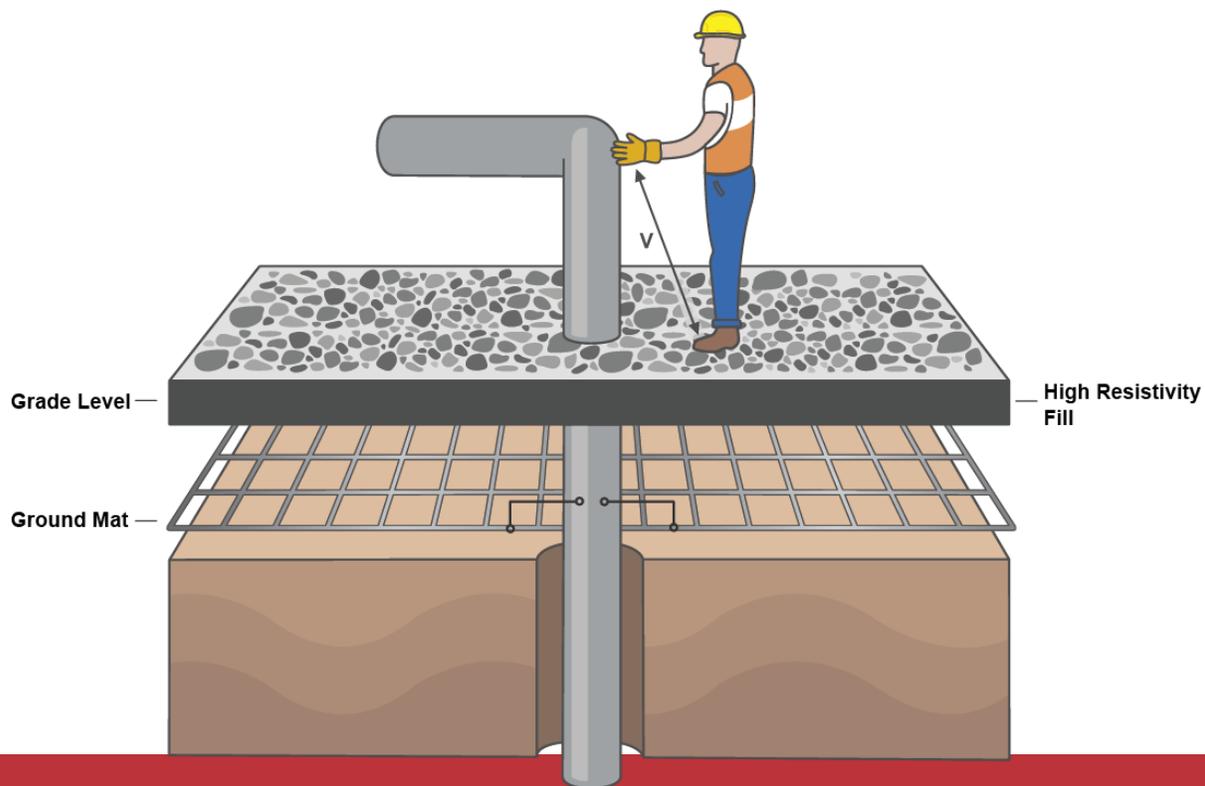


AC INTERFERENCE - ISSUES

PERSONNEL SAFETY HAZARD – TOUCH AND STEP VOLTAGES

CRITERIA: NACE SP0177-2019

Maximum allowed: 15 Volts-AC





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}

- I_{AC} Current density limits:

	DC Current Density > 1 A/m ²	DC Current Density < 1 A/m ²	AC/DC Current Density Ratio
NACE Limits (SP21424)	AC Current Density < 30 A/m ²	AC Current Density < 100 A/m ²	
European Limits (EN 15280:2013)	AC Current Density < 30 A/m ²	No Limit Stated	<5 (Lowest Possible)
CFR 192.473	AC Current Density < 100 A/m ²	AC Current Density < 100 A/m ²	



AC INTERFERENCE - ISSUES

AC CORROSION

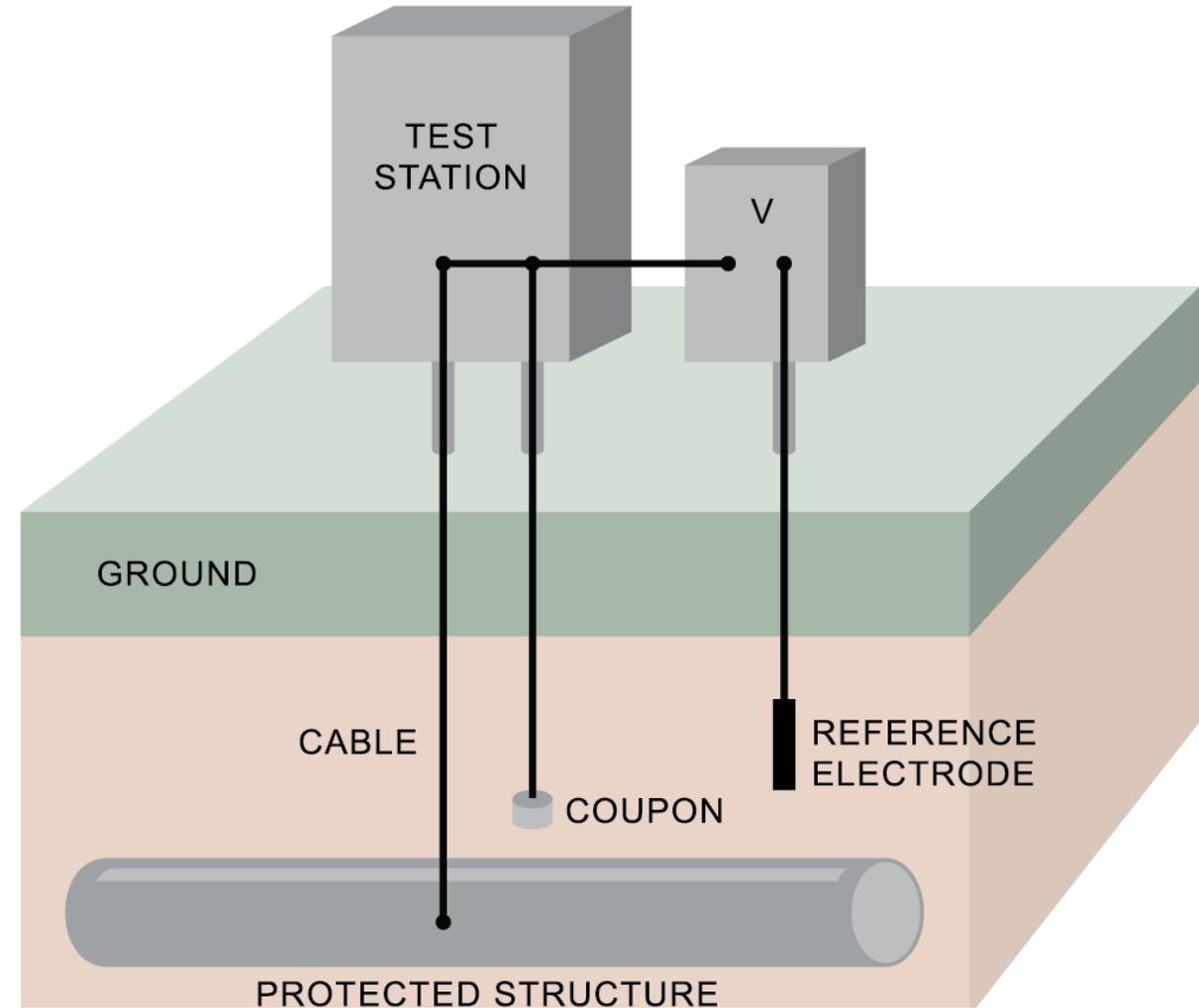
CRITERIA: AC corrosion current density (I_{AC})

Options for determining I_{AC}

- Calculations

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

- Directly measure I_{AC} with Coupon





AC INTERFERENCE - ISSUES

AC CORROSION

- Higher CP potentials can reduce spread with resistance
- ...which increases AC current density
- Thus, criteria are also dependent on CP current density

REFERENCE

NACE SP21424-2018

EN 50443, EN15280





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

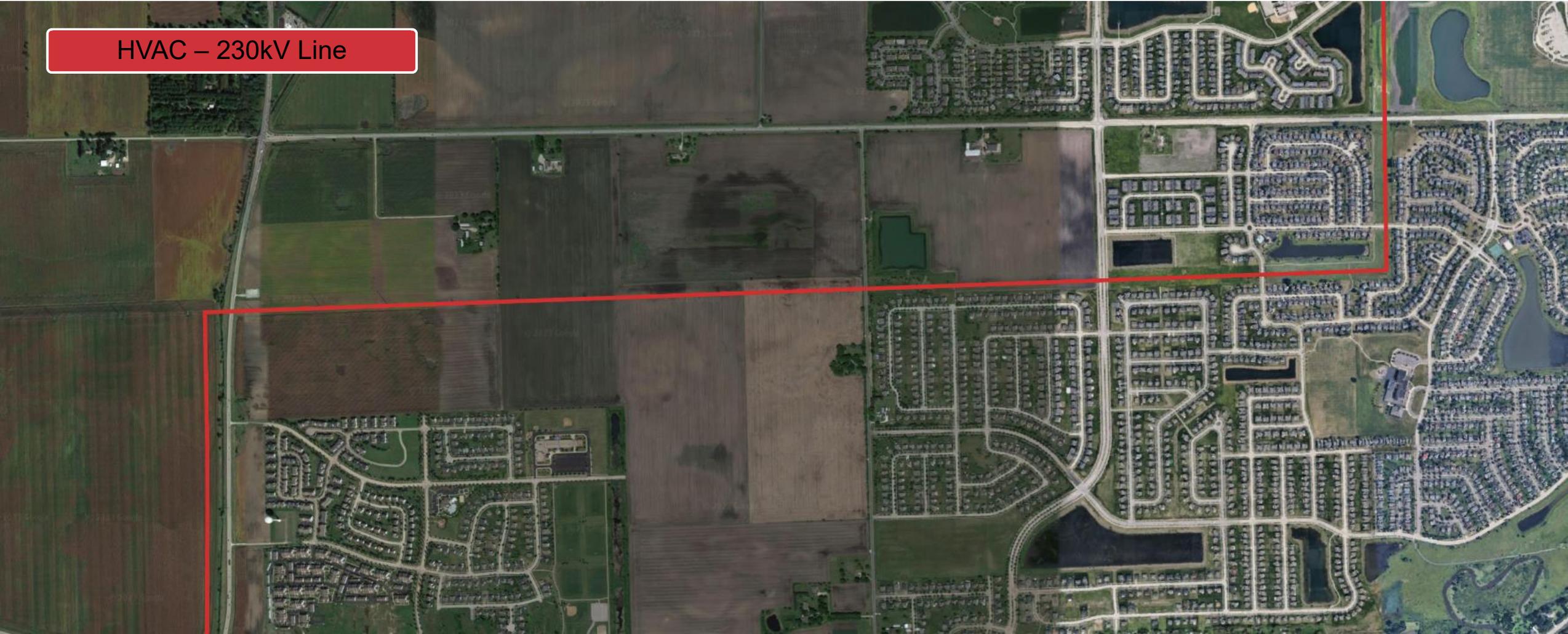
Coating Resistance

Above Grade
Assets



AC INTERFERENCE MODELING EXAMPLE

HVAC – 230kV Line

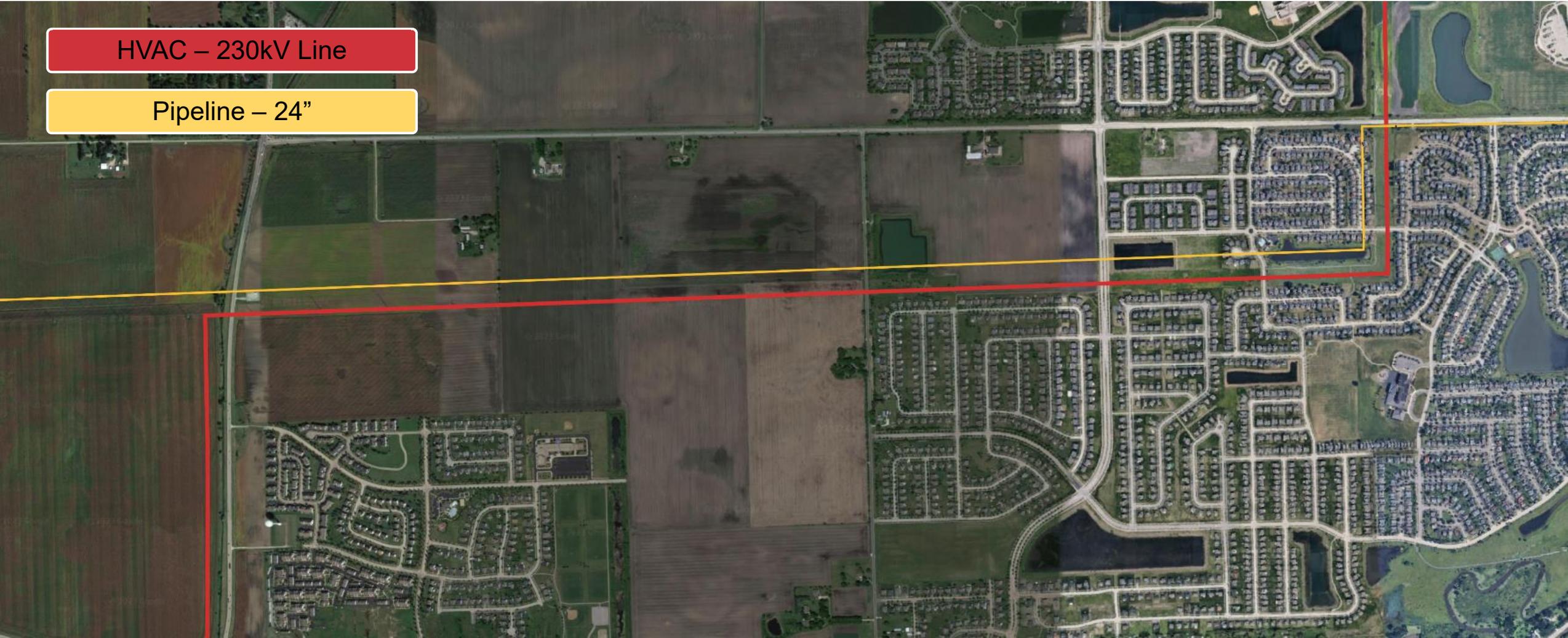




AC INTERFERENCE MODELING EXAMPLE

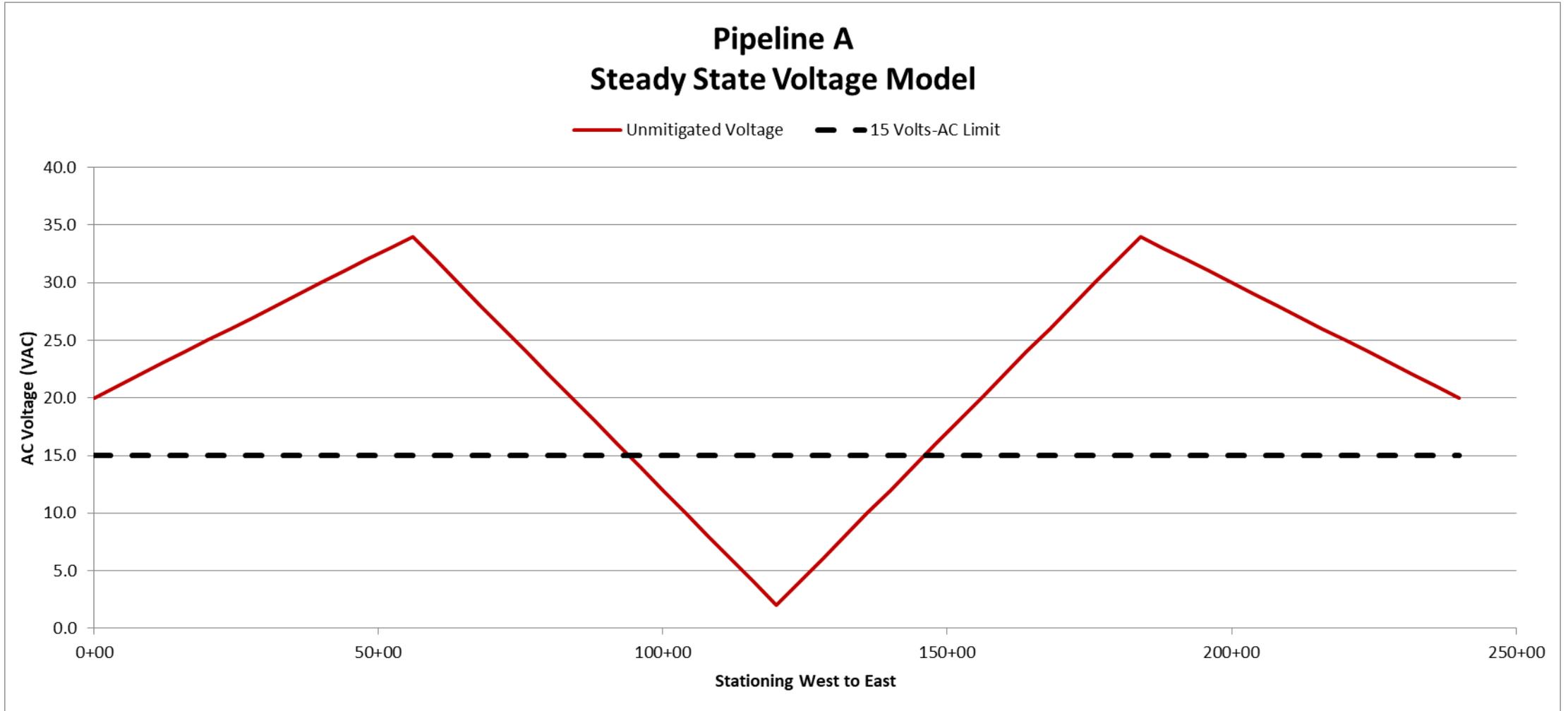
HVAC – 230kV Line

Pipeline – 24"



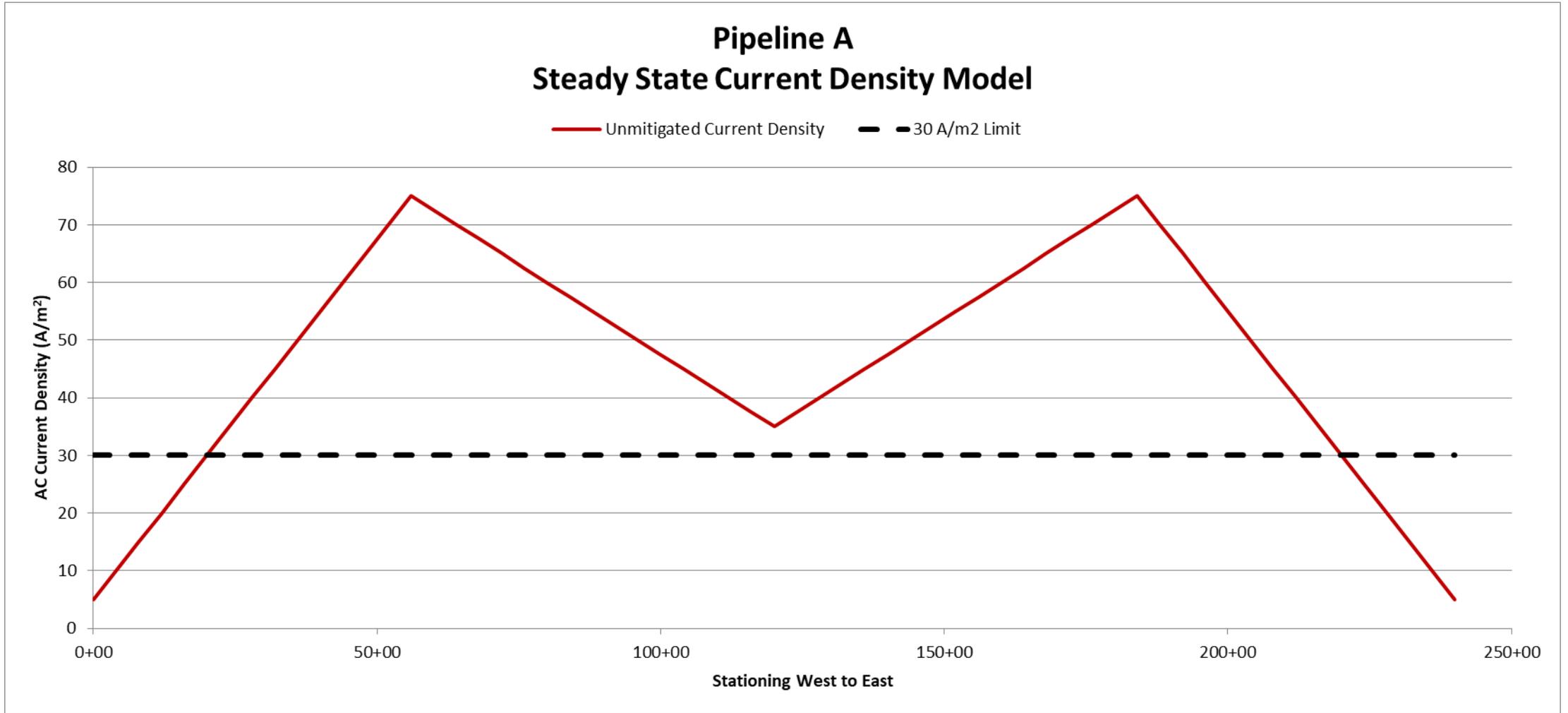


AC MITIGATION GRAPHS





AC MITIGATION GRAPHS





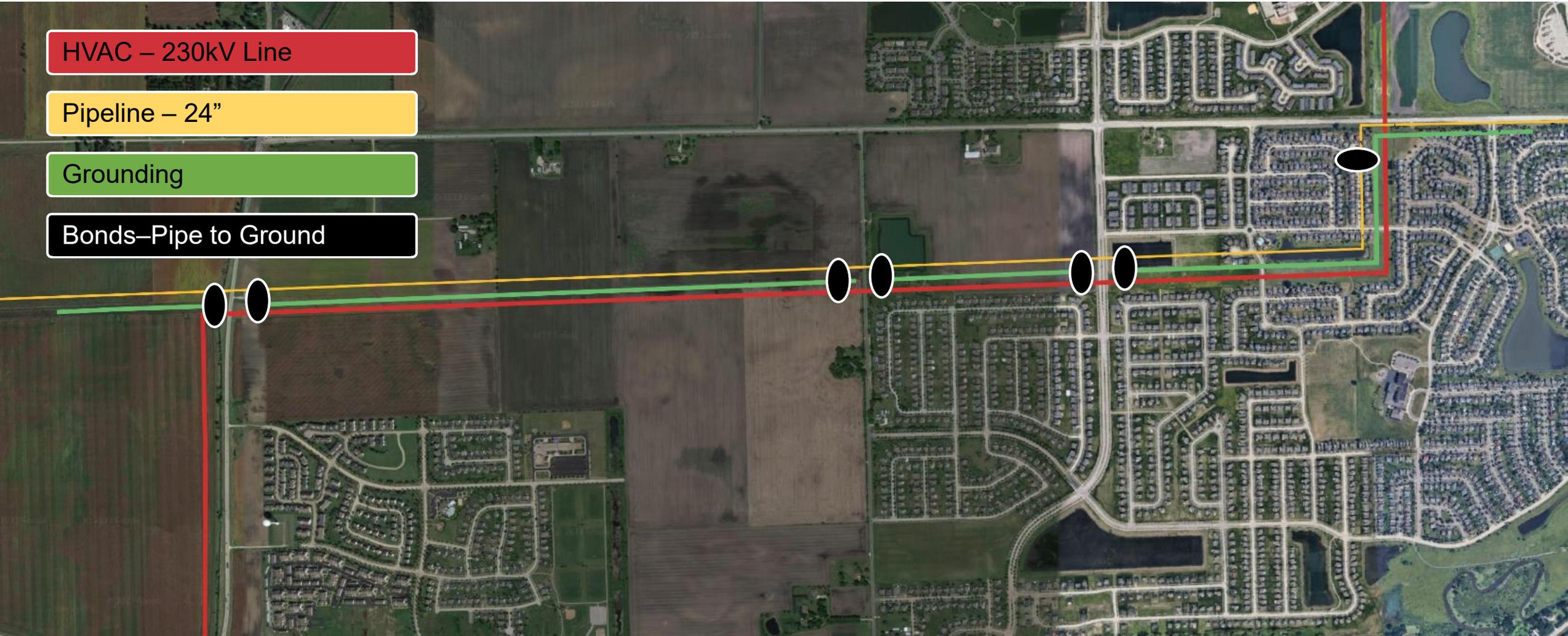
AC INTERFERENCE MODELING EXAMPLE

HVAC – 230kV Line

Pipeline – 24"

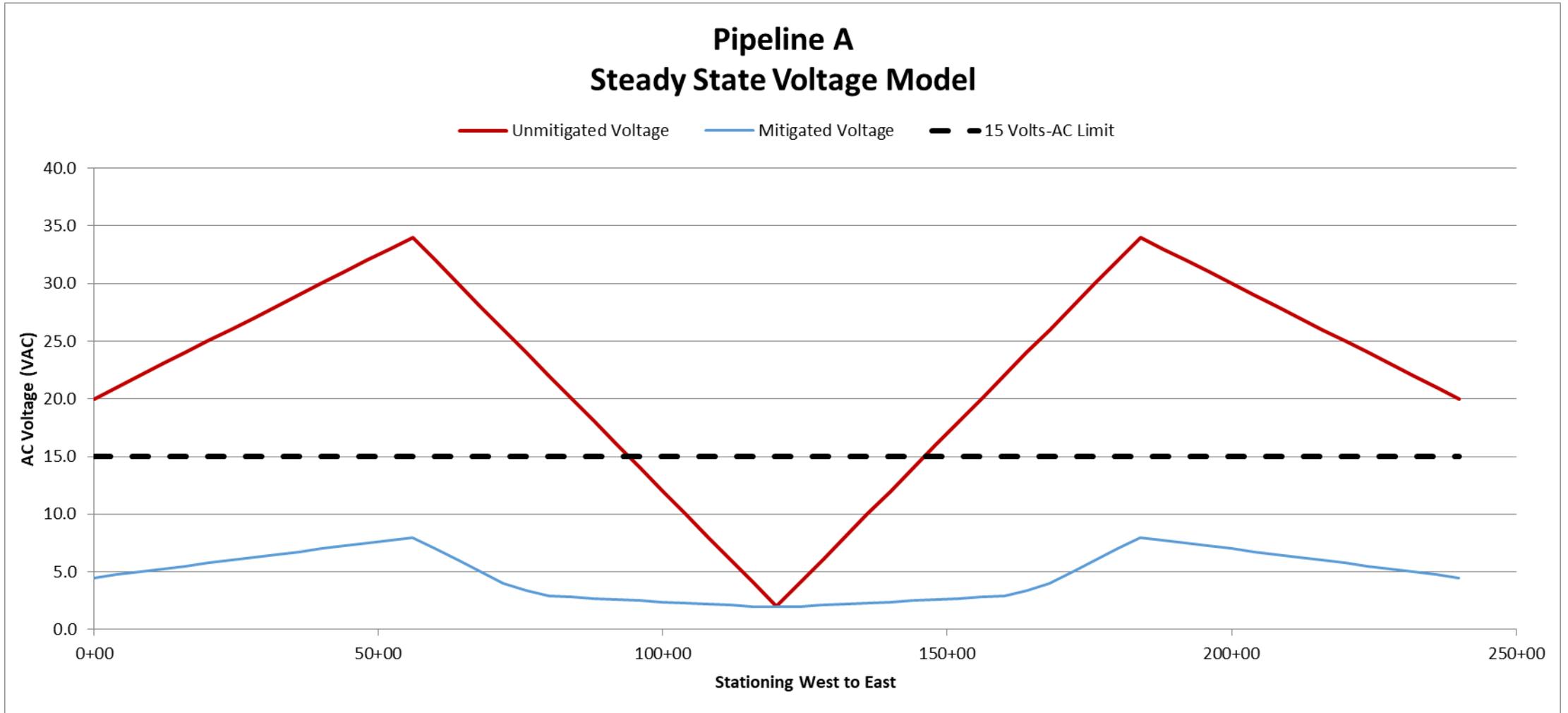
Grounding

Bonds–Pipe to Ground



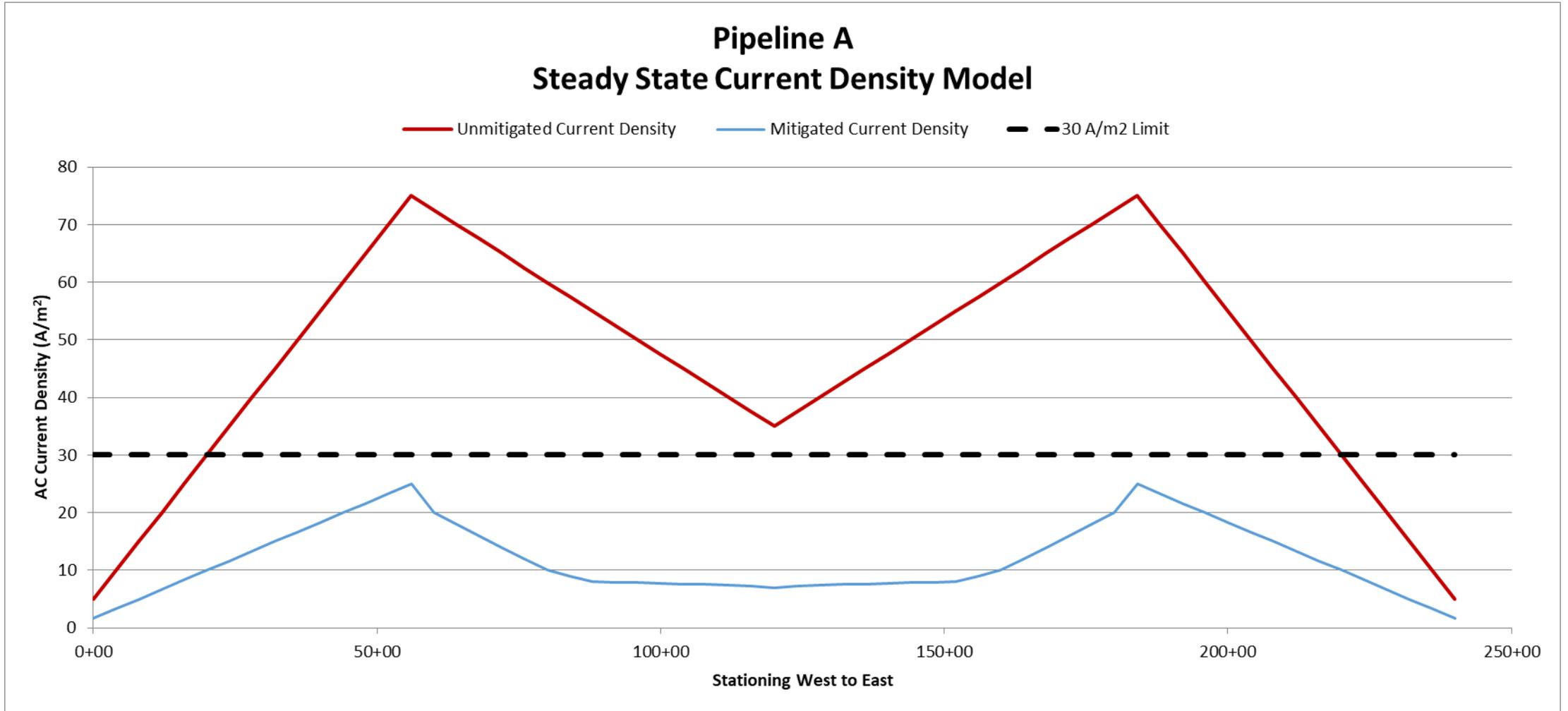


AC MITIGATION GRAPHS





AC MITIGATION GRAPHS





CP and AC Systems in Harmony – Decouplers

PROPER GROUNDING IS ESSENTIAL FOR PIPELINES AND TANKS AFFECTED BY AC:

- To mitigate AC interference
- For electrical equipment grounding
- For protection from lightning

GROUNDING COMPROMISES CP EFFECTIVENESS

DECOUPLERS PROVIDE SIMULTANEOUS AC GROUNDING AND DC ISOLATION





WHAT IS A DECOUPLER?

A DEVICE THAT ACTS AS AN OPEN SWITCH FOR LOW VOLTAGE DC AND A CLOSED SWITCH FOR AC AND HIGHER VOLTAGES

- Blocks DC current
- Conducts AC current
- Rated for AC faults and lightning
- “Fail-Safe” design



DAIRYLAND
ELECTRICAL INDUSTRIES

WARNING
Potential electrostatic charging hazard.
Plastic enclosures are to be cleaned
or wiped only with a damp cloth.

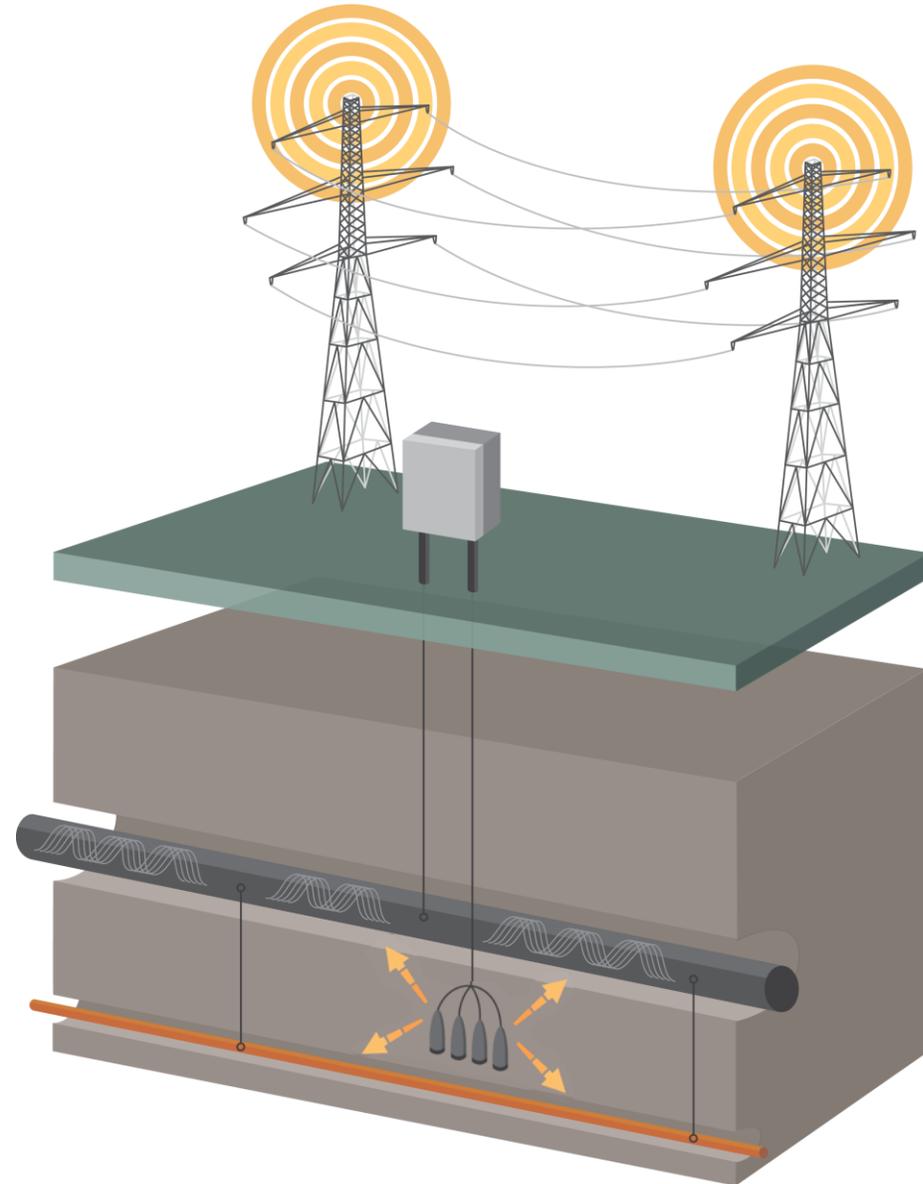
AVERTISSEMENT
Risque de décharge électrostatique.
Les boîtiers en plastique doivent être
nettoyés ou essuyés uniquement avec
un chiffon humide.

PCR
Class I, Div. 2, Decoupler for use in Hazardous Locations
Model: E167183
Max. DC Blocking Voltage:
Steady-State AC Current:
Momentary AC Current:
Peak Inrush Current:
Ambient Temperature Range:
READ INSTALLATION INSTRUCTIONS
Dairyland Electrical Industries, Inc.
P.O. Box 107 Oshkosh, WI 53589, U.S.A.
www.dairyland.com
UL LISTED
S/N: XXXXXX
01/2020
CE
Enclosure: NEMA 4X, IP66
Polarity
Negative (-) Positive (+)



WHY ARE DECOUPLERS NEEDED?

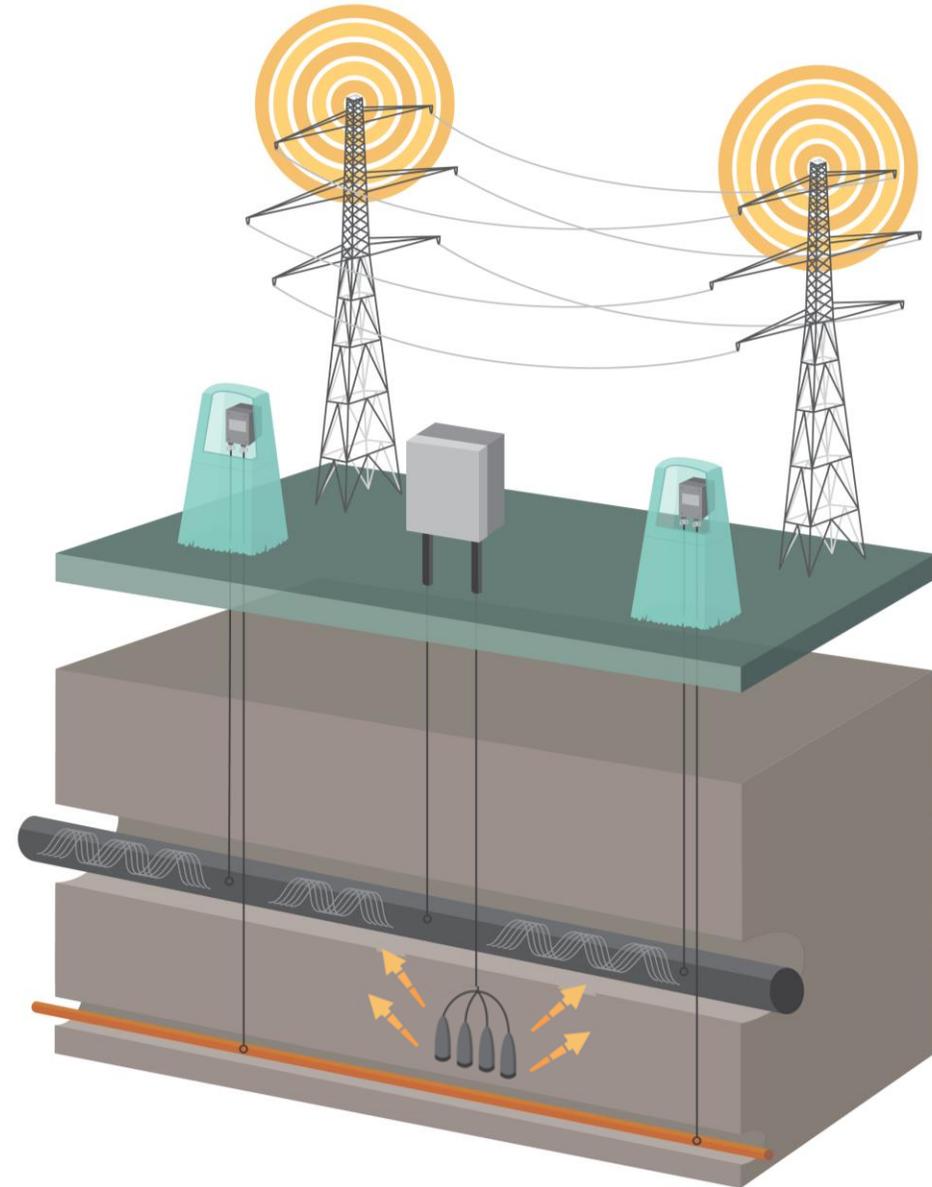
AC MITIGATION WITHOUT DECOUPLING





WHY ARE DECOUPLERS NEEDED?

AC MITIGATION WITH DECOUPLING





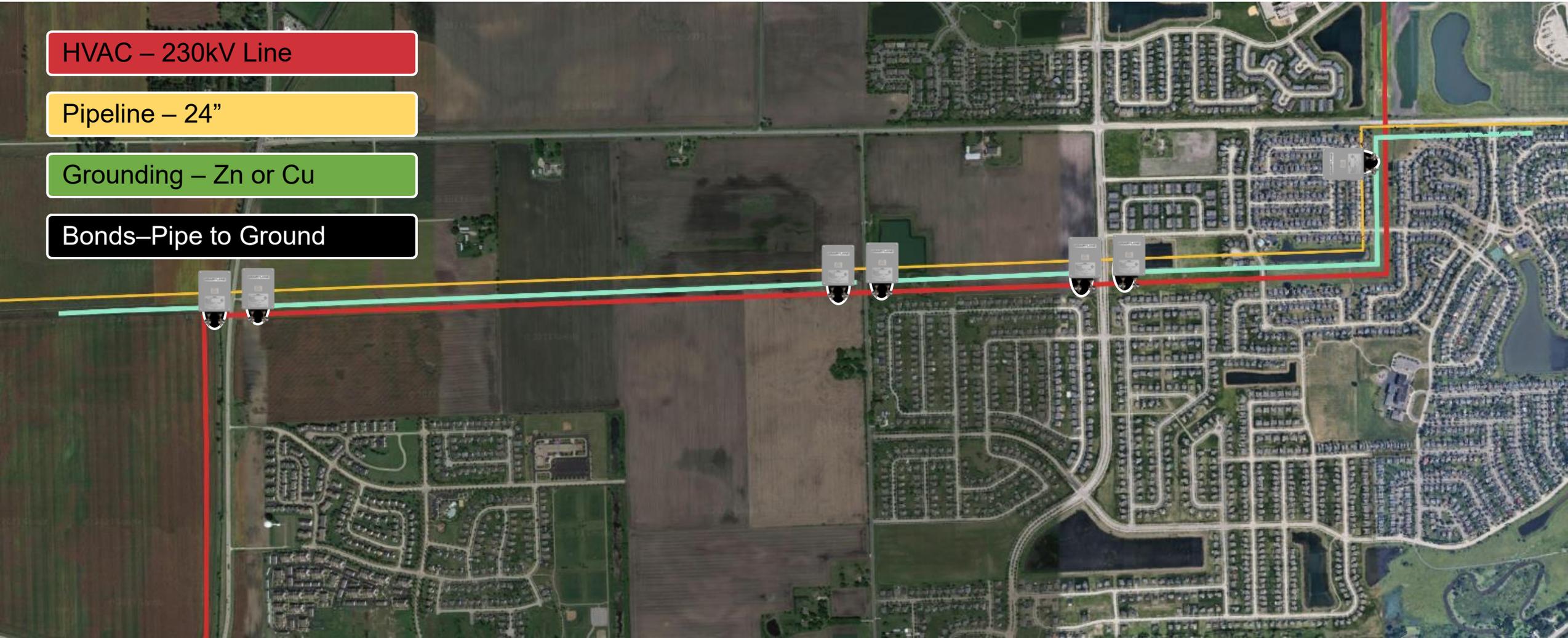
AC INTERFERENCE MODELING EXAMPLE

HVAC – 230kV Line

Pipeline – 24"

Grounding – Zn or Cu

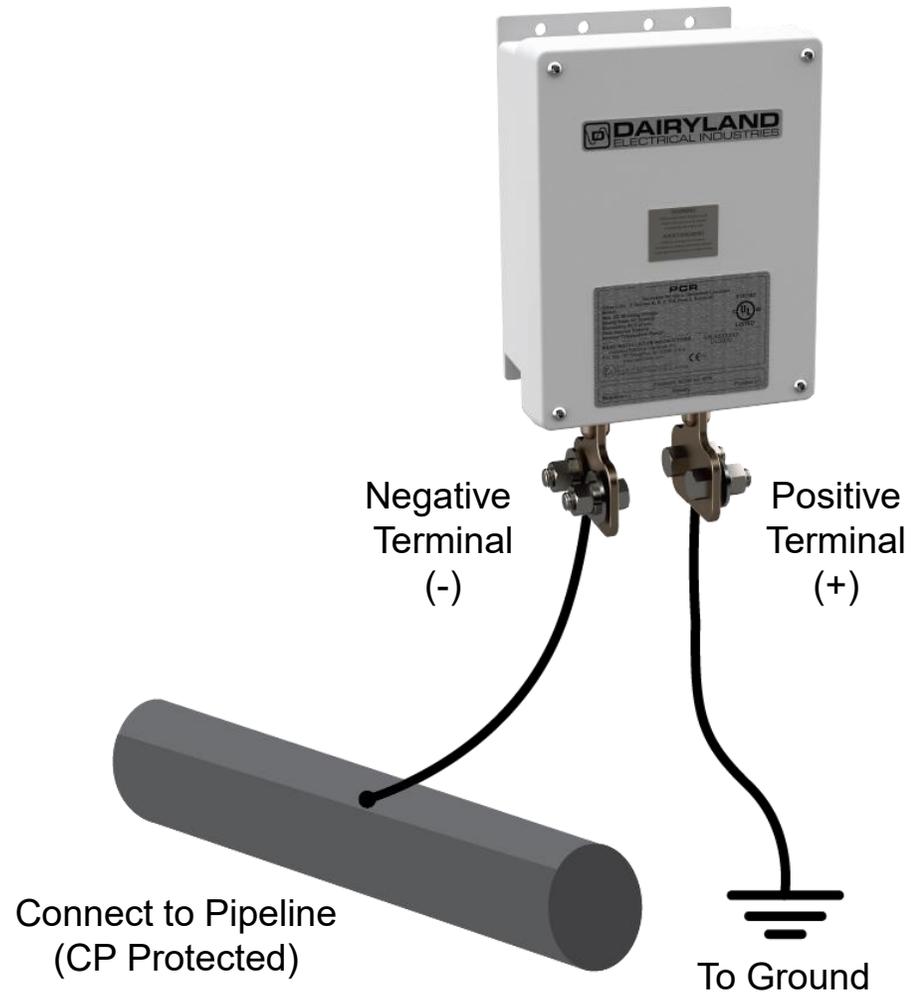
Bonds–Pipe to Ground



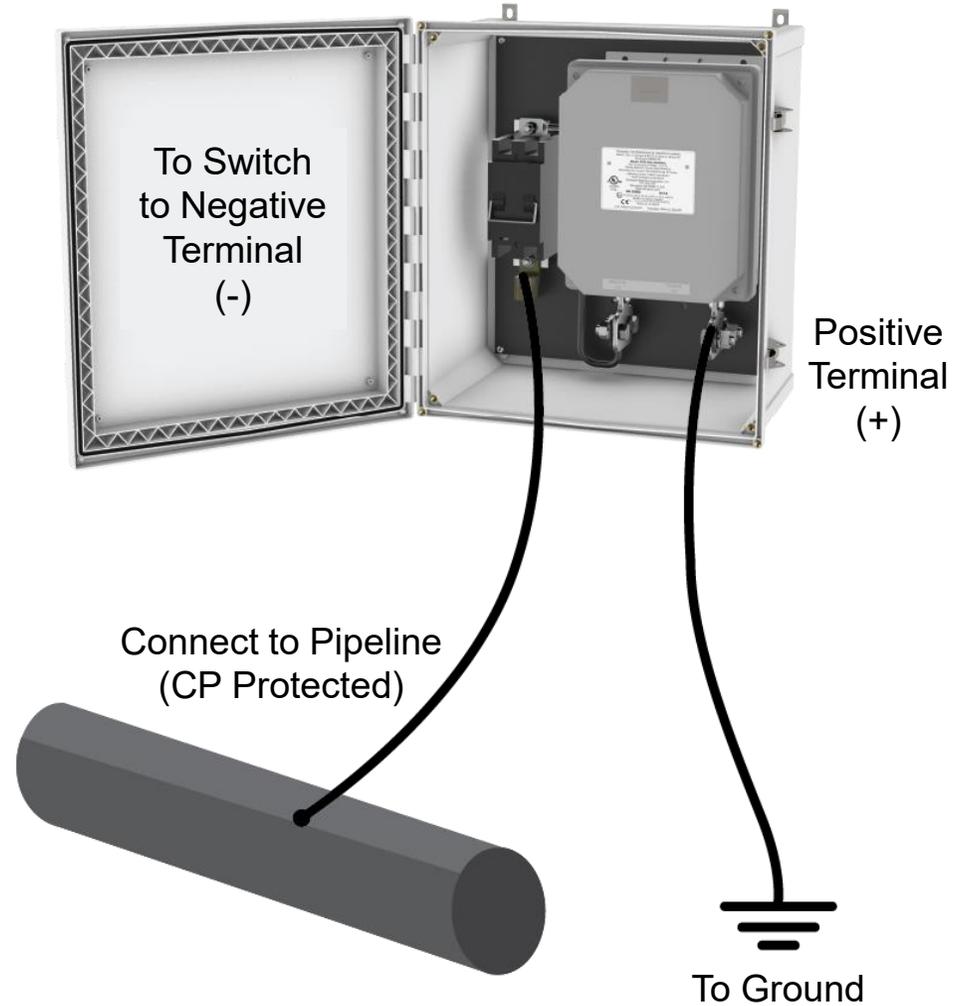


DECOUPLER INSTALLATION

STANDARD CONNECTION



SWITCHED CONNECTION





COMMON APPLICATION QUESTIONS

WHAT DECOUPLER SPACING DO YOU RECOMMEND?

- Depends on the factors and resulting Volts-AC and AC current density

DOES GROUNDING MATERIAL MATTER?

- Copper or zinc – both recommended – based on operator

WHAT THRESHOLD RATING DO I USE?

- Symmetric for zinc and asymmetric (negative biased) for copper

HOW TO CHOOSE FAULT RATING?

- Based on electrical parameters present
- Minimum recommended of 3.7kA



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

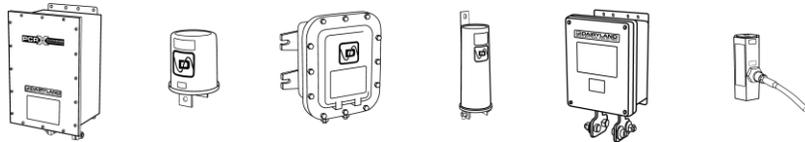




DAIRYLAND ELECTRICAL INDUSTRIES

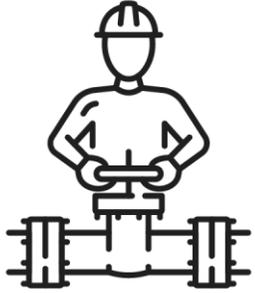
AT DAIRYLAND, WE CULTIVATE INNOVATION TO DELIVER RUGGED AND RELIABLE SOLUTIONS.

Addressing a wide range of complex electrical problems, we engineer our highly specialized products to provide safety protection for assets and personnel across numerous industries. Backed by third-party certifications to standards around the world, Dairyland manufactures products to the highest quality, ensuring unmatched performance.





DAIRYLAND ELECTRICAL INDUSTRIES



SAFETY & PROTECTION

Dairyland products maintain a failure rate of less than 0.01% and are suited for even the harshest conditions, resulting in protection for assets and equipment, and safety for personnel.



QUALITY & PERFORMANCE

Our products are expertly designed and built in-house, certified to global standards, and made with components from vetted suppliers.



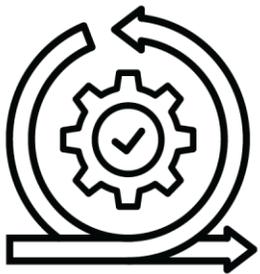


DAIRYLAND ELECTRICAL INDUSTRIES



SERVICE & SUPPORT

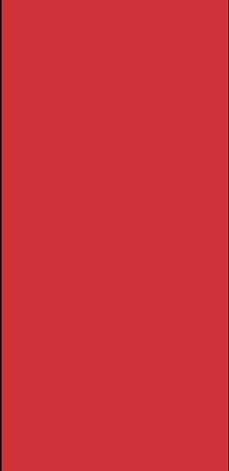
From customer service and tech support to our extensive library of technical resources, we guide customers to the best solution—even if it's not our product.



CONTINUOUS IMPROVEMENT

We pride ourselves on being an innovative industry leader and are dedicated to upholding this reputation through continuous improvement within the business.





WE'RE HERE TO HELP.
**OUR EXPERIENCED TEAM EXCELS AT FINDING INNOVATIVE
SOLUTIONS FOR YOUR TOUGHEST PROBLEMS.**

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