NEBRASKA CENTER FOR ENERGY SCIENCES RESEARCH

Cycle 20
January 2026

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Project Title.
Corrosion Behavior of Galvanized Pipes Once Lead is Eliminated

Abstract.

Center-pivot irrigation systems are critical to agriculture in Nebraska, but a persistent problem is that their steel pipelines often begin leaking after only 7–10 years of service. The primary cause is corrosion, which results from long-term exposure to water, dissolved minerals, chemicals, temperature changes, and sometimes microorganisms. Recently, pipeline operators have observed that corrosion appears to accelerate after lead was removed from galvanized (zinc-coated) pipes, raising concerns about reduced pipeline lifespan and increased maintenance costs.

Galvanization protects steel by applying a zinc coating that both blocks water from reaching the steel and corrodes sacrificially to protect the underlying metal. Historically, small amounts of lead were added during the galvanizing process because lead improves how well zinc spreads and adheres to steel. However, due to environmental and health concerns, modern standards have largely eliminated lead from galvanized coatings. While this improves safety, it may unintentionally reduce corrosion resistance.

This project aims to understand why galvanized pipes may corrode faster after lead removal and to develop effective, lead-free strategies to improve pipeline durability. The researchers hypothesize that lead indirectly slowed corrosion by improving coating quality and possibly influencing microbial activity on pipe surfaces. Without lead, zinc coatings may be more prone to breakdown, localized pitting, or attack by corrosion-causing bacteria present in irrigation water.

The study will compare three types of pipelines: uncoated steel, galvanized steel with lead, and galvanized steel without lead. Laboratory corrosion tests will be performed using both purified water and real irrigation water from Nebraska. Based on our findings, the project will work with irrigation companies and utilities to develop practical, lead-free solutions. The goal is to extend pipeline service life, reduce repair costs for farmers, protect water quality, and strengthen the long-term reliability of Nebraska's irrigation infrastructure—without reintroducing lead.