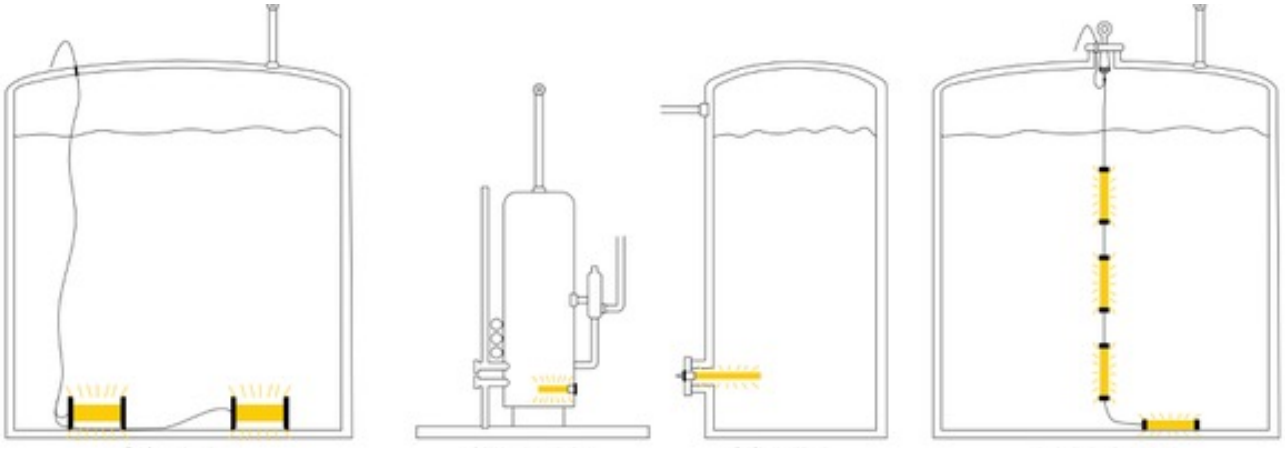
HOW LOW-COST CATHODIC PROTECTION REDUCES PRODUCTION TANK LEAKS

Corrosion is the leading cause of leaks from steel tanks that store brine, natural gas liquids, oil and water



Floor Anodes | Heater Treater Anode | Wall Anode | Hanging Anodes

Tank anodes — internal and external — provide cost-effective coverage against the direct material and labor costs of replacing tanks, cleanup of contaminated soil and water, damages paid to landowners, legal expenses, lost productivity and fines from regulatory agencies. Environmental impact liability — harm to ecosystems, water sheds, and local public relations — can only be quantified after the fact, unfortunately.

The EPA's (Environmental Protection Agency) SPCC (Spill Prevention Control & Countermeasure) January 2010 amended Rule 40 CFR Part 112 requires corrective action to repair leaking produced water containers, such as tanks and pipes, as identified through visual inspections or tests and to remediate any oil discharges. Over the ensuing decade, many new and existing tanks have been placed inside secondary containment barriers with engineered impermeable synthetic liners. The liners are the last line of defense against corroded tank leaks into local soil and ground water.

Anode Systems Company engineers were surprised to learn as recently as 2018 that there still are many produced water tank batteries *not* inside lined containment enclosures, which puts the safety of people and their local ecosystems at risk. Air and water corrode steel. By redirecting the electrolysis to a sacrificial metal — anode — the structural integrity of the steel remains intact.

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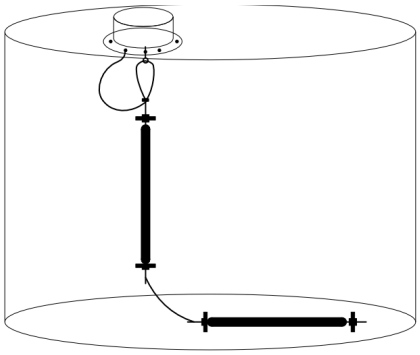
Cathodic Protection: Sacrifice The Anodes, Save The Steel

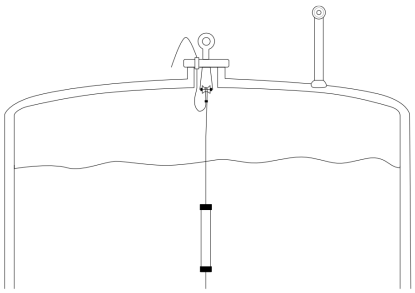


Developed through collaborative efforts by the National Association of Corrosion Engineers NACE, corrosion protection of internal and external steel tank surfaces is achieved through a proven process called cathodic protection whereby more reactive “sacrificial” metals — anodes — protect the less active steel tanks — cathodes. Anode size, metallurgy, quantity, and frequency of replacement are all dependent on a variety of factors, such as tank size, tank coating, the water salinity and acidity.

The Battery Effect

Cathodic protection using aluminum anodes with internal coatings is a proven method for protecting steel tanks from internal corrosion. Aluminum anodes come in several shapes and sizes.

Anodes are set off the floor, hung from the top, or inserted through the walls of tanks. Anodes must be submerged in water and grounded with a wire or fitting to the tank. This creates a battery effect where the anode is the “+” terminal, the tank is the “-“ terminal and electrons travel from the “+” anode to the “-“ cathode. As with any battery, the anode (rather than the steel) is consumed over time.



The level of corrosion protection in a tank is generally tested with a voltmeter and a copper sulfate electrode; or by measuring the electric current created between the anode and the tank using an ammeter or a small resistance wire called a shunt. If the electric current drops to zero on the ammeter or if there is no measurable current flowing across the shunt, it is highly likely that the anode has been consumed and in need of replacement. By monitoring and tracking the measurements, operators can better forecast replacement schedules.

Produced water with high salt content corrodes metals significantly faster than brackish or fresh water.

Some anodes can be seen on the floor of tanks during an internal inspection. Some anodes that hang from the top of tanks can be pulled up for a visual inspection. Other anodes that mount through fittings on the outside wall of a tank can be removed for inspection after the tank has been drained.

Because it is impossible to visually inspect the underside of a tank bottom while in use, the external surfaces of a tank bottom are most often protected using magnesium anodes.

The life of an anode can be as short as a few months or as long as several years. Generally, the larger the anode, the longer it will last. Some anodes weigh as much as 50 pounds while others weigh less than 10 pounds. Larger tanks typically require larger anodes for maximum protection. Smaller tanks can be protected with smaller anodes.

Also, produced water with high salt content consumes an anode significantly faster than brackish or fresh water.

Corrosion engineers help producers control replacement and cleanup costs.

The more operators that add cathodic protection in the form of anodes inside or outside their steel tanks, the sooner they reduce expenses in replacement and cleanup costs.

Case Study: COLORADO By The Numbers

- 2,012 barrels of produced oil spilled and 28,146 barrels of produced water spilled in 2019
- 12,500 tanks at risk for leaks as of 2020
- More than 53,000 active oil & gas wells as of 2020
- Approximately 20,000 abandoned wells as of 2020
- 50,000 tanks storing crude oil, gas condensate, brine, frac water, produced salt water or fresh water on oil & gas leases as of 2020

Sourced and extrapolated from Colorado Oil & Gas Conservation Commission data and Environmental Protection Agency data.

About Anode Systems Company

Founded in 1984 by corrosion engineer Hans Schmoldt, Anode Systems Company provides cathodic protection engineering services and materials serving the oil & gas, transportation, fuel marketers, water utilities, ski resorts, irrigation districts, and power plants. The company has installed galvanic and impressed current cathodic protection systems on hundreds of produced water tanks. The company's primary objective is to prevent corrosion on steel pipes and tanks, which benefits operators, employees, and communities.

In Colorado, for example, Anode Systems Company has installed its systems to protect tanks from leaking in the Piceance Basin, the San Juan Basin, the Denver-Julesburg Basin, the Raton Basin, and the San Wash Basin. For more information about the benefits of anodes, go to anodesystems.com.

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