



Title	ES-301-4.10: Cathodic Protection Corrosion Prevention on Buried Tanks and Piping
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### 1) Activity Description:

Maintaining the programmatic corrosion protection for buried steel piping and USTs as well as protection of AST systems in contact with corrosive surfaces. This includes use of coatings and cathodic protection according to National Association of Corrosion Engineers (NACE) standards.

### 2) Potential Environmental Risks

- A. The following environmental concerns are associated with these activities:
  - i) Release of regulated materials to surface soils or State waters
  - ii) Fuel or other releases
  - iii) Loss of materials
  - iv) Air emissions
  
- B. Potential consequences from performing the activity incorrectly:
  - i) Property damage, personal injury, or damage to the environment
  - ii) Regulatory non-compliance, Notices of Violation, and related [financial & non-financial] penalties

### 3) Critical Operating Requirements

- A. Prohibited Activities
  - i) Steel piping, tanks, and other steel devices will not be buried without engineering considerations for protection from corrosion pursuant to referenced industrial and DEN specifications and standards.
  - ii) Steel equipment and piping in contact with corrosive soils will not be allowed to operate out of parameters dictated by specifications.
  - iii) **Galvanic corrosion protection systems are the preferred** method of providing electrochemical protection to buried or soil contacting steel tank and piping systems.
  - iv) Impressed current cathodic protection systems will **not** be preferred; they will be installed only upon approval by the DEN Cathodic Protection Program Manager.
  - v) Water supply piping shall be protected by cathodic protection up to the first flange inside the building. Thereafter the water piping shall be continuous with the building electrical ground.
  
- B. General Considerations
  - i) Buried steel systems will be designed with applicable corrosion protection systems including coatings and cathodic protection.
  - ii) Except in extenuating circumstances, galvanic corrosion protection methods will be used in place of impressed current systems.
  - iii) Systems with cathodic protection will be supplied with appropriate test stations that will allow testing of system voltage potentials relative to reference electrodes.
  - iv) The system operators will test cathodic protection for proper protection according to appropriate National Association of Corrosion Engineers standards on a minimum annual basis.
  - v) The reports will be forwarded to the DEN Director of Environmental Programs.
  - vi) Systems that fail test standards will be immediately repaired and brought up to standards.

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- vii) Cathodic protection system designers shall be professional engineers with a corrosion engineering specialization.
- viii) System owners and operators will maintain records on cathodic protection system design.

C. Training Requirements

- i) System operators shall use NACE-trained and -qualified personnel to test the systems on an annual basis.

**4) Planning Requirements**

- A. All new construction should be reviewed for applicable systems by the DEN project manager and the DEN ES planning coordinator. The project manager should route applicable design information to the cathodic protection program manager as designated by the DEN Director of Environmental Programs. Refer to DEN Design Standard 16642, Cathodic Protection.
- B. Systems shall be installed and tested by expert and knowledgeable personnel, whether a construction contracted installation or a maintenance function.

**5) Critical Tasks**

- A. Ensure that the systems are properly designed and installed with careful review early in design and field inspected by vendors and DEN-designated Cathodic Protection Manager twice annually.
- B. Operators shall have their cathodic systems tested at least annually or whenever the system appears to be malfunctioning.
- C. Check with DEN Environmental Services (ES) for any questions.

**6) Response to Loss of Protection**

- A. Should a system fail a test for corrosion protection, a plan must be immediately formulated to identify the problem and re-establish protection.

**7) Inspection and Maintenance Requirements**

- A. Cathodic protection systems should be a part of every visual inspection of the systems.
- B. All cathodic protection systems should be inspected for compliance with applicable NACE standards for system-to-soil voltage relative to reference electrodes. The inspections should, at a minimum, be conducted on an annual frequency. Depending on the system characteristics or sensitivity, the surveys may need to occur more frequently. In the case of tank bottoms over containment systems with impressed current, the test may be for an adequate current density.
- C. Equipment associated with generating impressed direct current voltage should be monitored quarterly, at a minimum, or as needed to ensure adequate voltage and current.

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- D. Records should be kept of all inspections and monitoring. Records of non-compliant measurements, system malfunctions, and repairs should be kept by the operator for the life of the system concerned.

## 8) Expected Records and Outputs

- A. Original system review
  - i) Copy of submission to DEN ES of review and recommendations by same
  - ii) Maintain survey/matrix on file after review by DEN ES
- B. Construction Records
  - i) Vendor data on all coatings and cathodic protection components – one set to DEN ES
  - ii) Completion and startup testing records – one set provided to DEN ES
- C. Inspection and Maintenance Records
  - i) Maintained for life of the system
  - ii) Vendor information as installed
  - iii) Installation startup records
  - iv) Inspection records
  - v) Outage and repair records
  - vi) Updated drawings and sketches after improvements and alterations

## 9) References

- A. Phone Numbers
  - i) DEN Communications Center (for spill reporting) (303) 342-4200
  - ii) DEN Environmental Services (Main Line) (303) 342-2730
- B. Guidance Materials (list is not limited to the following)
  - i) National Association of Corrosion Engineers (NACE) Standards
    - o SP0169-2013 or latest – Control of External Corrosion on Underground or Submerged Metallic Piping Systems
    - o RP0193-2001 or latest – External Cathodic Protection of On-Grade Metallic Storage Tank Bottoms
    - o SP0285-2011 or latest – Corrosion Control of Underground Storage Tank Systems by Cathodic Protection
    - o SP0572-2007 or latest – Design, Installation, Operation, and Maintenance of Impressed Current Deep Groundbeds
    - o SP0286-2007 or latest – Electrical Isolation of Cathodically Protected Pipelines
  - ii) DEN Design/Construction Standard 264200 – Cathodic Protection
  - iii) DEN Design/Construction Standard 260526 – Grounding and Bonding for Electrical Systems
- C. Training Materials (list is not limited to the following)
  - i) NACE Basic Corrosion Technician Training
  - ii) Previous inspection reports and as-built drawings
- D. Related Environmental Documents (list is not limited to the following)

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- i) ES 301-3.01 Construction
  - ii) ES 301-3.02 Planning and Environmental Review
  - iii) ES 301-4.09 Management of Petroleum Storage Tanks and Containers
- E. Applicable Regulations (list is not limited to the following)
- i) 40 CFR Part 112 Spill Prevention, Control, and Countermeasure Plans
  - ii) 6 CCR 1007-3, Part 280/281 State RCRA Regulations
  - iii) Colorado Petroleum Storage Tank Regulations – 7 CCR 1101-14
  - iv) DEN Rules and Regulations

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