STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION

DIVISION OF UNDERGROUND STORAGE TANKS

COMPLIANCE GUIDANCE DOCUMENT - 109

EFFECTIVE DATE - July 29, 1996
(REVISION DATE - July 19, 1999)

RE: REQUIREMENTS FOR CORROSION PROTECTION

The purpose of this guidance document is to assist the regulated community in understanding the requirements for UST system construction, design, and corrosion protection requirements.

New underground storage tanks (UST) and/or piping must be installed in accordance with *Rule 1200-1-15-.02(1)*. New UST systems (tanks and piping) are systems installed after December 22, 1988.

Existing USTs and/or piping must be upgraded by December 22, 1998 in accordance with *Rule 1200-1-15-.02(2)(a and b)*. Existing UST systems were systems installed prior to December 22, 1988.

UST SYSTEM DESIGN, CONSTRUCTION, AND CORROSION PROTECTION

All cathodic protection systems must be designed, constructed, operated, and maintained to continuously provide corrosion protection to the metal components of that portion of the tank and piping that routinely contains petroleum and is in contact with the ground. Several methods of corrosion protection are allowed for new and existing UST systems. Acceptable methods are listed below.

Corrosion Protection for New Tanks and Piping

1. New tanks must be properly designed and constructed, and any portion underground that routinely contains petroleum must be protected from corrosion by **one** of the following:

    a. Tank is constructed of fiberglass-reinforced plastic

    b. Tank is constructed of steel, and is coated with a suitable dielectric material, and is protected from corrosion by a cathodic protection system (either galvanic cathodic protection or impressed current cathodic protection)

    c. Tank is constructed of a steel-fiberglass-reinforced-plastic composite

    d. Tank is constructed of fiberglass-reinforced plastic, steel-fiberglass-reinforced-plastic composite, and/or steel, and is not underground

2. New piping* must be properly designed and constructed, and any portion that routinely contains petroleum and is in contact with the ground must be protected from corrosion by **one** of the following methods:

    a. Piping is constructed of fiberglass-reinforced plastic

    b. Piping is constructed of steel, and is coated with a suitable dielectric material, and is protected from corrosion by a cathodic protection system (either galvanic cathodic protection or impressed current cathodic protection)

    c. Piping is constructed of fiberglass-reinforced plastic and/or steel that is not in contact with the ground.

Corrosion Protection for Existing Tanks and Piping

1. Existing steel tanks must meet new tank standards, permanent closure requirements, or be upgraded by **one** of the following:

    a. Interior tank lining

    b. Cathodic Protection (either galvanic cathodic protection or impressed current cathodic protection)

    c. Interior tank lining combined with cathodic protection

2. Existing steel piping* must meet new tank standards, permanent closure requirements, or be upgraded by **one** of the following:

    a. Replacing metal piping with fiberglass-reinforced plastic piping

    b. Cathodic protection (either galvanic cathodic protection or impressed current cathodic protection)

    c. Metal piping that is not in contact with the ground

***Flex connectors are considered piping and must be protected from corrosion. The following are acceptable:**

1. Isolation from the soil, e.g., isolation boots; or

2. Not buried; or

3. Cathodic protection, e.g., anodic doughnuts, which must be tested six (6) months after installation and every three (3) years thereafter; or

4. A non-corrosive material that is compatible with the product stored.

Note: Corrosion protection is not required on tanks and piping constructed of metal at facilities where the environment is determined by a corrosion expert not to be corrosive enough to cause a release due to corrosion from any portion of the UST system during its operational life.

Documentation that the site is non-corrosive must be kept for the life of the system at the facility or at a readily available alternative site. A copy must also be sent to the Division's Fees and Notification Section in the Nashville Central Office.

Note: UST systems must be constructed of materials that are compatible with the petroleum stored.

All field installed corrosion protection systems must be designed by a **corrosion expert**. A corrosion expert means a person who, by reason of thorough knowledge of the physical sciences and the principles of engineering and mathematics acquired by a professional education and related practical experience, is qualified to engage in the practice of corrosion control on buried or submerged metal piping systems and metal tanks. Such a person must submit documentation for review by the Division that they have accreditation or certification as a corrosion specialist or senior corrosion technologist by the National Association of Corrosion Engineers or have education and a minimum of 4 years responsible charge work experience the corrosion field. If it is determined by the Division that a person has sufficient experience and education to be qualified to take responsible charge in corrosion control of buried or submerged metal piping systems and metal tanks, then that person shall be classified by the Division as a Corrosion Expert. Documentation that the cathodic protection systems are designed by a corrosion expert must be maintained by the owner and/or operator for inspection by the Division.

A "corrosion expert' must be either:

1. Certified by NACE as a Corrosion Specialist or Cathodic Protection Specialist; or

2. A registered Professional Engineer or registered Engineer in Training, with a minimum of four years of corrosion work experience in responsible charge; or

3. Have a Bachelor of Science Degree in Engineering or Physical Science and a Ph.D. in Engineering or Physical Science that required a qualifications exam.

All impressed current cathodic protection systems must be designed to allow determination of current operating status.

UPGRADING REQUIREMENTS

Interior Tank Lining:

A tank may be upgraded if the lining is installed in accordance with *Rule 1200-1-15-.03(4)* (see below) and:

1. An internal tank inspection must confirm that it is structurally sound.

2. The lining must be compatible with the product stored.

3. The lining must be installed according to the manufacturer's specifications.

4. After the tank is lined, it must be tightness tested in accordance with *Rule 1200-1-15-.04(3)(c)* before it is brought back into service.

Cathodic Protection:

A tank may be upgraded with cathodic protection if the integrity of the tank is ensured using **one** of the following methods:

1. The tank is internally inspected and found to be structurally sound and free of corrosion holes prior to installing the system. (This must be done on tanks 10 or more years old.)

2. The tank has been installed for less than 10 years and is monitored monthly for releases in accordance with *Rule 1200-1-15-.04(3)(d-h).*

3. The tank has been installed for less than 10 years and is assessed for corrosion holes by conducting two tightness tests. The first test is conducted prior to installing the cathodic protection system and the second test is conducted three to six months after installation.

4. The tank can be assessed for corrosion holes by an alternative procedure, provided the method is approved by the Division.

Internal Lining Combined with Cathodic Protection:

A tank may be upgraded by using interior lining and cathodic protection if the lining is installed in accordance with *Rule 1200-1-15-.03(4)* and:

1. An internal tank inspection must find it to be structurally sound.

2. The lining must be compatible with the product stored.

3. The lining must be installed according to the manufacturer's directions.

4. After the tank is lined, it must be tightness tested in accordance with *Rule 1200-1-15-.04(3)(c)* before it is placed back into service.

5. Cathodic protection (either galvanic or impressed current) is added to the UST system.

***Rule 1200-1-15-.03(4)* states:**

Repairs allowed. Owners and/or operators of UST systems must ensure that repairs will prevent releases due to structural failure or corrosion as long as the UST system is used to store petroleum. The repairs must meet the following requirements:

(a) Repairs to UST systems must be conducted so as to effectively prevent releases for the operational life of the tank system.

(b) Repairs to fiberglass-reinforced plastic tanks shall be made by the manufacturer's authorized representative or in accordance with the manufacturer's specifications.

(c) Metal pipe sections and fittings that have released product as a result of corrosion or other damage must be replaced. Fiberglass pipes and fittings may be repaired in accordance with the manufacturer's specifications.

(d) Repaired tanks and piping must be tightness tested in accordance with Rule 1200-1-15-.04(3)(c) and Rule 1200-1-15-.04(4)(b) within 30 days following the date of the completion of the repair except as provided in parts (d)1. through 3. of Rule 1200-1-15.03(4):

1. The repaired tank is internally inspected; or

2. The repaired portion of the UST system is monitored monthly for releases in accordance with a method specified in Rule 1200-1-15-.04(3)(d) through (h); or

3. Another test method is used that is determined by the Division to be no less protective of human health and the environment than those listed above.

(e) Within 6 months following the repair of any cathodically protected UST system, the cathodic protection system must be tested in accordance with Rule 1200-1-15-.03(2)(b) and (c) to ensure that it is operating properly.

(f) UST system owners and/or operators must maintain records of each repair for the remaining operating life of the UST system that demonstrates compliance with the requirements of Rule 1200-1-15-.03(4).

INSPECTION, TESTING, AND RECORDKEEPING

Interior Lined Tanks:

Ten years after lining and every **five** years thereafter, the tank must be internally inspected and found to be structurally sound. After the internal inspection, if the structural integrity of the tank is compromised, the tank must be tightness tested before it is brought back into service. Tank inspection results must be retained until the next internal inspection.

Tanks with Galvanic Cathodic Protection Systems:

1. The system must be tested six months after installation and every three years thereafter.

2. Results from the last **two** testing events must be maintained by the owner and/or operator.

An owner/operator may use a pre-engineered corrosion control testing device that is permanently installed and is designed by a Corrosion Expert to test the cathodic protection system on the UST. The owner/operator must be able to demonstrate proper operation of the testing equipment.

Tanks with Impressed Current Systems:

1. The rectifier must be visually inspected every sixty days, noting that it is turned on and operating properly. The last **three** visual inspection results must be maintained by the owner and/or operator.

2. The system must be tested six months after installation and every three years thereafter. Results from the last **two** testing events must be maintained by the owner and/or operator.

All **testing** events (required at least six months after installation and every three years thereafter) performed on cathodic protection systems must be performed by a qualified cathodic protection tester. Test results must be recorded on the form provided as a part of this compliance guidance document. A qualified cathodic protection tester means a person who can demonstrate an understanding of the principles and measurements of all common types of cathodic protection systems as applied to buried or submerged metal piping and tank systems. At a minimum, such persons must have education and experience in soil resistivity, stray current, structure-to-soil potential, and component electrical isolation measurements of buried metal piping and tank systems.

A "qualified cathodic protection tester" must be either:

1. NACE certified as a Corrosion Technologist, Senior Corrosion Technologist, Cathodic Protection Specialist, or Corrosion Specialist; or

2. Meet the definition of Corrosion Expert by virtue of their professional qualifications without NACE certification; or

3. A Corrosion Technician under direct supervision of a higher level NACE certified individual. "Direct supervision" means that the supervisor is directly responsible for the test and must be physically present on site at the location during the entire time the Corrosion Technician is making the measurements. The supervisor must sign off on all such work completed by the Corrosion Technician and attest to the fact that he was physically present during the entire test. Any work submitted by a Corrosion Technician not meeting these conditions is unsuitable and the tank owner will be required to have the cathodic protection system retested; or

4. Anyone who has sufficient knowledge to perform cathodic protection testing may do so. However, the Division will only consider such testing valid if the results are recorded on the Corrosion Protection Monitoring Form provided with this compliance guidance document and the tester has signed and dated all applicable pages.

Visual inspections (required at least every sixty days) performed on impressed current cathodic protection systems may be performed by anyone who can demonstrate that the equipment is operating properly.

All records of repairs made on the tank system must be kept for the operational life of the system. The results of tightness testing performed after a repair must be kept for the operational life of the tank system.

After new tanks and/or piping are installed or existing tanks and/or piping are upgraded, owners and/or operators must report the applicable information to the Division's Fee and Notification Section within thirty (30) days. Such reports shall be made using the Notification form. **Failure to report this information is a violation.**

DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF UNDERGROUND STORAGE TANKS

CORROSION PROTECTION MONITORING FORM

(Not required for tanks equipped with PP-4 test station)

Facility Information
(Print or Type)

Facility Name _____

Street Address _____

City _____

State _____ Zip _____

Name/Address of Testing Company

_____

_____

_____

Phone Number (____) _____

Person Conducting Test _____

Date of Test _____

Facility Identification Number ___--___ ___ ___ ___ ___ ____

Number of Tanks _____

Tank Type _____

Piping Material _____

Type of Corrosion Protection (Galvanic or Impressed Current)

For Impressed Current Systems Only

Rectifier Serial Number _____

Voltage _____ Current _____

Conclusion _____

Comments _____

_____

_____

In the space below, sketch the important parts of the facility (tanks, tank manway locations, vents, pump islands, buildings, etc.). Indicate reference cell locations where structure-to-soil potential or continuity measurements have been made using letters of the alphabet. Include tank sizes and type of product stored. Use these letters in the tables on the following pages to indicate reference cell locations.

My signature below is affirmation that I have sufficient education and/or experience to meet the definition of cathodic protection tester in Tennessee Rule 1200-1-15-.01(3)(h) [40 CFR 280.12], I am competent to perform the tests indicated above, that test results on this form are a complete and truthful record of all testing at this location on the date shown, and that I am responsible for all conclusions contained therein.

_____ Name

_____ Date

CN-1140

Facility Name _____ Facility I. D. Number ___ --___ ___ ___ ___ ___ ___

CONTINUITY MEASUREMENTS (GALVANIC & IMPRESSED CURRENT SYSTEMS)
(Use separate sheet for each type, if necessary.)

Contact Points (Take readings wherever access is available)	Voltage	Comments (continuous, isolated)
TANK 1		
A. Tank Bottom		
B. Fill Pipe Riser		
C. Pump Riser		
D. Tank Monitor		
E. Product Piping		
F. Vent Line		
G. Test Station Lead Wire		
H. Other:		
Reference Cell Location:		
TANK 2		
A. Tank Bottom		
B. Fill Pipe Riser		
C. Pump Riser		
D. Tank Monitor		
E. Product Piping		
F. Vent Line		
G. Test Station Lead Wire		
H. Other:		
Reference Cell Location:		
TANK 3		
A. Tank Bottom		
B. Fill Pipe Riser		
C. Pump Riser		
D. Tank Monitor		
E. Product Piping		
F. Vent Line		
G. Test Station Lead Wire		
H. Other:		
Reference Cell Location:		

My signature below is affirmation that I have sufficient education and/or experience to meet the definition of cathodic protection tester in Tennessee Rule 1200-1-15-.01(3)(h) [40 CFR 280.12], I am competent to perform the tests indicated above, that test results on this form are a complete and truthful record of all testing at this location on the date shown, and that I am responsible for all conclusions contained therein.

Name _____ Date _____

Facility Name _____ Facility I. D. Number ___--___ ___ ___ ___ ___ ___

STRUCTURE TO SOIL POTENTIAL MEASUREMENTS (GALVANIC SYSTEM)			
Contact Points (Take readings wherever access is available)	Location of Reference Cell	Voltage	Comments (Pass, Fail, etc.)
TANK 1			
A. Tank Bottom			
B. Fill Pipe Riser			
C. Pump Riser			
D. Tank Monitor			
E. Product Piping			
F. Vent Line			
G. Test Station Lead Wire			
H. Other:			
TANK 2			
A. Tank Bottom			
B. Fill Pipe Riser			
C. Pump Riser			
D. Tank Monitor			
E. Product Piping			
F. Vent Line			
G. Test Station Lead Wire			
H. Other:			
TANK 3			
A. Tank Bottom			
B. Fill Pipe Riser			
C. Pump Riser			
D. Tank Monitor			
E. Product Piping			
F. Vent Line			
G. Test Station Lead Wire			
H. Other:			

My signature below is affirmation that I have sufficient education and/or experience to meet the definition of cathodic protection tester in Tennessee Rule 1200-1-15-.01(3)(h) [40 CFR 280.12], I am competent to perform the tests indicated above, that test results on this form are a complete and truthful record of all testing at this location on the date shown, and that I am responsible for all conclusions contained therein.

_____ Name

_____ Date

CN-1140

Facility Name _____ Facility I. D. Number ___--___ ___ ___ ___ ___ ___

100 MILLIVOLT POLARIZATION DECAY MEASUREMENTS (FOR IMPRESSED CURRENT SYSTEMS)
(Not required if Instant Off Voltage reading exceeds 850 millivolts)

Contact Points (Take readings wherever access is available)	Location of Reference Cell	Voltage (Current On)	Instant Off Voltage	Final Voltage	Voltage Decay	Comments (Pass, Fail, etc.)
TANK 1						
A. Tank Bottom						
B. Fill Pipe Riser						
C. Pump Riser						
D. Tank Monitor						
E. Product Piping						
F. Vent Line						
G. Test Station Lead Wire						
H. Other:						
TANK 2						
A. Tank Bottom						
B. Fill Pipe Riser						
C. Pump Riser						
D. Tank Monitor						
E. Product Piping						
F. Vent Line						
G. Test Station Lead Wire						
H. Other:						
TANK 3						
A. Tank Bottom						
B. Fill Pipe Riser						
C. Pump Riser						
D. Tank Monitor						
E. Product Piping						
F. Vent Line						
G. Test Station Lead Wire						
H. Other:						

My signature below is affirmation that I have sufficient education and/or experience to meet the definition of cathodic protection tester in Tennessee Rule 1200-1-15-.01(3)(h) [40 CFR 280.12], I am competent to perform the tests indicated above, that test results on this form are a complete and truthful record of all testing at this location on the date shown, and that I am responsible for all conclusions contained therein.

_____ Name

_____ Date