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From: Commander, Naval Facilities Engineering Command (Code 15C)
To: Distribution

Subj: CATHODIC PROTECTION SYSTEMS, INTERIM TECHNICAL GUIDANCE

Ref: (a) DPL-90-0006, Cathodic Protection Systems, Policy Guide
(b) CFR Title 49 Chapter 1, Part 192, Transportation of Natural and Other Gas by Pipeline; and Part 195, Transportation of Liquids by Pipeline
(c) CFR Title 40 Part 280, Technical Standards and Corrective Action for Owners and Operators of Underground Storage Tanks
(d) MIL-HDBK-1004/10, Electrical Engineering, Cathodic Protection
(e) NAVFAC MO-306, Maintenance and Operation of Cathodic Protection Systems
(f) NAVFACINST 11014.52

Encl: (1) Interim Design Criteria for Cathodic Protection Systems
(2) EFD Points of Contact for Corrosion Control, October 93

1. Purpose: To provide interim technical guidance for the use of cathodic protection systems (CPS) in shore utility systems and facilities. The guidance can be retained for record purposes until it is incorporated in the criteria noted in paragraph 4.d. This guidance supersedes and cancels reference (a).

2. Background: CPS reduce corrosion of buried or submerged metallic structures and utility systems, thus reducing the probability of failure with concomitant environmental, operational, safety and economic repercussions. Environmental laws prohibit the leakage of hazardous material into the environment. Additionally, the Navy spends millions of dollars annually repairing and replacing corroded metallic utility systems and structures that are unprotected by CPS. References (b) and (c) require the installation of CPS on certain buried or submerged steel gas, fuel and other hazardous material pipelines and storage facilities. However, in many cases CPS are not considered in the planning or design of such systems. Structures in corrosive environments also benefit from the installation of CPS, but are rarely considered for such protection. Some rehabilitation applications such as driving new sheet piling outboard of existing deteriorated piling, may result in the new sheet piling being anodic to the old and thus accelerating corrosion of the new sheet piling. Other similar rehabilitation projects may also incur a risk that repairs will accelerate corrosion. Finally, some NFGS guide specification sections currently do not adequately specify CPS requirements.

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3. Technical Guidance: Provide corrosion protection measures on all new and existing buried or submerged metallic utility systems and metallic waterfront structures as described in enclosure (1). The overall corrosion protection system shall include cathodic protection systems, coatings, material thickness incrementation, encasement, or other methods as required by enclosure (1). Consult with the NAVFAC Criteria Office, Code 15C, or the cognizant EFD/EFA Corrosion Control Coordinator listed in enclosure (2) prior to deviating from this guidance.

4. Action:

a. Planning. Include CPS requirements as a separate line item in cost estimates and planning documentation for the construction of new or the repair/upgrade of existing metallic utility systems and metallic structures described above. Include CPS narratives and cost estimates on DD Form 1391 under supporting utilities. Coordinate CPS requirements with the activity corrosion control plan to establish and ensure compatibility with existing systems. The cognizant EFD Corrosion Control Coordinator can assist in determining the system requirements.

b. Design. Navy engineers and architects in charge of design (AIC/EIC): ensure that project designs include CPS where required and appropriate, and comply with reference (d), enclosure (1) and other applicable Military Handbooks and Design Manuals including specifications for CPS in NFGS-16641 or NFGS-16642 as applicable; refer to NFGS-16641 or NFGS-16642 as applicable in specifications that reference CPS (e.g., NFGS-02682 and NFGS-02694); in designs prepared for the Air Force, comply with the current Air Force CPS Engineering Technical Letter (ETL) and coordinate with the Air Force Base Corrosion Engineer.

c. Construction. The Navy Officer in Charge of Construction and Resident Officer in Charge of Construction (OICC/ROICC): perform CPS construction inspections and ensure as-built drawings provide locations of all CPS equipment, test stations, insulating fittings, etc.; supervise the acceptance tests of the CPS to ensure the tests comply with procedures specified in the contract documents. In the absence of a qualified CPS inspector, obtain assistance from the EFD corrosion control coordinator, see enclosure (2).

d. Criteria. The NAVFAC Criteria Office: coordinate the revision of the following criteria to incorporate the CPS interim technical guidance:

MIL-HDBK-1025/1, Piers and Wharves
MIL-HDBK-1025/2, Dockside Utilities for Ship Service
MIL-HDBK-1025/6, General Criteria Waterfront Construction
MIL-HDBK-1002/1, Structural Engineering, General Requirements
MIL-HDBK-1002/3, Structural Engineering, Steel Structures

MIL-HDBK-1003/8A, Exterior Distribution of Utility Steam, High Temperature Water, Chilled Water, Natural Gas
MIL-HDBK-1004/10, Cathodic Protection
Design Manual 7.2, Foundations and Earth Structures
Design Manual 22, Petroleum Fuel Facility
NFGS-01730, Operation Maintenance Data
NFGS-02368, Rolled Steel Section Piles
NFGS-02366, Sheet Steel Piles
NFGS-02666, Exterior Water Distribution
NFGS-02661, Exterior Water Distribution Minor Construction
NFGS-02682C, Exterior Fuel Distribution
NFGS-02685, Gas Distribution System
NFGS-02694, Exterior Underground Heat System
NFGS-02697B, Exterior Buried Pumped Condensate Return
NFGS-02698, Exterior Buried Preinsulated Water Piping
NFGS-13209, Water Storage Tank
NFGS-13216, Underground Petroleum Tanks
NFGS-15486, Aviation Fuel Distribution and Dispenary
NFGS-15488, LP Compressed Air System
NFGS-15489, HP Compressed Air System
NFGS-15492, Fuel Gas Piping
NFGS-15511, Low Temperature Water
NFGS-16641, Cathodic Protection
NFGS-16643, Water Tanks

e. Operation and Maintenance. Perform maintenance according to references (e) and (f), CPS Operation and Maintenance Support Information (OMSI) Manuals and cognizant EFD requirements.

f. Training. The National Association of Corrosion Engineers (NACE), various academic institutions, and the various services offer CPS design and inspection courses. Contact the cognizant EFD Corrosion Control Coordinator for recommended training courses.

5. Points of Contact: For additional information concerning design criteria, please contact Mr. Charles Mandeville, P.E., Electrical Engineering Criteria Manager, NAVFACENGCOM Code 15C, at DSN 564-9599 or commercial (804) 444-9599. For additional information concerning maintenance criteria, please contact Mr. Bruce Bell, NAVFACENGCOM, Code 1334, at DSN 221-0046 or commercial (703) 325-0046. The technical point of contact for

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CPS is Mr. Tom Tehada, PACNAVFACENGCOM, Code 1621A. He can be reached at DSN 312-5949 or commercial (808) 474-5360.

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INTERIM DESIGN CRITERIA
FOR
CATHODIC PROTECTION SYSTEMS
April 1994

1. Provide Cathodic Protection Systems (CPS) and protective coatings for the following buried or submerged metallic utility systems regardless of soil or water corrosivity:

a. Natural gas pipelines
b. Petroleum, Oil and Lubricant (POL) pipelines
c. Oxygen pipelines
d. Underground POL and gasoline storage tanks
e. Underground hazardous substance storage tanks
f. All water storage tanks interiors

2. Consider CPS in conjunction with other protective measures such as material thickness incrementation, protective coatings and encasement for the following waterfront metallic structural systems:

a. Steel sheet piling bulkheads
b. Steel bearing piles for piers
c. Steel fender piles for piers
d. Mooring components

In marine environments, CPS are most effective and can greatly extend the life of the submerged zones of steel waterfront structures. The splash and atmospheric zones will require reapplication of coatings and encasements for maximum system service life. Partial concrete encasement of steel piles creates a zone of high potential at the concrete encasement-to-bare steel pile interface where submerged. CPS should be provided in these circumstances in addition to the partial encasement.

3. Install CPS for the exterior bottoms of steel above ground POL storage tanks (AST) with or without impervious liners unless field tests and inspections by a qualified corrosion engineer indicate the environment to be non-corrosive. Existing tanks with bottoms on oil-filled sand pads on plastic liners are not necessary. However, when these tank bottoms are replaced, provide CPS unless field tests and inspections by a qualified corrosion engineer indicate the environment to be non-corrosive.

4. Provide CPS and bonded protective coatings on other buried or submerged new steel, ductile iron, or cast iron utility pipelines not mentioned above when the resistivity is below 30,000 ohms at the installation depth at any point along the installation. Do not use unbonded protective coatings such as loose polyethylene wraps. Provide joint bonding on all ductile iron and cast iron installations.

Enclosure (1)

5. Economic feasibility of providing CPS shall be evaluated for the following buried or submerged systems:

a. Gravity sewer lines, force mains
b. Existing steel waterfront structures
c. Reinforcing steel in concrete
d. Cast/ductile iron potable water lines in soils with resistivities greater than 30,000 ohm-cm along its entire length
e. Concentric neutral cable
f. Below ground hydraulic elevator cylinders
g. All buried or submerged metallic structures not mentioned above.

Implementation of CPS on these systems shall be based on life-cycle economics. The requirements for CPS shall be determined by the corrosion engineer.

6. When rehabilitating existing steel sheet pile bulkheads by driving new sheets outboard of the existing, include the following requirements for the CPS:

a. Electrically isolate new piling from old piling.
b. Electrically isolate tie rods from existing sheet piling by cutting a hole in the old pile and providing a dielectric sleeve through the pile.
c. Coat tie rods and new piling on all sides.
d. Consider CPS as part of the total corrosion protection system. Use conventional soil side anodes to protect the seaside and landside of the pile and to protect the tie rods if field tests indicate this to be feasible. Otherwise, consider using a deep anode bed system. Waterside anodes are appropriate only in areas not subject to maintenance dredging, water turbulence from ship/boat traffic, normal or storm generated heavy wave action, or constant movement of the sea bottom. Conduct a site survey to determine the appropriate anode configuration and cathodic protection system requirements.

7. CPS shall provide protective potentials according to the requirements of the National Association of Corrosion Engineer (NACE) Standard RP01-69 (latest revision), Control of External Corrosion on Underground or Submerged Metallic Piping Systems and NACE Standard RPO2-85 (latest revision), Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems.

8. Architect-Engineer (A-E) CPS surveys and designs shall be accomplished under the supervision of one of the following individuals:

a. Registered Professional Corrosion Engineer
b. Registered Professional Engineer who is also a NACE certified corrosion protection specialist or cathodic protection specialist or has a minimum of five years of experience in the applicable CPS

c. NACE certified corrosion protection specialist or cathodic protection specialist with a minimum of five years experience in the applicable CPS.

CPS surveys or designs accomplished by Navy in-house design personnel need not comply with paragraphs 8.a through 8.c above, but shall be reviewed by the cognizant EFD Code 16 Corrosion Control (C2) Coordinator or PACNAVFACENGCOM Code 1621A.

9. Perform field tests (resistivity, pH, current requirements, etc.) at the proposed installation to evaluate, as a minimum, soil and/or water corrosivity. The tests shall be used to design the CPS and assumptions shall be supported by the field test data.

10. Design submittals shall include as a minimum the following:

a. PEP - soil and/or water corrosivity data, current requirement test data (if applicable), and all design calculations.
b. Final drawings - CPS one line diagrams, locations of all Cathodic Protection equipment (Anodes, rectifiers, test stations, etc.), interference test points, installation details, insulating fittings, and bond connections.
c. Final specifications - acceptance testing procedures including static (native) potentials, initial and final system potentials, and interference tests.

Project Managers shall contact the EFD Corrosion Control Coordinator regarding the CPS design at the pre-final project phase and, upon request, shall forward the design documents to the Coordinator for review.

11. CPS shall be compatible with existing systems. When plastic pipe is selected to replace or extend existing pipe, thermal weld an insulated No. 8 AWG copper wire to the existing steel pipe and run the full length of the plastic pipe for continuity and locator tracing purposes.

12. Design CPS for overall system maintainability.

EFD POINTS OF CONTACT FOR CORROSION CONTROL
MAY 1994

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