

ORIGINAL

Decision No. 80268

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

In the Matter of the Application of
CALIFORNIA-PACIFIC UTILITIES COMPANY,
PACIFIC GAS AND ELECTRIC COMPANY,
PACIFIC LIGHTING SERVICE COMPANY,
SAN DIEGO GAS & ELECTRIC COMPANY,
SOUTHERN CALIFORNIA GAS COMPANY, and
SOUTHWEST GAS CORPORATION, public
utility gas corporations, for an order
incorporating Subpart I of Part 192 of
Title 49 of the Code of Federal Regu-
lations, which prescribes minimum
requirements for the protection of
metallic pipelines from external,
internal and atmospheric corrosion,
into General Order No. 112-C.

Application No. 53259
(Filed April 12, 1972)

In the Matter of the Application of
CALIFORNIA-PACIFIC UTILITIES COMPANY,
PACIFIC GAS AND ELECTRIC COMPANY,
PACIFIC LIGHTING SERVICE COMPANY,
SAN DIEGO GAS & ELECTRIC COMPANY,
SOUTHERN CALIFORNIA GAS COMPANY, and
SOUTHWEST GAS CORPORATION, public
utility gas corporations, for an Order
modifying General Order No. 112-C
adopted April 2, 1971, in Decision
No. 78513 by amending Sections 192.607
and 192.611(e) to conform with the
changes to the Minimum Federal Safety
Standards issued by the Office of
Pipeline Safety as more particularly
set forth in the Application herein.

Application No. 53263
(Filed April 13, 1972)

O P I N I O N

Applicants' Request

These applications were filed pursuant to the authority granted in Section 142.1 of the Commission's General Order No. 112-C^{1/}.

In Application No. 53259 applicants are requesting an Order from the Commission incorporating Subpart I to Part 192 of Title 49 of the Code of Federal Regulations (hereinafter referred to as "Subpart I"), which prescribes minimum requirements for the protection of metallic pipelines from external, internal and atmospheric corrosion, into General Order No. 112-C.

General Order No. 112-C includes the minimum federal safety standards (49 CFR Part 192) which became effective November 12, 1970. At that time, Subpart I covering corrosion control was reserved for further study by the Technical Pipeline Safety Standards Committee. Subsequently a new Subpart I was added to Part 192 of Title 49 of the Code of Federal Regulations and became effective August 1, 1971. By Resolution No. G-1529, this Commission ordered that Subpart I be adopted as of August 10, 1971 to supplement the gas safety standards of this Commission, but was not then included as part of General Order No. 112-C.

1/ Section 142.1 of General Order No. 112-C provides:

"142.1. For the purpose of keeping the provisions, rules, standards, and specifications of this General Order up to date, the gas utilities subject to these rules, either individually or collectively, shall file an application setting forth such recommended changes in rules, standards, or specifications as they deem necessary to keep this General Order up to date in keeping with the purpose, scope and intent thereof. However, nothing herein shall preclude other interested parties from initiating appropriate formal proceedings to have the Commission consider any changes they deem appropriate, or the Commission from acting upon its own motion."

In Application No. 53263 applicants are specifically requesting the amendment of Sections 192.607 and 192.611(e) to conform with the changes to the Minimum Federal Safety Standards issued by the Office of Pipeline Safety on September 7, 1971.

Section 192.607 provides that a study shall be completed on all segments of pipelines operating at more than 40% of specified minimum yield strength to ascertain their class locations, and that the maximum allowable operating pressure of these pipelines be confirmed or revised in two steps by January 1, 1972, and January 1, 1973. Applicants are requesting that the time for completing confirmation or revision determined to be necessary by the study be extended through December 31, 1974 with a single completion date for all pipelines, rather than a two-step deadline as is now provided.

Applicants allege that the proposed change to Section 192.611(e) would provide for integrating future confirmations or revisions with the overall comprehensive plan. Existing confirmation or revision projects and those which are required by class location changes occurring before July 1, 1973, must be included in the initial comprehensive plan or integrated into it as they become necessary. These confirmations or revisions must be completed no later than the time for completion of the overall plan, that is, by December 31, 1974. Confirmation or revision required by a change in class location occurring on or after July 1, 1973, must be completed within eighteen months of the change in class location.

In support of this extension of time, both Pacific Gas and Electric Company and Pacific Lighting Service Company have furnished schedules to confirm or revise the maximum allowable operating pressure of pipeline sections not commensurate with class locations. In addition, San Diego Gas & Electric Company indicated that with the extension of time there would be some economies in the use of line pack of its 30-inch transmission main before any derating from 800 psig to 595 psig.

Findings

Upon consideration of the evidence, the Commission finds that:

1. It is in the best interest of the consuming public and the public utility corporations that General Order No. 112-C be revised to incorporate Subpart I of Part 192 of Title 49 of the Code of Federal Regulations. This subpart prescribes minimum requirements for the protection of metallic pipelines from external, internal and atmospheric corrosion.
2. It is also advantageous to the consuming public and the public utility corporations to modify General Order No. 112-C by amending Sections 192.607 and 192.611(e) to conform with the changes to the Minimum Federal Safety Standards issued by the Office of Pipeline Safety on September 7, 1971.
3. A public hearing is not necessary and Appendix A and Appendix B should be adopted as necessary revisions or modifications to General Order No. 112-C.

The Commission having found as hereinabove set forth concludes that it should issue its order as follows:

O R D E R

IT IS ORDERED that:

1. Subpart I of Part 192 of Title 49 of the Code of Federal Regulations, as set forth in Appendix A, shall be made a part of General Order No. 112-C.
2. Sections 192.607 and 192.611(e) of General Order No. 112-C shall be amended, as set forth in Appendix B, to conform with the changes to the Minimum Federal Safety Standards issued by the Office of Pipeline Safety.

3. A copy of this decision shall be mailed to each gas corporation under the jurisdiction of this Commission.

Dated at Los Angeles, California, this 18th
day of JULY, 1972.

Vernon L. Stinger
President
William J. Lyons
William J. Lyons
William J. Lyons
William J. Lyons
Commissioners

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SUBPART I - REQUIREMENTS FOR CORROSION CONTROL

Section No.

- 192.451 Scope.
- 192.453 General.
- 192.455 External corrosion control: buried or submerged pipelines installed after July 31, 1971.
- 192.457 External corrosion control: buried or submerged pipelines installed before August 1, 1971.
- 192.459 External corrosion control: examination of buried pipeline when exposed.
- 192.461 External corrosion control: protective coating.
- 192.463 External corrosion control: cathodic protection.
- 192.465 External corrosion control: monitoring.
- 192.467 External corrosion control: electrical isolation.
- 192.469 External corrosion control: test stations.
- 192.471 External corrosion control: test leads.
- 192.473 External corrosion control: interference currents.
- 192.475 Internal corrosion control: general.
- 192.477 Internal corrosion control: monitoring.
- 192.479 Atmospheric corrosion control: general.
- 192.481 Atmospheric corrosion control: monitoring.
- 192.483 Remedial measures: general.
- 192.485 Remedial measures: transmission lines.
- 192.487 Remedial measures: distribution lines other than cast iron or ductile iron lines.
- 192.489 Remedial measures: cast iron and ductile iron pipelines.
- 192.491 Corrosion control records.

Appendix D - Criteria for cathodic protection and determination of measurements.

Authority: The Provisions of this Subpart I issued under Natural Gas Pipeline Act of 1968 (49 U.S.C. sec. 1671 et seq., Part I regulations of Office of the Secretary of Transportation, 49 CFR Part I, and delegation of authority to Director, Office of Pipeline Safety, 33 F.R. 16468).

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SUBPART I - REQUIREMENTS FOR CORROSION CONTROL

Sec. 192.451 Scope.

This subpart prescribes minimum requirements for the protection of metallic pipelines from external, internal, and atmospheric corrosion.

Sec. 192.453 General.

Each operator shall establish procedures to implement the requirements of this subpart. These procedures, including those for the design, installation, operation and maintenance of cathodic protection systems, must be carried out by, or under the direction of, a person qualified by experience and training in pipeline corrosion control methods.

Sec. 192.455 External corrosion control: buried or submerged pipelines installed after July 31, 1971.

(a) Except as provided in paragraphs (b) and (c) of this section, each buried or submerged pipeline installed after July 31, 1971 must be protected against external corrosion, including the following:

(1) It must have an external protective coating meeting the requirements of Sec. 192.46.

(2) It must have a cathodic protection system designed to protect the pipeline in its entirety in accordance with this subpart, installed and placed in operation within one year after completion of construction.

(b) An operator need not comply with paragraph (a) of this section, if the operator can demonstrate by tests, investigation, or experience in the area of application, including, as a minimum, soil resistivity measurements and tests for corrosion accelerating bacteria, that a corrosive environment does not exist. However, within 6 months after an installation made pursuant to the preceding sentence, the operator shall conduct tests, including pipe-to-soil potential measurements with respect to either a continuous reference electrode or an electrode using close spacing, not to exceed 20 feet, and soil resistivity measurements at potential profile peak locations, to adequately evaluate the potential profile along the entire pipeline. If the tests made indicate that a corrosive condition exists, the pipeline must be cathodically protected in accordance with paragraph (a)(2) of this section.

(c) An operator need not comply with paragraph (a) of this section, if the operator can demonstrate by tests, investigation, or experience that -

(1) For a copper pipeline, a corrosive environment does not exist; or

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(2) For a temporary pipeline with an operating period of service not to exceed 5 years beyond installation, corrosion during the 5-year period of service of the pipeline will not be detrimental to public safety.

(d) Notwithstanding the provisions of paragraph (b) or (c) of this section, if a pipeline is externally coated, it must be cathodically protected in accordance with paragraph (a)(2) of this section.

(e) Aluminum may not be installed in a buried or submerged pipeline if that aluminum is exposed to an environment with a natural pH in excess of 8, unless tests or experience indicate its suitability in the particular environment involved.

Sec. 192.457 External corrosion control: buried or submerged pipelines installed before August 1, 1971.

(a) Except for buried piping at compressor, regulator, and measuring stations, each buried or submerged transmission line installed before August 1, 1971, that has an effective external coating must, not later than August 1, 1974, be cathodically protected along the entire area that is effectively coated, in accordance with this subpart. For the purposes of this subpart, a pipeline does not have an effective external coating if its cathodic protection current requirements are substantially the same as if it were bare. The operator shall make tests to determine the cathodic protection current requirements.

(b) Except for cast iron or ductile iron, each of the following buried or submerged pipelines installed before August 1, 1971, must, not later than August 1, 1976, be cathodically protected in accordance with this subpart in areas in which active corrosion is found:

(1) Bare or ineffectively coated transmission lines.

(2) Bare or coated pipes at compressor, regulator, and measuring stations.

(3) Bare or coated distribution lines. The operator shall determine the areas of active corrosion by electrical survey, or where electrical survey is impractical, by the study of corrosion and leak history records, by leak detection survey, or by other means.

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(c) For the purpose of this subpart, active corrosion means continuing corrosion which, unless controlled, could result in a condition that is detrimental to public safety.

Sec. 192.459 External corrosion control: examination of buried pipeline when exposed.

Whenever an operator has knowledge that any portion of a buried pipeline is exposed, the exposed portion must be examined for evidence of external corrosion if the pipe is bare, or if the coating is deteriorated. If external corrosion is found, remedial action must be taken to the extent required by Sec. 192.483 and the applicable paragraphs of Sections 192.485, 192.487, or 192.489.

Sec. 192.461 External corrosion control: protective coating.

(a) Each external protective coating, whether conductive or insulating, applied for the purpose of external corrosion control must -

- (1) Be applied on a properly prepared surface;
- (2) Have sufficient adhesion to the metal surface to effectively resist underfilm migration or moisture;
- (3) Be sufficiently ductile to resist cracking;
- (4) Have sufficient strength to resist damage due to handling and soil stress; and
- (5) Have properties compatible with any supplemental cathodic protection.

(b) Each external protective coating which is an electrically insulating type must also have low moisture absorption and high electrical resistance.

(c) Each external protective coating must be inspected just prior to lowering the pipe into the ditch and backfilling, and any damage detrimental to effective corrosion control must be repaired.

(d) Each external protective coating must be protected from damage resulting from adverse ditch conditions or damage from supporting blocks.

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(e) If coated pipe is installed by boring, driving, or other similar method, precautions must be taken to minimize damage to the coating during installation.

Sec. 192.463 External corrosion control: cathodic protection.

(a) Each cathodic protection system required by this subpart must provide a level of cathodic protection that complies with one or more of the applicable criteria contained in Appendix D of this subpart. If none of these criteria is applicable, the cathodic protection system must provide a level of cathodic protection at least equal to that provided by compliance with one or more of these criteria.

(b) If amphoteric metals are included in a buried or submerged pipeline containing a metal of different anodic potential -

(1) The amphoteric metals must be electrically isolated from the remainder of the pipeline and cathodically protected; or

(2) The entire buried or submerged pipeline must be cathodically protected at a cathodic potential that meets the requirements of Appendix D of this part for amphoteric metals.

(c) The amount of cathodic protection must be controlled so as not to damage the protective coating or the pipe.

Sec. 192.465 External corrosion control: monitoring.

(a) Except where impractical on offshore pipelines, each pipeline that is under cathodic protection must be tested at least once each calendar year, but with intervals not exceeding 15 months, to determine whether the cathodic protection meets the requirements of Sec. 192.463. However, if tests at those intervals are impractical for separately protected service lines or short sections of protected mains, not in excess of 100 feet, these service lines and mains may be surveyed on a sampling basis. At least 10 percent of these protected structures, distributed over the entire system, must be surveyed each calendar year, with a different 10 percent checked each subsequent year, so that the entire system is tested in each 10-year period.

(b) At intervals not exceeding 2 months, each cathodic protection rectifier or other impressed current power source must be inspected to ensure that it is operating.

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(c) At intervals not exceeding 2 months, each reverse current switch, each diode, and each interference bond whose failure would jeopardize structure protection, must be electrically checked for proper performance. Each other interference bond must be checked at least once each calendar year, but with intervals not exceeding 15 months.

(d) Each operator shall take prompt remedial action to correct any deficiencies indicated by the monitoring.

(e) After the initial evaluation required by paragraphs (b) and (c) of Sec. 192.455 and paragraph (b) of Sec. 192.457, each operator shall, at intervals not exceeding 3 years, reevaluate its unprotected pipelines and cathodically protect them in accordance with this subpart in areas in which active corrosion is found. The operator shall determine the areas of active corrosion by electrical survey, or where electrical survey is impractical, by the study of corrosion and leak history records, by leak detection survey, or by other means.

Sec. 192.467 External corrosion control: electrical isolation.

(a) Each buried or submerged pipeline must be electrically isolated from other underground metallic structures, unless the pipeline and the other structures are electrically interconnected and cathodically protected as a single unit.

(b) An insulating device must be installed where electrical isolation of a portion of a pipeline is necessary to facilitate the application of corrosion control.

(c) Except for unprotected copper inserted in ferrous pipe, each pipeline must be electrically isolated from metallic casings that are a part of the underground system. However, if isolation is not achieved because it is impractical, other measures must be taken to minimize corrosion of the pipeline inside the casing.

(d) Inspection and electrical tests must be made to assure that electrical isolation is adequate.

(e) An insulating device may not be installed in an area where a combustible atmosphere is anticipated unless precautions are taken to prevent arcing.

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(f) Where a pipeline is located in close proximity to electrical transmission tower footings, ground cables or counterpoise, or in other areas where fault currents or unusual risk of lightning may be anticipated, it must be provided with protection against damage due to fault currents or lightning, and protective measures must also be taken at insulating devices.

Sec. 192.469 External corrosion control: test stations.

Except where impractical on offshore and wet marsh area pipelines, each pipeline under cathodic protection required by this subpart must have sufficient test stations or other contact points for electrical measurement to determine the adequacy of cathodic protection.

Sec. 192.471 External corrosion control: test leads.

(a) Each test lead wire must be connected to the pipeline so as to remain mechanically secure and electrically conductive.

(b) Each test lead wire must be attached to the pipeline so as to minimize stress concentration on the pipe.

(c) Each bared test lead wire and bared metallic area at point of connection to the pipeline must be coated with an electrical insulating material compatible with the pipe coating and the insulation on the wire.

Sec. 192.473 External corrosion control: interference currents.

(a) After July 31, 1973, each operator whose pipeline system is subjected to stray currents shall have in effect a continuing program to minimize the detrimental effects of such currents.

(b) Each impressed current type cathodic protection system or galvanic anode system must be designed and installed so as to minimize any adverse effects on existing adjacent underground metallic structures.

Sec. 192.475 Internal corrosion control: general.

(a) After July 31, 1972, corrosive gas may not be transported by pipeline, unless the corrosive effect of the gas on the pipeline has been investigated and steps have been taken to minimize internal corrosion.

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(b) Whenever any pipe is removed from a pipeline for any reason, the internal surface must be inspected for evidence of corrosion. If internal corrosion is found -

(1) The adjacent pipe must be investigated to determine the extent of internal corrosion;

(2) Replacement must be made to the extent required by the applicable paragraphs of Sec. 192.485, Sec. 192.487, or Sec. 192.489; and

(3) Steps must be taken to minimize the internal corrosion.

(c) Gas containing more than 0.1 grain of hydrogen sulfide per 100 standard cubic feet may not be stored in pipe-type or bottle-type holders.

Sec. 192.477 Internal corrosion control: monitoring.

If corrosive gas is being transported, coupons or other suitable means must be used to determine the effectiveness of the steps taken to minimize internal corrosion. After July 31, 1972, each coupon or other means of monitoring internal corrosion must be checked at intervals not exceeding 6 months.

Sec. 192.479 Atmospheric corrosion control: general.

(a) Pipelines installed after July 31, 1971. Each aboveground pipeline or portion of a pipeline installed after July 31, 1971 that is exposed to the atmosphere must be cleaned and either coated or jacketed with a material suitable for the prevention of atmospheric corrosion. An operator need not comply with this paragraph, if the operator can demonstrate by test, investigation, or experience in the area of application, that a corrosive atmosphere does not exist.

(b) Pipelines installed before August 1, 1971. Not later than August 1, 1974, each operator having an aboveground pipeline or portion of a pipeline installed before August 1, 1971 that is exposed to the atmosphere, shall -

(1) Determine the areas of atmospheric corrosion on the pipeline;

(2) If atmospheric corrosion is found, take remedial measures to the extent required by the applicable paragraphs of Secs. 192.485, 192.487, or 192.489; and

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(3) Clean and either coat or jacket the areas of atmospheric corrosion on the pipeline with a material suitable for the prevention of atmospheric corrosion.

Sec. 192.481 Atmospheric corrosion control: monitoring.

After meeting the requirements of paragraphs (a) and (b) of Sec. 192.479, each operator shall, at intervals not exceeding 3 years, reevaluate its aboveground pipelines or portions of pipelines that are exposed to the atmosphere and take remedial action wherever necessary to maintain protection against atmospheric corrosion.

Sec. 192.483 Remedial measures: general.

(a) Each segment of metallic pipe that replaces pipe removed from a buried or submerged pipeline because of external corrosion must have a properly prepared surface and must be provided with an external protective coating that meets the requirements of Sec. 192.461.

(b) Each segment of metallic pipe that replaces pipe removed from a buried or submerged pipeline because of external corrosion must be cathodically protected in accordance with this subpart.

(c) Except for cast iron or ductile iron pipe, each segment of buried or submerged pipe that is required to be repaired because of external corrosion must be cathodically protected in accordance with this subpart.

Sec. 192.485 Remedial measures: transmission lines.

(a) General corrosion. Each segment of transmission line pipe with general corrosion and with a remaining wall thickness less than that required for the maximum allowable operating pressure of the pipeline, must be replaced or the operating pressure reduced commensurate with the actual remaining wall thickness. However, if the area of general corrosion is small, the corroded pipe may be repaired. Corrosion pitting so closely grouped as to affect the overall strength of the pipe is considered general corrosion for the purpose of this paragraph.

(b) Localized corrosion pitting. Each segment of transmission line pipe with localized corrosion pitting to a degree where leakage might result must be replaced or repaired, or the operating pressure must be reduced commensurate with the strength of the pipe, based on the actual remaining wall thickness in the pits.

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Sec. 192.487 Remedial measures: distribution lines other than cast iron or ductile iron lines.

(a) General corrosion. Except for cast iron or ductile iron pipe, each segment of generally corroded distribution line pipe with a remaining wall thickness less than that required for the maximum allowable operating pressure of the pipeline, or a remaining wall thickness less than 30 percent of the nominal wall thickness, must be replaced. However, if the area of general corrosion is small, the corroded pipe may be repaired. Corrosion pitting so closely grouped as to affect the overall strength of the pipe is considered general corrosion for the purpose of this paragraph.

(b) Localized corrosion pitting. Except for cast iron or ductile iron pipe, each segment of distribution line pipe with localized corrosion pitting to a degree where leakage might result must be replaced or repaired.

Sec. 192.489 Remedial measures: cast iron and ductile iron pipelines.

(a) General graphitization. Each segment of cast iron or ductile iron pipe on which general graphitization is found to a degree where a fracture or any leakage might result, must be replaced.

(b) Localized graphitization. Each segment of cast iron or ductile iron pipe on which localized graphitization is found to a degree where any leakage might result, must be replaced or repaired, or sealed by internal sealing methods adequate to prevent or arrest any leakage.

Sec. 192.491 Corrosion control records.

(a) After July 31, 1972, each operator shall maintain records or maps to show the location of cathodically protected piping, cathodic protection facilities, other than unrecorded galvanic anodes installed before August 1, 1971, and neighboring structures bonded to the cathodic protection system.

(b) Each of the following records must be retained for as long as the pipeline remains in service:

(1) Each record or map required by paragraph (a) of this section.

(2) Records of each test, survey, or inspection required by this subpart, in sufficient detail to demonstrate the adequacy of corrosion control measures or that a corrosive condition does not exist.

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Appendix D - Criteria for Cathodic Protection and Determination of Measurements

I. Criteria for cathodic protection.

A. Steel, cast iron, and ductile iron structures.

- (1) A negative (cathodic) voltage of at least 0.85 volt, with reference to a saturated copper-copper sulfate half cell. Determination of this voltage must be made with the protective current applied, and in accordance with Sections II and IV of this appendix.
- (2) A negative (cathodic) voltage shift of at least 300 millivolts. Determination of this voltage shift must be made with the protective current applied, and in accordance with Sections II and IV of this appendix. This criterion of voltage shift applies to structures not in contact with metals of different anodic potentials.
- (3) A minimum negative (cathodic) polarization voltage shift of 100 millivolts. This polarization voltage shift must be determined in accordance with Sections III and IV of this appendix.
- (4) A voltage at least as negative (cathodic) as that originally established at the beginning of the Tafel segment of the E-log-I curve. This voltage must be measured in accordance with Section IV of this appendix.
- (5) A net protective current from the electrolyte into the structure surface as measured by an earth current technique applied at predetermined current discharge (anodic) points of the structure.

B. Aluminum structures.

- (1) Except as provided in subparagraphs (3) and (4) of this paragraph, a minimum negative (cathodic) voltage shift of 150 millivolts, produced by the application of protective current. The voltage shift must be determined in accordance with Sections II and IV of this appendix.
- (2) Except as provided in subparagraphs (3) and (4) of this paragraph, a minimum negative (cathodic) polarization voltage shift of 100 millivolts. This polarization voltage shift must be determined in accordance with Sections III and IV of this appendix.

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- (3) Notwithstanding the alternative minimum criteria in subparagraphs (1) and (2) of this paragraph, aluminum, if cathodically protected at voltages in excess of 1.20 volts as measured with reference to a copper-copper sulfate half cell, in accordance with Section IV of this appendix, and compensated for the voltage (IR) drops other than those across the structure-electrolyte boundary, may suffer corrosion resulting from the buildup of alkali on the metal surface. A voltage in excess of 1.20 volts may not be used unless previous test results indicate no appreciable corrosion will occur in the particular environment.
- (4) Since aluminum may suffer from corrosion under high pH conditions, and since application of cathodic protection tends to increase the pH at the metal surface, careful investigation or testing must be made before applying cathodic protection to stop pitting attack on aluminum structures in environments with a natural pH in excess of 8.

C. Copper structures.

A minimum negative (cathodic) polarization voltage shift of 100 millivolts. This polarization voltage shift must be determined in accordance with Sections III and IV of this appendix.

D. Metals of different anodic potentials.

A negative (cathodic) voltage, measured in accordance with Section IV of this appendix equal to that required for the most anodic metal in the system must be maintained. If amphoteric structures are involved that could be damaged by high alkalinity covered by subparagraphs (3) and (4) of paragraph B of this section, they must be electrically isolated with insulating flanges, or the equivalent.

II. Interpretation of voltage measurement.

Voltage (IR) drops other than those across the structure-electrolyte boundary must be considered for valid interpretation of the voltage measurement in paragraph A(1) and (2) and paragraph B(1) of Section I of this appendix.

III. Determination of polarization voltage shift.

The polarization voltage shift must be determined by interrupting the protective current and measuring the polarization decay. When the current is initially interrupted, an immediate voltage shift occurs. The voltage reading after the immediate shift must be used as the base reading from which to measure polarization decay in paragraphs A(3), B(2), and C of Section I of this appendix.

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IV. Reference half cells.

- A. Except as provided in paragraphs B and C of this section, negative (cathodic) voltage must be measured between the structure surface and a saturated copper-copper sulfate half cell contacting the electrolyte.
- B. Other standard reference half cells may be substituted for the saturated copper-copper sulfate half cell. Two commonly used reference half cells are listed below along with their voltage equivalent to - 0.85 volt as referred to a saturated copper-copper sulfate half cell:
 - (1) Saturated KCl calomel half cell: - 0.78 volt.
 - (2) Silver-silver chloride half cell used in sea water: - 0.80 volt.
- C. In addition to the standard reference half cells, an alternate metallic material or structure may be used in place of the saturated copper-copper sulfate half cell if its potential stability is assured and if its voltage equivalent referred to a saturated copper-copper sulfate half cell is established.

APPENDIX B

AMENDMENTS TO 192.607 AND 192.611(e) OF GENERAL ORDER NO. 112-C

1. Section 192.607 is amended by revising the section heading and paragraph (b), and by adding a new paragraph (c) at the end thereof, to read as follows:

Sec. 192.607 Plan for confirmation or revision of maximum allowable operating pressure.

* * * * *

(b) Each segment of pipeline that has been determined under paragraph (a) of this section to have an established maximum allowable operating pressure producing a hoop stress that is not commensurate with the class location of the segment of pipeline and that is found to be in satisfactory condition, must have the maximum allowable operating pressure confirmed or revised in accordance with Sec. 192.611. The confirmation or revision must be completed not later than December 31, 1974.

(c) Each operator required to confirm or revise an established maximum allowable operating pressure under paragraph (b) of this section shall, not later than December 31, 1971, prepare a comprehensive plan, including a schedule, for carrying out the confirmations or revisions. The comprehensive plan must also provide for confirmations or revisions determined to be necessary under Sec. 192.609, to the extent that they are caused by changes in class locations taking place before July 1, 1973.

2. Section 192.611(e) is revised to read as follows:

Sec. 192.611 Change in class location: Confirmation or revision of maximum allowable operating pressure.

* * * * *

(e) Confirmation or revision of the maximum allowable operating pressure that is required as a result of a study under Sec. 192.609 must be completed as follows:

(1) Confirmation or revision due to changes in class location that occur before July 1, 1973, must be completed not later than December 31, 1974.

(2) Confirmation or revision due to changes in class location that occur on or after July 1, 1973, must be completed within 18 months of the change in class location.