Overview	This work procedure describes the steps that Pacific Gas and Electric Company (Company) Numbered Document O-16, "Corrosion Control of Gas Facilities," requires to review the adequacy of cathodic protection systems.
Governing Document	Utility Standard S4133, "Gas T&D Corrosion Control Requirements" – *Expected publication 2009*
Safety	Perform all cathodic protection assessment/resurvey work safely and in accordance with all applicable safety rules, the *Code of Safe Practices*, and Utility Standard Practice (USP) 22, "Safety and Health Program."

Cathodic Protection Area Assessment/ Resurvey Procedures

Maintenance and construction (M&C) directors and supervisors of corrosion mechanics are responsible for implementing the procedures in this document.

Cathodic protection resurveys revealing the need for corrective actions are reviewed and acted upon by the responsible supervisors.

The division resurveys a minimum of 12% of the total subject cathodic protection areas (CPAs) each year, with a goal of 17% per year. The divisions have until December 31, 2011 to complete the resurveys for the additional distribution of CPAs containing transmission facilities that were added to the scope of this work procedure in 2005.

Attachments 1, 2, and 3 to this work procedure contain worksheets, forms, and checklists to complete the reviews and resurveys. Documentation requirements are also included in the attachments.

1. General

Review CPAs, as defined in this work procedure, at least once every 6 nominal years. The resurvey procedures are described in the following attachments:

[redacted] [redacted]

Table 1. Attachments to Work Procedure WP4133-02

Attachment	Title	Description
1	Initial CPA Assessment Worksheet	The checklist used to conduct a CPA review. It describes how to review a CPA to determine if further field work is required (a CPA long, modified short, or short resurvey).
2	CPA Field Resurvey Checklist **(only required when a complete survey, i.e., a long resurvey, is performed)**	A checklist to assist corrosion mechanics conducting a detailed CPA field resurvey to ensure proper cathodic protection. The resurvey should be performed only if a CPA assessment worksheet indicates the need for a long resurvey.
3	CPA Resurvey File Review Form	The form used to document a file review of a CPA resurvey.

2. CPA Assessment

Conduct the initial CPA assessment and subsequent assessments using the "Initial CPA Assessment Worksheet" (Attachment 1). To complete this worksheet, first obtain the following information:

- External corrosion leakage repairs on protected facilities for the past 5 years by the CPA.
- CPA maintenance record.
- CPA pipe-to-soil sheets.
- Total present electrical current requirements for the CPA (in amperes).
- Total linear footage of steel main, by size, tied to the CPA and the number of copper services and steel services tied to the CPA. (The footage of services can be determined by applying a division average service length factor to the number of services.)

  Inventory services by material. Complete current requirement sheets for each CPA.

Use the above information to evaluate the four initial criteria in the "Initial CPA Assessment Worksheet (Attachment 1)." If the CPA does not meet any one of the four criteria, conduct field work to clarify the situation before continuing with the assessment, or a long resurvey will be required.

If the CPA meets the first four criteria, review the following gas documents to determine if there is any need to conduct field investigations within the CPA:

- Job orders with significant steel main installations, steel main replacements with plastic or with steel with significantly different and impactive current requirements, significant service replacements, deactivations, or abandonments in the CPA.
- The Tangible Property List (TPL) system can be the source of a listing of steel installations and abandonments by job, by plat sheet. Use this data to identify the scope of cathodic protection plant changes within the CPA.

[redacted] [redacted]

Examine plastic main installations that could potentially isolate a section of steel main or steel services from the CPA rectifier. Those local areas within the CPA must be interrupted to ensure that isolations did not occur.

If the review process shows the CPA either cannot meet any one of the first four criteria or has experienced significant main installations, replacements, deactivations, or abandonments that will likely significantly affect the cathodic protection in the CPA, conduct a long resurvey, as detailed in the "CPA Field Resurvey Checklist" (Attachment 2).

If the review process shows that the CPA meets **all** the criteria questions and has not had any significant facility changes in the CPA, significant field resurvey work is not required. Ensure that the CPA files are complete by filling out F4133-02-3, "CPA Resurvey File Review Form" (Attachment 3), described in Section 4, "CPA File Reviews."

3. CPA Field Resurvey Checklist

If the "Initial CPA Assessment Worksheet" (Attachment 1) shows the need to conduct a long resurvey of a CPA, conduct such resurvey with the "CPA Field Resurvey Checklist"(Attachment 2).

Fill out each step on the "CPA Field Resurvey Checklist" completely with the initials of the person carrying out the step and the date the step is completed.

4. CPA File Reviews

After the initial resurvey, use F4133-02-3, "CPA Resurvey File Review Form" (Attachment 3) for subsequent resurveys. If previously filled-out Attachments 1 and 2 are complete and current CPA records indicate that no significant changes have taken place in the CPA since the previous resurvey, only Attachment 3 is required for subsequent resurvey documentation. This form ensures that the CPA file folder contains all of the required resurvey information.

5. Recordkeeping

File all checklists and worksheets completed in the appropriate CPA file folder and keep them until two subsequent reviews are completed. Retain all worksheets associated with the latest "File Review" in the file folder.

Note: If Attachment 3 is completed and reviewed, no additional documented "Reviewed by/Initials" and dates are required on other filed documents.

[redacted] [redacted]

Definition of Terms

CPA: A cathodic protection area that consists of either of the following materials:

- Segments of steel pipe that are electrically bonded and protected by the use of impressed current.
- More than eight blocks of steel pipe or 1 mile of steel pipe that are/is electrically bonded and protected by the use of galvanic anodes.

Gas distribution CPA: For the purpose of this work procedure, a CPA that is either an impressed current CPA with a rectifier directly tied to the gas distribution facilities or a CPA where 25% or more of the linear footage of the main facilities in the CPA are distribution facilities.

Long resurvey: A complete resurvey where new maps, pipe-to-soil profiles, boundary validation, and other field data is required.

Modified short resurvey: A resurvey where more than 2 hours and less than or equal to 6 hours (see Table 2 below) of field work is required to bring the file to standard.

Table 2. Typical Hour Allocations for Specified Work

Task	Allocated Hours
Record file review	½
Obtain and review leak records	½
One (1) interference test	1
Update the current calculation sheet	2
Update new maps	1
Validate pipeline current map spans	1
Validate pipe-to-soil readings (2-4)	1
Pipe-to-soil saturation	3
Hardwire the CPA	Typically 12 (varies)
Pipeline current map the CPA	Typically 8 (varies)

Nominal year: Any day within the respective calendar year.

Short resurvey: A resurvey where data and records are critically reviewed and it is determined that no more than 2 hours of work (see Table 2 above) is required to bring the file to standard.

Tangible Property List (TPL): See the senior corrosion specialist for information.

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Recision

This work procedure cancels and supersedes Utility Operations Standard S5467, "Cathodic Protection Area Assessment/Resurvey Procedures for Gas Distribution," issued February 2006.

Reference Documents

Code of Federal Regulations (CFR) Title 49, Section 192.465, "External corrosion control: Monitoring"

Code of Safe Practices, Basic Safety Requirements, Sections 1, 2, 3, 13, and 15

Numbered Document O-16, "Corrosion Control of Gas Facilities"

UO Policy 3-7, "Gas and Electric Operation, Maintenance, and Construction"

Utility Standard Practice (USP) 22, "Safety and Health Program"

Attachments

Attachment 1 , "Initial CPA Assessment Worksheet"

Attachment 2 "CPA Field Resurvey Checklist"

Attachment 3, F4133-02-3, "CPA Resurvey File Review Form"

Contact for More Information

[redacted]

Date Issued

October 2008

Approved by

Brian Daubin,
Senior Manager

Revision History

Chg No.	Date	Description	By (LAN ID)
00	October 2008	Issued.	[redacted]

[redacted]

[redacted]

Initial CPA Assessment Worksheet

Objective: Use this worksheet to determine if a cathodic protection area (CPA) is under adequate cathodic protection and has an adequate *"record of each test, survey, or inspection required by this subpar, in sufficient detail to demonstrate the adequacy of corrosion control measures or that a corrosive condition does not exist."* [1]

#	Source Document	Reference Paragraph	Steps	Observed or Documented Result	Source of Information	Conclusion	Initials	Date
			CPA PERFORMANCE ASSESSMENT					
			Review the following questions for the CPA. If the criteria cannot be met and cannot be explained to ensure that the CPA is providing adequate protection, a complete field resurvey may be required to ensure that adequate cathodic protection is being achieved in the CPA. All the below questions need to have a **Yes** answer or be explained to ensure that the CPA is performing adequately.					
			Does the CPA meet all of the following criteria?					
1	49 CFR 192	192.463 (a)	1. The lowest pipe-to-soil on-potential in the CPA is at least as negative as 850 millivolts with reference to a saturated copper-copper sulfate electrode.					
2	O-16	2.I	2. The number of pipe-to-soil on-potential readings on the most recent saturated pipe-to-soil potential map are a minimum of one per block, or as deemed necessary by the Company corrosion supervisor. *Acceptable correction without a full resurvey: Take extra pipe-to-soil readings at the end of the system or as needed.*					
3	Gas compliance review	4.5	3. All pipe-to-soil potentials of routine bimonthly monitoring points in the CPA are within +/- 200 millivolts of their readings of the last resurvey date as measured on a similar month-to-month basis (e.g., compare winter readings with winter readings, summer readings with summer readings).					
4	Suggested Company Best Management Practice		4. External corrosion leakage (as measured by corrosion leak repairs per mile of protected main and services per year) has not exceeded one leak per mile per year. If the leakage rate has exceeded one leak per mile per year, this does not dictate that a long resurvey needs to be conducted, just that the Gas Operations engineer or a Gas Distribution engineer needs to critically review and evaluate this data. It may be determined that no additional field work is required. A pipe replacement project may be planned that will resolve the situation and make a long resurvey of little or no value.					

[1] From US Federal Code, Section 49 CFR 192.491 (c)

Initial CPA Assessment Worksheet, *Continued*

#	Source Document	Reference Paragraph	Steps	Observed or Documented Result	Source of Information	Conclusion	Initials	Date
			GAS FACILITIES DOCUMENT REVIEW					
			Review the following questions for the CPA. If the related gas facilities documents for the CPA indicate changes to the CPA that are likely to significantly affect the CPA since the last assessment/review which have not been addressed to ensure the CPA is protecting all pipe, then a complete or partial field resurvey may be required to ensure that adequate cathodic protection is being achieved in the CPA.					
			Does the CPA meet all of the following conditions?					
5	O-16	7	5. Does a review of the most recent plat sheets for the CPA indicate no jobs involving main installations, deactivations, or replacements occurring in the time period since the last CPA resurvey of the area that would likely affect the CP levels within the CPA? (Ensure all current requirement changes caused by plastic main installations are accounted for and take pipe-to-soil on-potential readings on potentially isolated sections of steel.) A copy of a tangible property line (TPL) based report by year supplies a listing of steel installation and deactivation jobs by plat. Research the jobs to see if they were within the CPA.					
6	O-16	7	6. Does a review of the external corrosion leak records in the CPA indicate that no significant external corrosion levels exist? (Retain a copy of the leak data report for the previous 6 years in the CPA file.)					
			COMPANY MANAGEMENT REVIEW AND APPROVAL					
7	O-16		7. Does the Company **corrosion supervisor or the Gas Distribution and Technical Services (GD&TS) construction specialist** concur with this assessment? Indicate if the CPA needs to be field resurveyed. Use the "CPA Field Resurvey Checklist" (Attachment 2) to help conduct the field resurvey. If the "Initial CPA Assessment Worksheet" or subsequent CPA assessment indicates that the CPA is providing adequate levels of cathodic protection, conduct a CPA file review using Form F4133-02-3, "CPA Resurvey File Review Form" (Attachment 3).					

Comments: (Include any comments about work performed, observations, and things to check in the next assessment/resurvey.)

CPA Field Resurvey Checklist

Objective: Use this checklist to determine if a cathodic protection area (CPA) is under adequate cathodic protection and has adequate *"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."* [1]

#	Task	Reference	Who? (Initial when Complete)	Date Completed
1	Ensure that the CPA has been assessed for performance using the "Initial CPA Assessment Worksheet" (Attachment 1). Ensure that the CPA needs a complete field resurvey.	Initial CPA Assessment Worksheet	**Corrosion Supervisor**	
2	Review updated code requirements.	49 CFR 192, Subpart I	Corrosion Mechanic (CM)	
3	Review updated Company requirements.	O-16	CM	
4	It is suggested that a new set of full size plat sheets for the CPA be used to validate the latest CPA maps in Step 5 below.	Maps	Mapping	
5	Color code the final CPA maps (these maps should be scaled so as to allow the entire CPA to be readily viewed, usually a 1-inch=500-foot scale is used).		Mapping/CM	
6	Verify all CPA boundaries in the field.		CM	
7	Verify that the CPA boundaries in the field match the CPA boundaries shown in the CPA file and the CPA boundaries on the CPA map file records used by mapping personnel. If the adjacent CPA is down when checking the boundary, this CPA must be brought back up into compliance before the resurvey can be completed. Document these pipe-to-soil reads on the resurvey map.		CM	
8	Recalculate current requirements based on all substantial changes to the CPA, including new boundaries, newly installed or reconstructed piping, and services (as needed).		Estimating/ Engineering/CM	
9	Field test (e.g., pipeline current mapper [PCM] spanning, field measurements) and clear all contacts in the CPA.		CM	
10	Compare actual rectifier current output with current requirements as calculated in Step 8. Investigate and clear any significant discrepancies.		CM	
11	Take all final on-pipe to soil (-P/S) and instant off reads (one per block or less if deemed appropriate by the corrosion supervisor). Note that instant off reads apply to impressed current CPAs.		CM	
12	Take all final spans, noting measurements on plats.		CM	
13	Identify all interference problems in the area.		CM	
14	Identify all steel mains in the CPA that are not protected.		CM	
15	Investigate the feasibility of protecting unprotected steel mains in an area.		Engineering/CM	

[1] From US Federal Code, Section 49 CFR 192.491 (c)

[redacted]

CPA Field Resurvey Checklist, *Continued*

#	Task	Reference	Who? (Initial when Complete)	Date Completed
16	Ensure that the CPA is now adequately protected because all of the following conditions are met:			
17	1. The lowest pipe-to-soil on-potential in the CPA is at least as negative as 850 millivolts with reference to a saturated copper-copper sulfate electrode.	49 CFR 192.463 (a)	CM	
18	2. The number of pipe-to-soil on-potential readings must be a minimum of one per block as documented on a saturated pipe-to-soil potential map, or as deemed necessary by the Company corrosion supervisor.	O-16 2.I	CM	
19	3. The current flow shall be accounted for down to 50 milliampere (mA) – or less when deemed necessary by the Company corrosion supervisor – when using hardwire spanning or 15 mA when using the PCM.	0-16, 2I	CM	
20	Ensure that the CPA file folder is complete with all required updated information as listed in the "CPA Resurvey File Review Form F4133-02-3" (Attachment 3).	CPA File Resurvey Review Form	CM	

Comments:

[redacted] [redacted]