PACIFIC GAS AND ELECTRIC COMPANY
GAS TRANSMISSION AND DISTRIBUTION
GAS ENGINEERING
GAS INTEGRITY MANAGEMENT AND TECHNICAL SUPPORT

Risk Management Procedure

Procedure No. RMP-06

Gas Transmission Integrity Management Program
for PG&E and Standard Pacific Pipeline Inc.

			Prepared by	Approved by		Approved by	Approved by
Rev. No.	Date	Description	Integrity Management Program Manager	Manager, System Integrity		Director, GSM&TS	Vice President – Gas Transmission and Distribution, President/CEO, Standard Pacific Pipelines, Inc.
0	12/9/04	Initial Issue	CMW4	ADE1		FT1	RTHc
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Rev. No.	Date	Description	Integrity Management Program Manager	Director System Integ. & Gas Matters		Director, Gas Engineering	Vice President – Gas Transmission and Distribution, President/CEO, Standard Pacific Pipelines, Inc.
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5		See Change Forms for detailed descriptions					

2. Threat Identification: Data Integration

2.1. Scope

Potential threats to an HCA must be identified and then evaluated through a comprehensive risk analysis process. This section provides information on collecting the data that is needed to perform effective assessments.

2.2. Background

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B31.8S 2.2

There are a minimum of 21 causes of gas pipeline incidents identified by the integrity management regulations and B31.8S, these are placed into nine categories, plus the category of "unknown".

Time-Dependent	1	External Corrosion	1	External Corrosion
	2	Internal Corrosion	2	Internal Corrosion
	3	Stress Corrosion Cracking	3	Stress Corrosion Cracking
Stable	4	Manufacturing Related Defects	4	Defective pipe seam
			5	Defective pipe
	5	Welding/Fabrication Related	6	Defective pipe girth weld
			7	Defective fabrication weld
			8	Wrinkle bend or buckle
	6	Equipment	9	Stripped threads/broken pipe/coupling failure
			10	Gasket O-ring failure
			11	Control/Relief equipment malfunction
			12	Seal/pump packing failure
			13	Miscellaneous
Time-Independent (includes Human Error)	7	Third Party/Mechanical Damage	14	Damage inflicted by first, second, or third parties (instantaneous/immediate failure)
			15	Previously damaged pipe (delayed failure mode)
			16	Vandalism
	8	Incorrect Operations	17	Incorrect operational procedure
	9	Weather Related and Outside Force	18	Cold weather
			19	Lightning
			20	Heavy rains or floods
			21	Earth Movements
Unknown		Unknown	22	Unknown

Since more than one threat can occur on a section of pipe, each HCA must be examined to ascertain which of these threats possibly present an element of risk to that HCA. This Section covers the process by which data is assembled for HCAs.

Section 3 "Threat Identification: Risk Assessment" discusses the method by which the HCAs are examined for each risk factor to best determine the driving risk factors for that HCA.

2.3. Company Compliance

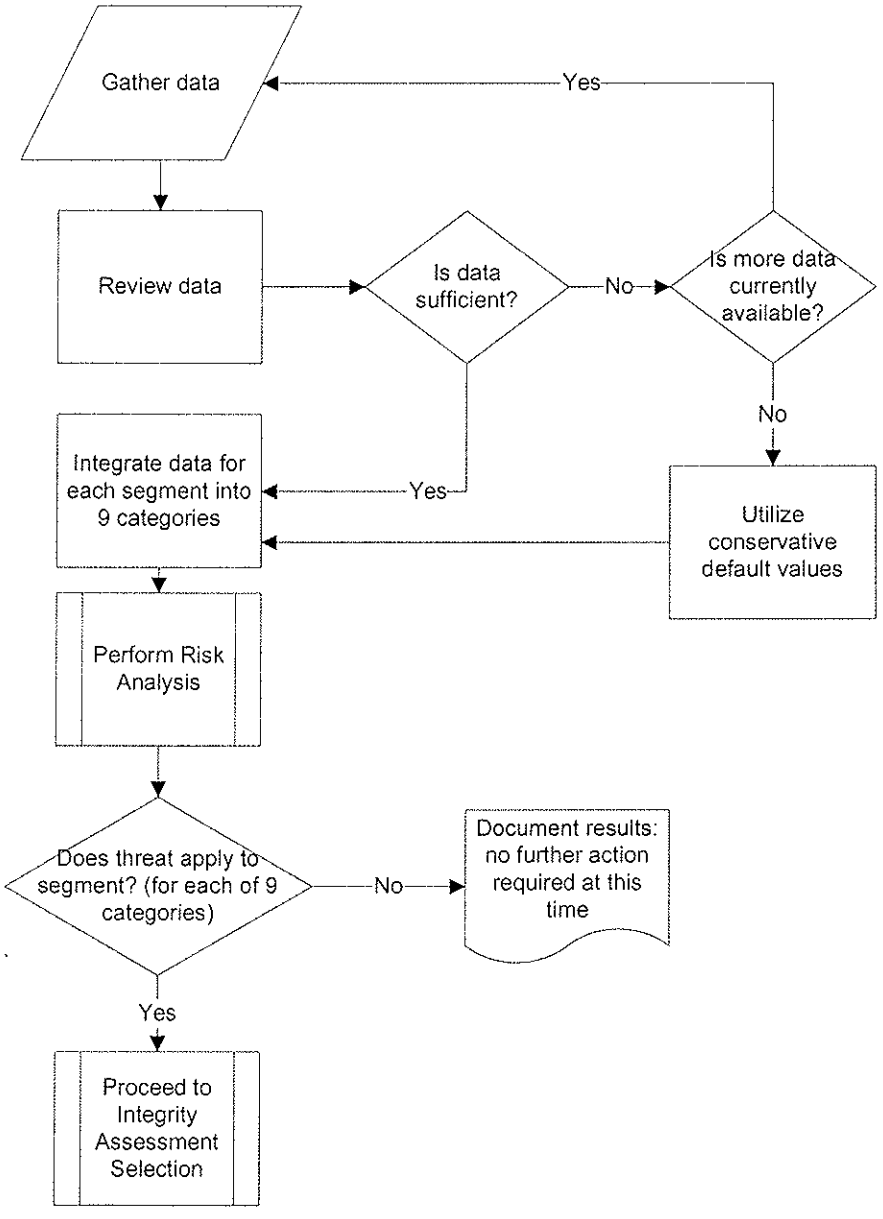
To ensure that the risk assessment and threat identification remains current, it is Company policy to perform risk assessment (per procedure RMP-01) for all transmission pipelines on an annual basis and threat analysis for all HCAs also on an annual basis. Procedure RMP-01 (Risk Management) and supporting procedures RMP-02 (External Corrosion Threat Algorithm), RMP-03 (Third Party Threat Algorithm), RMP-04 (Ground Movement Threat Algorithm), and RMP-05 (Design/Materials Threat Algorithm) provide the requirements for determining the relative risk ranking of all of the Company's transmission pipelines and serve as a basis for this procedure's description of data integration into the threat identification for HCAs.

The overall process by which the Company has chosen to comply with these requirements consists of the following steps:

1. Gather data
2. Review data
3. Integrate data to understand the condition of the pipe
4. Perform risk analysis
5. Identify the location-specific threats that could affect each HCA based on the nine categories as identified in Section 2.2 of B31.8S
    - External Corrosion Threat
    - Internal Corrosion Threat
    - Stress Corrosion Cracking Threat
    - Manufacturing Threat
    - Construction Threat
    - Equipment Threat
    - Third Party Threat
    - Incorrect Operations Threat
    - Weather and Outside Force Threat

This process is illustrated by the following flowchart.

Threat Identification and Risk Analysis Process Flowchart



3. Threat Identification: Risk Assessment

3.1. Scope

Potential threats to an HCA must be identified and then evaluated through a comprehensive risk analysis process. This Section covers the process by which HCAs are examined for each threat to best determine the driving risk factors.

3.2. Background

There are a minimum of 21 causes of gas pipeline incidents identified by integrity management regulations and B31.8S, which are placed into nine categories plus the category of "unknown." See Section 2 Threat Identification: Data Integration for a description of these threats and the data elements selected to perform the initial risk analysis and threat identification.

Since more than one threat can occur on a section of pipe, each HCA must be examined to ascertain which of these threats possibly present an element of risk.

3.3. Risk Assessment

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Risk assessment is performed per RMP-01. The RMP-01 methodology looks at all threats for which meaningful data is available. Including threats where meaningful data is not available will mask the significance of those threats which can be more precisely defined. As better data becomes available for threats not currently included in RMP-01, that procedure will be updated to include them. This risk assessment provides a method to prioritize HCAs for the baseline assessment schedule as well as providing the information needed for effective preventive and mitigative actions. Assessment also helps determine modified inspection intervals for continued re-assessments and whether or not alternative inspection methods are needed.

Risk assessment provides a rational and consistent method to make determinations about the integrity of a pipeline segment and allows more effective use of resources in both identifying and mitigating threats. Effective data integration combined with assessment identifies the scenarios more likely to occur and prevents focusing on improbable catastrophic events.

3.4. Risk Definition and Computations

Risk can be described as the product of "likelihood" and "consequence". Risk Analysis is performed per procedure RMP-01 for all transmission pipelines. The method described in the procedure is a relative risk ranking approach with Subject Matter Experts providing input and direction as to the algorithms used to perform the computations.

Steering Committees have been established and meet each calendar year to review the algorithms and consider changes to improve the accuracy of the algorithm results. The membership and minutes from the meetings are documented in the Risk Mgmt Library, File 4.0. The established Steering Committees include;

- Consequence Steering Committee with oversight of RMP-01 (Risk Management),
- External Corrosion Steering Committee with oversight of RMP-02 (External Corrosion Threat Algorithm),
- Third Party Steering Committee with oversight of RMP-03 (Third Party Threat Algorithm),
- Ground Movement Steering Committee with oversight of RMP-04 (Ground Movement Threat Algorithm), and
- Design/Materials Steering Committee with oversight of RMP-05 (Design/Materials Threat Algorithm)

3.5. Threat Analysis

Threat Analysis shall be performed for all covered pipeline segments integrating information from Risk Analysis for both covered and non-covered pipeline segments as follows

External Corrosion: The External Corrosion Threat was assumed to exist on all gas transmission pipelines. Information integrated into the risk calculations required to comply with RMP-02 and used to weight the relative significance of the threat include:

- Past Corrosion Surveys,
- Visual Inspection of Coating,
- Presence of Casings,
- Past ILI,
- EC Leak Experience,
- Coating Type,
- AC/DC Interference,
- Coating Age,
- MOP vs. Pipe Strength,
- Visual Inspections of Pipe,
- Pressure Testing, and
- Past ECDA (External Corrosion Direct Assessment). Also included, to meet these requirements, is pipe Outside Diameter, Wall Thickness, MOP.
- Soil Resistivity
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Inspection data and leak experience on adjacent pipeline segments, whether HCA or not, shall be considered in the quantification of Likelihood Of Failure (LOF) due to external corrosion per the requirements of RMP-02.

Internal Corrosion: Internal Corrosion threat is known to exist if an internal corrosion leak has occurred in the vicinity of the HCA or if in the threat exists in the judgment of the Senior Corrosion Engineer. The Senior Corrosion Engineer shall perform this system-wide analysis and specify where the threat is known to exist

Internal corrosion is a possible threat for the remaining pipeline so additional data integration will occur during the pre-assessment and direct examination phases of ECDA, in order to determine if the threat exists. The additional data integration includes:

- During pre-assessment, historical records, operating history and the experience of field personnel will be researched. If pre-assessment reveals the potential for internal corrosion, ICDA will be performed to assess the HCAs affected.
- During direct examinations, ultrasonic wall thickness reads will be taken at the bottom of the pipe, if internal corrosion is discovered ICDA will be performed to assess the affected HCAs.

Stress Corrosion Cracking: The Stress Corrosion Cracking (SCC) Threat shall be assumed to exist if SCC has been experienced (determined by a leak, Pressure Test Failure, or inspection) on any pipeline segment with similar pipe properties and operating conditions or if all of the following conditions are present:

- Operating stress > 60% SMYS
- Distance from (downstream) of a compressor station $\leq$ 20 miles
- Coating system other than fusion bonded epoxy (FBE)

Manufacturing Threat: The Manufacturing Threat shall be assumed to exist if the HCA meets one of the two following criteria.

1. If the pipe segment is a) Cast Iron, b) installed before 1970, c) joined with acetylene welds, d) joined with mechanical couplings, or
2. If the pipe segment has a Joint Efficiency Factor of less than 1.0 or is manufactured with Low Frequency ERW or Flash Welded Pipe (assumed to be pipe installed with ERW, Flash Weld, or Unknown Seam prior to 1970).

Construction Threat: Due to the concern for potentially non-ductile girth welds, it shall be assumed that the Construction Threat exists for all HCAs installed prior to 1947. In addition, pipelines with wrinkle bends shall be assumed that the Construction Threat exists.

Equipment Threat: This threat could result from a failure of equipment at any point in the system and is assumed to exist for all HCAs. It is addressed through the Company's maintenance and operations procedures.

Third Party Threat: The Third Party Threat shall be assumed to exist for all HCAs. Information integrated into the risk calculations documented in RMP-03 and used to weight the relative significance of the threat include:

- Feedback regarding pipelines particularly vulnerable to dig-ins
- Class Location
- Damage Prevention Measures (Standby/Aerial Patrol/None)
- Ground Cover (from inspection reports and GIS)
- Pipe Diameter
- Wall Thickness
- Line Marking
- MOP vs. Pipe Strength
- Third Party Leak History
- Public Education efforts in the area.

It should be noted that, inspection data and leak experience on adjacent segments, HCA or not, shall be considered in the quantification of Likelihood Of Failure (LOF) due to a third party.

Incorrect Operations Threat: The Incorrect Operations Threat was assumed to exist for all HCAs.

Weather and Outside Forces Threat: The Weather and Outside Forces Threat shall be assumed to exist if HCA meets any of the following criteria:

- Is in an area of potential ground acceleration greater than 0.2g
- Crosses a Historic or Holocene Earthquake Fault
- Crosses a navigable waterway
- Erosion has been identified
- Landslide has been identified
- Is in an area of High/Moderate or known Slope Instability
- Is in an area of Known or High/Moderate potential for liquefaction in combination with ground accelerations equal to or greater than 0.2g.
- **Levee crossings susceptible to erosion failure**

Hard Spot : The Hard Spot shall be assumed to exist if the HCA meets the following criteria:

- Operates at a stress greater than 50% SMYS (based on MOP) and has one of the following seam types:
  - Unknown seam type installed between 1947 and 1960,
  - Flash Welds from AO Smith or unknown manufacturer installed between 1952 and 1957,
  - DSAW Welds from Bethlehem, Kaiser, Republic or unknown manufacturer installed between 1949 and 1957,
  - ERW Welds from Youngstown Sheet and Tube or unknown manufacturer installed between 1947 and 1960.
  - Hard spots are not a recognized threat in 49CFR192 subpart O. The extent of PG&E's supplementary assessments or mitigations for this threat will vary from location to location and completion of an assessment or mitigation of this threat is not necessary to declare the pipeline assessment completed. Where identified, the primary mitigation will be through limiting the amount of cathodic protection to a pipe to soil potential of less than 1200 millivolts. The hard spot also shall be included in the risk algorithum.

Documentation: Results of the Threat Analysis and relevant data for each HCA shall be included in the BAP.