PACIFIC GAS AND ELECTRIC COMPANY

CALIFORNIA GAS TRANSMISSION
GAS SYSTEM MAINTENANCE & TECHNICAL SUPPORT
SYSTEM INTEGRITY SECTION
Risk Management

Procedure for Risk Management
Procedure No. RMP-02

External Corrosion Threat Algorithm

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1.0 PURPOSE

The purpose of this procedure is to provide a guideline for determining the External Corrosion Threat Algorithm for the determination of Likelihood of Failure and Risk for California Gas Transmission's (CGT) Risk Management Program (RMP).

2.0 SCOPE

This guideline is applicable to all of CGT's gas transmission pipeline facilities and is to be used in conjunction with RMP Procedure 01. The algorithm provided in this procedure is for Pipelines. It is not applicable to regulator, compressor, or storage station facilities

The RMP is responsible for managing risk within the scope of this procedure. The RMP shall establish and manage the risk of each pipeline facility by utilizing industry and regulatory accepted methodologies appropriate for PG&E's CGT facilities and shall be in conformance with this procedure. The Lead Risk Management Engineer shall be responsible for compliance with this procedure.

3.0 INTRODUCTION

The RMP is a process of calculating risk, developing risk mitigation plans to bring and maintain risk within an acceptable risk profile, and monitoring risk to accommodate changes in the factors which affect risk. (Procedure RMP-01 provides a guidelines for the Risk Management Process.) This procedure supports the calculation of risk, required by Procedure RMP-01, due to one of the basic threats imposed on gas pipelines, External Corrosion (EC).

As described in RMP-01, Risk is defined as the product of the Likelihood of Failure (LOF) and the Consequence of Failure (COF). A relative risk calculation methodology is used to establish risk for all pipeline segments within the scope of RMP-01. The method used to calculate risk is based on an index model and qualitative scoring approach. Likelihood Of Failure (LOF) is defined as the sum of the following threat categories: External Corrosion (EC), Third Party (TP), Ground Movement (GM) and Design/Materials (DM).

Each threat category is weighted in proportion to PG&E and industry failure experience. EC is weighted at 25%. The weightings on the threat categories will be reviewed and approved annually by the Consequence Steering Committee. For each threat category, the appropriate steering committee will identify the significant factors that influence the threat's likelihood of failure. For each factor, a percentage weighting will be established to identify the factor's relative significance in determining the threat's likelihood of failure within the threat algorithm. Points will be established based on criteria that the committee feels is significant to determining the threat's likelihood of failure due to each factor and the relative severity of failure (leak-before-break vs. rupture). (Negative points may be assigned where current assessments have been made to confirm pipeline integrity and/or mitigation efforts have eliminated or lowered susceptible to a threat.) Generally, the summation of the percentage weightings for all of the factors within each threat will be 100%. (There may be exceptions to permit the consideration of very

unusual conditions.) For the threat of EC, the scoring is based on direction from the EC Steering Committee.

4.0   EC Threat Algorithm

Scoring for the External Corrosion (EC) threat algorithm shall be calculated per the direction of the EC Steering Committee. This committee has determined that the factors in A through M of this section are significant for determining the Likelihood of Failure (LOF) of a gas pipeline due to EC. The EC contribution to LOF shall be the summation of assigned points times the assigned weighting of the following factors:

A) Soil Resistivity (4% Weighting): Points will be awarded as follows:

Criteria	Points	Contrib.
Less than or equal 500 Ohm-Centimeters	100	4
501 to 1000 Ohm-Centimeters	80	3.2
1001 to 2000 Ohm-Centimeters	60	2.4
2001 to 4000 Ohm-Centimeters	40	1.6
4001 to 10,000 Ohm-Centimeters	20	0.8
Above 10,000 Ohm-Centimeters	10	0.4

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B) Corrosion Survey Criteria (5% Weighting): Points will be awarded as follows:

Criteria	Points	Contrib.
No CIS* readings	50	2.5
CIS & meets criteria for acceptance	-100	-5
CIS & does not meet acceptance criteria	300	15

* CIS – (Close Interval Survey) This information is provided to the RMP by the Corrosion Engineer and, if acceptable, is considered valid for ten years. If the CIS does not meet acceptance criteria, it is valid until repeated.

C) Coating Visual Inspection[1] (10% Weighting): Points awarded as follows:

Criteria	Points	Contrib.
Severely disbonded, (Poor)	100	10
Locally damaged, disbonded (Fair)	50	5
Superficial damage only (Good)	20	2
Intact and bonded (Excellent)	10	1
Bare Pipe or No Inspection (Coating Age[2] ≤ 5 Years)	11	1.1
Bare Pipe or No Inspection (Coating Age[2] > 5 to ≤ 20 Years)	19	1.9
Bare Pipe or No Inspection (Coating Age[2] > 20 to ≤ 30 Years)	29	2.9
Bare Pipe or No Inspection (Coating Age[2] > 30 Years)	51	5.1

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[1] Inspection data greater than 20 years old shall not be used unless the information reflects a condition that is fair or poor.

In such cases, points will be awarded per the Inspection regardless as to when the Inspection was performed.
2   For Bare Pipe substitute Pipe Age.

D) Casing Survey (5% Weighting): Points awarded as follows:

Criteria	Points	Contrib.
No casing or Gelled	0	0
Existing casing	100	5

E) Magnetic Flux or Ultrasonic Inspection (5% Weighting): Points awarded as follows:

Criteria	Points	Contrib.
No survey performed	0	0
Inspection > 10 years old	-100	-5
Inspection 5 to 10 years old	-300	-15
Inspection 2 to <5 years old	-600	-30
Inspection <2 years old	-600	-30

F) External Corrosion Leak` Rate (10% Weighting): Points awarded as follows:

Criteria	Points	Contrib.
Leak in last 5 years	100	10
Leak in last 10 Years	80	8
Leak age >10 years	50	5

` Points applied to all pipe segments of similar vintage and coating type within a 1 mile radius of a leak.

G) Coating Design (10% Weighting): Points awarded as follows:

Criteria	Points	Contrib.
Uncoated	100	10
HAA	50	5
Extruded	100	10
Coal Tar	100	10
Somastic/Conc	20	2
Tape	100	10
Paint	50	5
FBE	10	1
Powercrete (PC)	10	1
Default	100	10

H) DC/AC Interference (9% Weighting): Points awarded as follows:

Criteria	Points	Contrib.
High or medium voltage within 500' of a Gas Pipeline without Cathodic Protection	100	9
High or medium voltage w/i 500' w/CP	50	4.5
No high or medium voltage	0	0

I) Coating Age (5% Weighting): Points awarded as follows:

Criteria	Points	Contrib.
>30 years or uncoated	100	5
>20 to 30 years	80	4
>10 to 20 years	30	1.5
10 years or less	10	0.5

J) MOP vs. Pipe Strength* (9% Weighting): Points awarded as follows:

Criteria	Points	Contrib.
>60%	100	9
50% to 60%	80	7.2
40% to <50%	50	4.5
30% to <40%	30	2.7
20% to <30%	10	0.9
Less than 20%	5	0.45

*   Pipe Strength shall be determined to be equal to (SMYS)(2)(t)(Jef)/(OD).

K) Pipe Visual Inspection' (8% Weighting): Points awarded as follows:

Criteria	Points	Contrib.
Heavy pitting or gouging (Poor)	100	8
Light pitting or gouging (Fair)	50	4
Heavy rusting	20	1.6
Light rusting (Good)	10	0.8
No pitting or rusting (Excellent)	0	0
No Inspection (Pipe Age ≤ 5 Years)	0	0
No Inspection (Pipe Age > 5 to ≤ 20 Years)	10	0.8
No Inspection (Pipe Age > 20 to ≤ 30 Years)	20	1.6
No Inspection (Pipe Age > 30 Years)	40	3.2

' Inspection data greater than 20 years old shall not be used unless the information reflects a condition that is fair or poor. In such cases, points will be awarded per the inspection regardless as to when the inspection was performed.

L) Test Pressure (TP)(5% Weighting): Points awarded as follows:

Criteria	Points	Contrib.
No Records Available	0	0
TP age is ≤ ASME B31.8S Table 8-1 requirements for Hydrostatic Test Interval	-200	-10
TP age is ≤ 3 years more than ASME B31.8S Table 8-1 requirements for Hydrostatic Test Interval	-100	-5
TP is > 3 years more than ASME B31.8S Table 8-1 requirements for Hydrostatic Test Interval	0	0

M) External Corrosion Direct Assessment (ECDA) (Weighting 10%)
Points awarded as follows:

Criteria	Points	Contrib.
ECDA Completed*	-200	-20
ECDA Not Completed	0	0

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* ECDA must have been completed within the last ten years.

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